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Administrative Costs Associated With Physician Billing and Insurance-Related Activities at an Academic Health Care System

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Supplemental content

IMPORTANCE Administrative costs in the US health care system are an important component of total health care spending, and a substantial proportion of these costs are attributable to billing and insurance-related activities.

OBJECTIVE To examine and estimate the administrative costs associated with physician billing activities in a large academic health care system with a certified electronic health record system.

DESIGN, SETTING, AND PARTICIPANTS This study used time-driven activity-based costing. Interviews were conducted with 27 health system administrators and 34 physicians in 2016 and 2017 to construct a process map charting the path of an insurance claim through the revenue cycle management process. These data were used to calculate the cost for each major billing and insurance-related activity and were aggregated to estimate the health system's total cost of processing an insurance claim.

EXPOSURES Estimated time required to perform billing and insurance-related activities, based on interviews with management personnel and physicians.

MAIN OUTCOMES AND MEASURES Estimated billing and insurance-related costs for 5 types of patient encounters: primary care visits, discharged emergency department visits, general medicine inpatient stays, ambulatory surgical procedures, and inpatient surgical procedures.

RESULTS Estimated processing time and total costs for billing and insurance-related activities were 13 minutes and $20.49 for a primary care visit, 32 minutes and $61.54 for a discharged emergency department visit, 73 minutes and $124.26 for a general inpatient stay, 75 minutes and $170.40 for an ambulatory surgical procedure, and 100 minutes and $215.10 for an inpatient surgical procedure. Of these totals, time and costs for activities carried out by physicians were estimated at a median of 3 minutes or $6.36 for a primary care visit, 3 minutes or $10.97 for an emergency department visit, 5 minutes or $13.29 for a general inpatient stay, 15 minutes or $51.20 for an ambulatory surgical procedure, and 15 minutes or $51.20 for an inpatient surgical procedure. Of professional revenue, professional billing costs were estimated to represent 14.5% for primary care visits, 25.2% for emergency department visits, 8.0% for general medicine inpatient stays, 13.4% for ambulatory surgical procedures, and 3.1% for inpatient surgical procedures.

CONCLUSIONS AND RELEVANCE In a time-driven activity-based costing study in a large academic health care system with a certified electronic health record system, the estimated costs of billing and insurance-related activities ranged from $20 for a primary care visit to $215 for an inpatient surgical procedure. Knowledge of how specific billing and insurance-related activities contribute to administrative costs may help inform policy solutions to reduce these expenses.

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Administrative costs have been estimated to represent 25% to 31% of total health care expenditures in the United States,[1-3] a proportion twice that found in Canada and significantly greater than in all other Organization for Economic Co-operation and Development member nations for which such costs have been studied.[1,3,4] The rate of growth in administrative costs in the United States has outpaced that of overall health care expenditures[1] and is projected to continue to increase without reforms to reduce administrative complexity.[5]

Most of the administrative costs in the US health care system (at least 62% based on prior studies) has been attributed to billing and insurance-related activities (described as *billing* hereafter).[6] Billing costs are disproportionately high in the United States: for instance, in primary care practice, performing these activities in the United States costs nearly 4 times more than performing the corresponding activities in Canada.[4]

Knowledge of how specific billing activities contribute to administrative costs may help inform policy solutions to reduce these expenses. However, most prior studies have analyzed billing costs in aggregate without attributing the costs to specific component activities. Furthermore, most of these studies were conducted over a decade ago and before widespread adoption of certified electronic health record (EHR) systems,[1-4,6-9] which were in part intended to simplify the billing process. Specifically, proponents of the widespread move to EHR systems have suggested that such systems would provide specific benefits to physicians, including, according to the Office of the National Coordinator for Health Information Technology, "accurate, streamlined coding and billing," "helping providers improve productivity," "enabling providers to improve efficiency and meet their business goals," and "reducing costs through decreased paperwork."[10]

Therefore, there is a need for high-quality, contemporary data on billing costs. The aim of this study was to use a state-of-the-art accounting method, time-driven activity-based costing, to develop estimates of billing-related costs in a single, large academic health care system and to determine whether such costs vary across 5 key types of patient encounters: primary care visits, discharged emergency department visits, general medicine inpatient stays, ambulatory surgical procedures, and inpatient surgical procedures.

Key Points

Question What are the administrative costs associated with billing and insurance-related activities at an academic health care system with a certified electronic health record system?

Findings In a time-driven activity-based costing study of personnel and overhead costs in a large academic health care system, the estimated costs of billing and insurance-related activities ranged from $20 for a primary care visit to $215 for an inpatient surgical procedure, representing 3% to 25% of professional revenue.

Meaning In an academic health care system with a certified electronic health record system, the estimated costs of billing and insurance-related activities were substantial and varied depending on the type of clinical encounter.

Methods

This study reports on the development of a model to estimate billing costs for physician services in an academic health system with a certified EHR system. The model used time-driven activity-based costing, a state-of-the-art accounting method. The institutional review board of the Duke University Health System determined that the study was exempt research.

Setting

This study was performed in an academic health care system in North Carolina with 66 000 inpatient stays in 1500 inpatient beds, more than 90 000 emergency department visits, and more than 2 million outpatient visits in fiscal year 2016. The system has more than 1600 physicians and 28 000 support staff; it adopted a certified EHR system in 2014.

More than 15 years ago, physician and hospital leaders consolidated all of the billing activities of the health system, except payer contract negotiation, in a single billing organization. The billing organization is a wholly owned limited liability company and employs more than 1500 full-time-equivalent staff in a standalone building of approximately 125 000 square feet, located more than 10 miles from the main academic campus.

Time-Driven Activity-Based Costing

This study used time-driven activity-based costing to estimate billing costs. This microanalytic technique combines a process mapping approach from industrial engineering with activity-based costing from accounting.[11-13] The method has been applied to several medical care pathways including anesthesia care,[14] orthopedic surgery,[15-18] radiology,[19,20] general surgery,[21] neurosurgery,[22] cancer care,[23-25] emergency care,[26] cardiac surgery,[27] and primary care.[28-30] To our knowledge, this analytic approach has not previously been applied to billing functions in a health care setting. The first step in this method was to construct a process map that charts the path followed by an individual bill through the revenue cycle. The second step was to calculate a time-driven cost for each major activity that such a bill encounters. The third step involved adding together the costs of each activity to calculate the total cost of processing an insurance claim. Overhead costs were analyzed and allocated separately. This section provides an overview of the study methods. Greater detail is provided in eMethods 1 and 2 and eTables 1, 2, and 3 in the Supplement.

Process Mapping

Process maps were developed based on interviews with administrators from business units throughout the billing organization. The interviews enabled the project team to describe "the life of a bill," from the time a patient is initially scheduled for an appointment through the time the health system receives payment for the care provided. The tasks performed during the life of a bill include preparing and submitting an insurance claim, documenting services provided to an insured health plan member, and obtaining payment from the appropriate insurer.

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Twenty-seven interviews were conducted systematically based on the organizational chart of the billing organization to ensure that the process map was complete and accurate; eTable 3 in the Supplement lists the position classifications of the interview participants. In each interview, respondents were asked to describe the specific steps in the billing process under their purview, the activities required to complete the steps, the personnel assigned to each task, and the administrative and support personnel in each administrative unit.

Despite the complexity of the process maps, they were a simplified depiction of the true billing process because the model assumed (1) a sequential process that closely approximates the true billing process, although in reality some bills occasionally cycle back to previous steps; (2) all payers require similar levels of documentation; and (3) management of the automatic charges created by an EHR system poses only minimal incremental costs.

Activity Costs

Each step in the process map identified a specific task to be completed by administrative staff. For each step, the analysis required an estimate of the time required to complete the task and a personnel cost for the activity. The billing organization did not have insight into the costs incurred by physicians engaging in billing-related activities, so these costs were estimated in a separate evaluation.

For most steps in the process map, management was able to provide industrial engineering productivity standards on the mean number of expected transactions per individual per day. For the few steps for which such standards did not exist, productivity standards were developed using estimates derived during manager interviews and validated through conversations with supervisory personnel. Respondents were not asked to provide payer-specific data, so the results represent typical payer-agnostic costs for each billing activity.

For each person working directly on process map tasks (treated as direct labor), there were supervisory and support staff assigned to support these individuals (treated as indirect labor). Indirect labor effort was assigned to direct labor based on existing staffing relationships determined during the manager interviews.

Administrative personnel labor costs were determined using the standard job classification level of the people assigned to direct or indirect tasks and applying the "market target" salary for people at that classification level as reported by the academic medical center. Labor costs for administrative personnel were calculated as the product of the activity time estimates (in minutes) for each step in the process map by the cost per minute of both direct and indirect personnel involved.

A separate survey was conducted to assess the component of billing costs incurred by physicians participating in billing-related activities. Examples of billing-related tasks, which typically take place at the site of clinical care delivery rather than within the billing organization, might include collecting data and documents that are not otherwise clinically necessary for patient care, completing billing-related data elements in the electronic record, obtaining prior authorization from insurance companies, responding to requests or queries from the billing organization (including coding-related questions), and participating in utilization management telephone calls. To better estimate the time required for these tasks, a convenience sample of physicians was surveyed from primary care, emergency medicine, hospitalist internal medicine, general surgery, and anesthesiology to provide an estimate of how many minutes were required to perform billing-related tasks for each patient encounter that do not contribute directly to clinical care. The median response within each specialty served as the time estimate for the cost model.

These time estimates were translated into costs for physician time spent on billing activities for each physician specialty using mean academic physician salaries (with fringe benefits applied at a rate of 27.5%),[31] mean annual family medicine physician work hours,[32,33] and mean differences in annual work hours across physician specialties[34] (annual work-hour estimates for anesthesiology were interpolated from available data). Surgical and anesthesia costs were added together in estimating physician costs for ambulatory and inpatient surgical procedure costs.

Overhead Costs

In addition to labor costs, the billing organization incurs corporate and divisional costs (eg, human resources, professional development, utility bills, information technology cost allocations, and building depreciation) that cannot be assigned directly to specific activities. These costs were treated as overhead costs and allocated based on total processing time within the organization (in other words, on a per-direct-labor-minute basis, excluding physician billing times because physicians are not supported by these administrative functions).

Analyses

Using the model described in the previous sections, physician billing costs were estimated for 5 types of patient encounters that were thought to be representative of common services offered by the health system: primary care visits, emergency department visits (discharged, not admitted), general medicine inpatient stays, ambulatory surgical procedures, and inpatient surgical procedures. For each of the 5 encounter types, the analysis "followed the bill" by documenting all revenue cycle activities required to support billing for the encounter. The personnel costs of all these activities (developed as described here), plus allocated divisional and corporate overhead, yielded the total revenue cycle billing cost for each encounter. Total personnel costs were divided into direct labor, support labor, and supervisory labor costs.

Some encounters, such as primary care visits, generate a single global bill for professional and facility fees. Encounters for other types of physician visits incur separate professional and facility (hospital) bills for services in the health system. In the latter cases, costs were developed for the entire episode of care, including billing costs from both professional and hospital claims processing.

The cost-accounting model was developed in Microsoft Excel and built from a variety of typical estimates of resource

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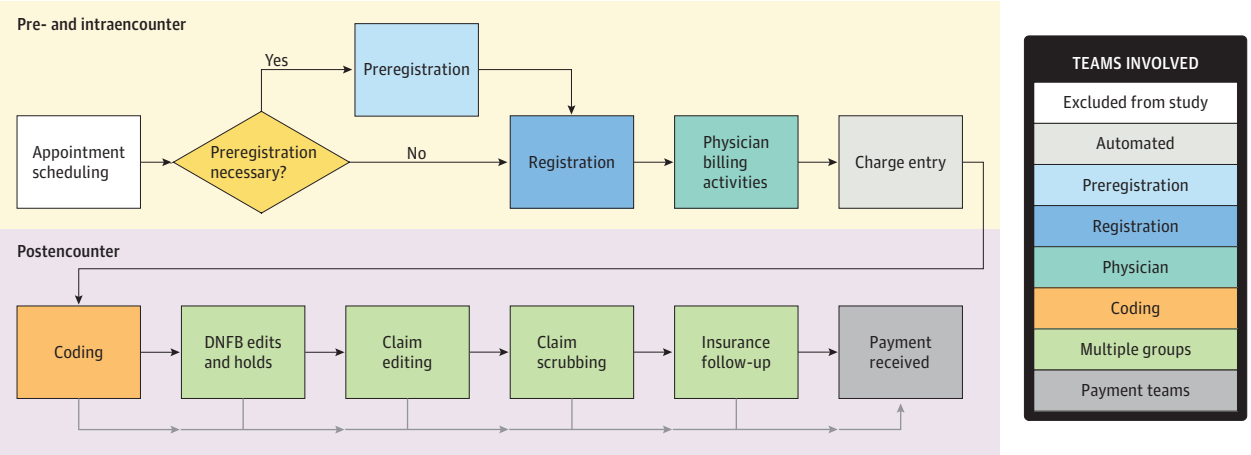
Figure. Simplified Revenue Cycle Process Map



The process map represents the activities involved in provider billing, while the teams involved in performing these activities are highlighted separately. The teams performing each activity are color-coded in the figure. The gray lines in the postencounter phase represent a process flow volume of less than 100%, reflecting claims that do not require each step in the process. For a full process map illustrating quantitative detail and other complexities, see the eFigure in the Supplement. DNFB indicates discharged, not final billed.

Table 1. Estimated Billing and Insurance-Related Administrative Costs by Activity[a]

Costs and Processing Time	Primary Care Visit	Emergency Department Visit[b]	General Inpatient Stay[c]	Ambulatory Surgery	Inpatient Surgery
Total processing time, min	13	32	73	75	100
Total cost, $ (%)	20.49 (100)	61.54 (100)	124.26 (100)	170.40 (100)	215.10 (100)
Cost breakdown by activity, $ (%)					
Pre- and intraencounter costs					
Registration and preregistration	3.82 (19)	5.58 (9)	16.48 (13)	16.48 (10)	16.48 (8)
Physician time	6.36 (31)	10.97 (18)	13.29 (11)	51.20 (30)	51.20 (24)
Postencounter costs					
Professional billing	4.22 (21)	11.72 (19)	4.22 (3)	45.55 (27)	45.55 (21)
Hospital billing		13.70 (22)	44.43 (36)	17.44 (10)	44.43 (21)
Overhead	6.10 (30)	19.57 (32)	45.84 (37)	39.72 (23)	57.43 (27)

[a] Percentages may not sum to 100 because of rounding.

[b] Emergency department visit without hospital admission.

[c] For a general medicine inpatient stay, the billing and insurance-related cost of physician time assumes that autopopulation of the electronic health record after the first inpatient day occurs correctly without subsequent need for physician time or alterations. The cost of professional billing assumes that the incremental cost of additional inpatient days is minimal with respect to the first inpatient day and that physicians are timely with their billing responsibilities, such that all inpatient professional rounding charges are processed and submitted to payers concurrently.

use at each step in the process map. The model did not incorporate variability because there is significant concern that variation in this multistep process is likely correlated in some unobservable fashion, leading to the potential for significant multiplicative errors.

In the base-case analysis, only the annual cost allocations for the certified EHR system to the billing organization were considered. A second analysis examined the influence of including in overhead a 6-year amortization of the full published costs of acquiring and implementing the health system's certified EHR system.[35,36] This analysis is based on the assumption that replacement of the previous noncertified electronic record system was entirely to support billing activities.

In the base-case analysis, overhead costs were allocated on the basis of direct labor costs. In a sensitivity analysis, an alternative calculation was performed in which overhead was allocated on a per-bill basis to examine the effect of this assumption on the results.

To estimate the percentage of physician revenue devoted to billing costs, billing costs were estimated for professional services (or for global billing in primary care), and compared with estimated physician revenue for each of the encounter types. Annual billing costs for primary care physicians were calculated using estimates of the standard clinical work schedule at the academic medical center and the calculated billing cost per visit.

Results

The **Figure** shows the activities in the billing organization's revenue cycle. The eFigure in the Supplement shows the

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Table 2. Estimated Billing and Insurance-Related Administrative Costs by Labor Category[a]

Labor Category	Primary Care Visit	Emergency Department Visit[b]	General Inpatient Stay[c]	Ambulatory Surgery	Inpatient Surgery
Total cost, $ (%)	20.49 (100)	61.54 (100)	124.26 (100)	170.40 (100)	215.10 (100)
Cost breakdown by labor category, $ (%)					
Direct	11.72 (57)	30.09 (49)	56.83 (46)	95.23 (56)	112.92 (52)
Supervisory	1.15 (6)	3.76 (6)	5.34 (4)	9.45 (6)	10.80 (5)
Support	1.52 (7)	8.12 (13)	16.25 (13)	25.99 (15)	33.94 (16)
Overhead	6.10 (30)	19.57 (32)	45.84 (37)	39.72 (23)	57.43 (27)

[a] Percentages may not sum to 100 because of rounding.

[b] Emergency department visit without hospital admission.

[c] For a general medicine inpatient stay, the billing and insurance-related cost of physician time assumes that autopopulation of the electronic health record after the first inpatient day occurs correctly without subsequent need for physician time or alterations. The cost of professional billing assumes that the incremental cost of additional inpatient days is minimal with respect to the first inpatient day and that physicians are timely with their billing responsibilities, such that all inpatient professional rounding charges are processed and submitted to payers concurrently.

Table 3. Estimated Professional Billing Costs as a Percentage of Physician Professional Revenue Per Encounter[a]

Patient Encounter Type	Professional Billing Costs, $	Professional Revenue, $	Professional Billing Costs as a Percentage of Professional Revenue, %
Primary care visit[b]	20.49	141.27	14.5
Emergency department visit	38.88	154.20	25.2
General inpatient stay	50.70	637.00	8.0
Ambulatory surgery	141.54	1055.73	13.4
Inpatient surgery	141.54	4569.57	3.1

[a] Comparison of professional billing costs with revenue estimates for encounters (across all payers) to estimate the professional billing costs as a percentage of professional revenue per encounter. This analysis included only professional billing costs and not facility billing costs.

[b] Primary care assumes a global bill (professional and facility).

full process map. A more complete description of each activity, as well as a full breakdown of cost contributions, can be found in eMethods 1 and eTable 4 in the Supplement.

Data from interviews conducted with 27 health system administrators and 34 physicians in 2016 and 2017 were used to construct the process maps and estimate the cost for each major activity (eTables 2 and 3 in the Supplement). **Table 1** shows the time-driven activity-based physician billing costs for the 5 types of encounters. Estimated total processing time and total costs for billing and insurance-related activities were 13 minutes and $20.49 for a primary care visit, 32 minutes and $61.54 for an emergency department visit, 73 minutes and $124.26 for a general inpatient stay, 75 minutes and $170.40 for an ambulatory surgery procedure, and 100 minutes and $215.10 for an inpatient surgical procedure. All estimates include costs for both professional billing and hospital billing.

Of these totals, the component of billing and insurance-related activities carried out by physicians were estimated at a median of 3 minutes or $6.36 for a primary care visit, 3 minutes or $10.97 for an emergency department visit, 5 minutes or $13.29 for a general inpatient stay, 15 minutes or $51.20 for an ambulatory surgery procedure, and 15 minutes or $51.20 for an inpatient surgery.

Between 63% and 77% of the total costs were attributable to administrative and physician labor, with the remainder representing allocated overhead costs (Table 1; described in eMethods 2 in the Supplement). The postencounter costs for non-primary care encounters were mostly attributable to medical coding.

When administrative costs were determined by labor type, direct labor costs were between 72% and 81% of total labor costs in all 5 encounter types (or 46%-57% of total overall costs) (**Table 2**). Supervisory labor costs were between 7% and 9% of total labor costs (or 4%-6% of total overall costs). Support labor costs were 11% for primary care visits and 19% to 22% for all other encounters (or 7%-16% of total overall costs).

In an analysis that amortized the full cost of the certified EHR on each encounter, billing costs increased to $32.52 for a primary care visit to $319.80 for an inpatient surgical encounter, which represented relative cost increases of 44% to 68% over the base-case results (eTable 5 in the Supplement).

In a sensitivity analysis in which overhead costs were allocated on a per-bill basis, the range of assigned overhead costs narrowed. In this analysis, overhead charges of $15.70 were applied to each encounter, with the exception of primary care encounters, which were allocated half that amount, or $7.85, given that these services generated only a single global bill. This alternative allocation method increased the billing cost for a primary care visit by 9% and reduced the billing cost of an emergency department visit by 6%, a general medicine inpatient stay by 24%, an ambulatory surgical visit by 14%, and an inpatient surgical visit by 19% (eTable 6 in the Supplement). Billing costs for professional services represented an estimated 14.5% of primary care visit revenue, 25.3% of emergency department visit revenue, 13.4% of ambulatory surgery visit revenue, 3.1% of inpatient surgery visit revenue, and 8% of inpatient hospitalist visit revenue (**Table 3**).

In the academic medical center practice, primary care physicians have 45 weeks of clinical service during which she or he has 36 hours per week of direct patient encounters. At a mean of 3 patients per hour, each primary care physician would have an estimated total of 4860 visits annually. With billing

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costs of $20.49 per visit, this represents an estimated annual billing cost of $99 581 per physician (Table 1).

Discussion

This study used a state-of-the-art cost accounting method to derive the costs associated with billing for physician activities at an encounter level. Across the 5 services examined in this study, billing costs for professional services ranged from 3.1% to 25.3% of professional revenue, which represented $20 to $215 in absolute costs per visit.

Previous studies of billing costs were developed before adoption of certified EHR systems. These studies used a variety of methods to estimate costs, including existing aggregate data,[2,3,6] cost reports and departmental budgets,[1,3,9] case studies,[7] and interviews and surveys.[3,4,6,8,9] They reported that physician billing costs represented 10% to 14% of revenue.[6,7,9] This study, using a more accurate cost-tracing approach, estimated these costs to be 14.5% of primary care physician annual revenue, which is at the upper end reported in previous studies.[4,9]

Billing activities were associated with these high costs despite specific efforts to streamline billing operations. Examination of the billing process did not reveal any significantly wasteful or inefficient efforts, such as overt duplication of tasks or the performance of low-skill tasks by high-wage personnel. One reason for this apparent efficiency may be that collecting data on billing activities from a single unified billing organization likely eliminated duplication and inefficiencies that could result from having the billing function performed in multiple locations.

Certified EHR systems were implemented, in part, to address concerns about the significant administrative cost burden in the US health care system. The Office of the National Coordinator for Health Information Technology has suggested that adoption of certified EHR systems could have economic benefits for physicians and health systems by directly addressing these costs.[10] However, the results of the current study suggest that administrative costs remain high even in the setting of a certified EHR. Although the EHR system can automatically generate bills for clinical visits, these systems require the time of high-cost physicians to perform coding and documentation activities that are unrelated to clinical services. In addition, the process maps revealed that despite the electronic system, the billing process still required multiple steps by many types of personnel. Full allocation of certified EHRs to billing activities significantly increased billing costs from the base-case estimate.

These findings suggest that significant investments in certified health information technology have not reduced high billing costs in the United States. To a large degree, the significant administrative costs measured in this study are the consequences of heterogeneous payment requirements across the multiple payers and health plans contracting with the academic health center. The lack of standardized contracts and price schedules within and across markets might explain why administrative costs in the United States are significantly higher than those in other nations that also make fee-for-service payments to private hospitals and physicians.[37] Adoption of certified EHR systems by hospitals appears to have been unable to cope with the complexity of multiple payer contracts or to catalyze significant transformation of the administrative business processes in US health care.

Limitations

This study has several limitations. First, the costs represent conservative estimates of the costs of the billing process based on a model of the process, not from actual examination of patient bills. The billing cost estimates may represent a lower bound on total billing costs because the study did not include the cost of some other billing activities, such as charge management and charge integrity, the costs of payer contract negotiations, or billing training for physicians. While the analysis included cost allocations for the EHR system, billing-related costs that are allocated to other units (such as clinical departments) were not included.

Second, this study used market wage rates for labor costs, and actual costs can vary by physician, market factors, and staff tenure; in fact, actual labor costs at the health system are on average 9% higher than wages used in the analysis due to staff retention and wage increases.

Third, the findings may be sensitive to payer mix and documentation requirements, which may vary by state or region. In addition, reimbursement rates negotiated with payers by academic medical centers may differ from rates negotiated by other health care centers and practices.

Fourth, the analysis was performed in an academic health system that had a centralized, standalone organization to perform all billing-related activities for all units in the system. This large shared-services organization likely benefits from some economies of scale. It is probable that smaller organizations, and those with more dispersed and fragmented billing functions, would incur higher costs to perform billing processes.

Fifth, although estimates were provided for annual billing costs per primary care physicians, data were not available to estimate per-physician annual billing costs for the other service lines examined in this study.

Sixth, the study did not consider the considerable costs that payers incur to process claims and pay bills. Previous studies have found commercial payer billing to be more costly than hospital and professional billing,[2,3,6] implying that a subsequent costing study that includes both payer and provider perspectives may produce total billing costs more than twice those found in the analysis.

Conclusions

In a time-driven activity-based costing study in a large academic health care system with a certified EHR system, the estimated costs of billing and insurance-related activities ranged from $20 for a primary care visit to $215 for an inpatient surgical procedure. Knowledge of how specific billing and insurance-related activities contribute to administrative costs may help inform policy solutions to reduce these expenses.

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