Effect of Physician Reimbursement Methodology on the Rate and Cost of Cataract Surgery

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Objectives: To compare the effects of 2 reimbursement methodologies, fee-for-service and contact capitation, on cataract extraction rates and costs in a stable physician population with little potential for the influence of patient selection. Previous research evaluating the relationship between physician reimbursement incentives and cataract surgical rates has been limited by physician and patient selection bias.

Methods: A pre-post analysis of claims and encounter data for an average of 91,473 commercial beneficiaries and 14,084 Medicare beneficiaries receiving eye care from a network of ophthalmologists and optometrists in St Louis, Mo, between 1997 and 1998. The rate of cataract extractions per 1000 beneficiaries, the costs of cataract procedures, the rates of noncataract procedures, and the level of professional reimbursement for providers were compared during the final 6 months of fee-for-service physician reimbursement and the first 6 months of contact capitation.

Results: Both commercial and Medicare beneficiaries were approximately one half as likely to have cataract extraction (P<.001) under contact capitation as compared with fee-for-service. Professional reimbursement increased by 8% whereas facility fees for cataract procedures decreased by approximately 45%. Cataract surgical rates were disproportionately affected when compared with other ophthalmologic procedures. During the study period, cataract surgical rates were stable in the national and Missouri traditional fee-for-service Medicare population.

Conclusions: The stability of the physician and patient populations allowed us to isolate the effects of physician reimbursement methodology on practice patterns. Compared with fee-for-service, contact capitation reimbursement was associated with significant decreases in cataract extraction rates and costs. The frequency of the cataract extraction surgery, the most common major elective procedure in ophthalmology, was more responsive to physician financial incentives than other ophthalmologic procedures were.

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I n an effort to control health care costs, capitated physician reimbursement has been widely used to curb physicians' procedure rates and resource use. A variety of studies have evaluated the influence of physician incentive and reimbursement systems on the provision of services. Many of these studies have evaluated practice patterns in the primary care setting, and the majority of them confirmed expectations that financial incentives to provide less care result in decreased hospitalization, resource use, and costs, although not universally. Other studies have found that patients enrolled in fee-for-service (FFS) plans receive more diagnostic tests and certain procedures than patients enrolled in managed care health plans.

Goldzweig et al specifically evaluated cataract surgical rates of patients enrolled in managed care and FFS insurance plans, and they found that FFS beneficiaries were twice as likely to undergo cataract extraction as were prepaid beneficiaries. Goldzweig and colleagues could not fully account for the method of physician reimbursement, as patients enrolled in capitated systems may have received care from physicians who were reimbursed on an FFS basis. In addition, most of the available literature (including the article by Goldzweig and colleagues) is limited by the use of retrospective comparisons of patient care in traditional FFS vs health maintenance organization plans. As Hellinger noted, no definitive conclusion can be made on the...
basis of existing studies because of numerous sources of potential bias. Both physician and patient selection biases confound this work, making it difficult to interpret whether physicians and patients choose plans consistent with their ideal view of health care, or whether the incentives in the plans are driving differences in care.

Our study provides a unique opportunity to compare 2 reimbursement systems, FFS and contact capitation (CC). Under FFS, physicians are reimbursed for each procedure, whereas under CC, physicians are provided a lump sum for each patient they manage. Our study is unique because the physician population remained constant during the study period, and while there likely was some turnover in the patient population, the overall enrollment was quite stable. Moreover, the patients in the population were unlikely to have been aware of the payment methodology of their ophthalmologists and, therefore, were unlikely to have selected their health plan on the basis of ophthalmologist reimbursement strategy.

The only variable that changed was the physician reimbursement methodology. The setting was the Barnes Eyecare Network (BECN), St Louis, Mo, and patients in this study were enrolled in a managed care organization (MCO) that outsourced eye care to BECN. At the start of the study period, physicians were reimbursed using an FFS system from a capitated pool. After 9 months, the professional reimbursement methodology was switched to CC. This study documents the subsequent influence on the rate and costs of cataract surgery.

We evaluated cataract extraction because it is among the most common surgical procedures performed, and it has been shown to be highly effective. Cataract extraction represents Medicare’s single largest expenditure for any procedure. Cataract surgery is also a highly elective procedure, and financial incentives may have a greater influence on physician behavior for elective rather than nonelective procedures.

METHODS

STUDY POPULATION

The setting of this study was BECN, which was created in St Louis in 1994 using community- and university-based optometrists and ophthalmologists. The network secured contracts with MCOs to provide eye care services for enrollees through network doctors under capitated, risk-based arrangements. In other words, BECN received capitated payments from MCOs for the provision of all of the eye care services of their members.

Our study population consisted of all of the 1997 and 1998 commercial and Medicare BECN beneficiaries. During the study period, commercial membership averaged 91 473 patients, and Medicare membership averaged 14 084 patients. There were 65 MDs and 85 ODs in the network, and there was no change in the physician population during the study period.

DATA SOURCE

All of the BECN medical and surgical office visits and procedures were analyzed using adjudicated claims for office visits and surgical procedures. Aggregate procedure rates by month were extracted. Cataract surgeries were identified as those with claims for Current Procedural Terminology codes 66820, 66821, 66823, 66830, 66840, 66850, 66852, 66920, 66930, 66940, 66983, and 66984.

To compare trends over time among our Medicare study cohort with national trends among Medicare patients, we analyzed aggregate data on cataract procedure use from January 1, 1997, to December 31, 1998, that were provided by Centers for Medicare and Medicaid Services, Baltimore, Md. We used the same Current Procedural Terminology codes to identify cataract surgeries that were performed. We also accessed Medicare carrier level data in Missouri to identify local trends in cataract surgical rates in the Medicare FFS population in the state during the study period.

PHYSICIAN REIMBURSEMENT METHODOLOGY

For the first 9 months of the study period (February 1, 1997, through September 30, 1997), a discounted FFS system was used to reimburse physicians from a per-member-per-month pool that was paid to BECN by the MCOs. The monthly claims for office visits and procedures were converted to relative value units. The total number of relative value units was divided into the available monthly capitation dollars to determine a floating conversion factor, which was then multiplied by the number of relative value units used for each provider to yield each provider’s reimbursement amount. Thus, each physician perceived financial incentives to increase the number of procedures provided. However, considering the fact that physicians were reimbursed from a limited pool, if the physician population as a whole performed more surgeries, then their facility costs would increase, resulting in a decrease in each physician’s reimbursement per procedure.

For the next 15 months (October 1, 1997, to December 31, 1998), each provider received 1 lump sum payment for each new patient. Every patient who visited an ophthalmologist after October 1, 1997, was considered a new patient, even if that patient was seen by the same physician previously. A new patient was strictly defined as the first visit of any patient after the initiation of CC reimbursement.

A physician’s individual compensation under CC was a function of that provider’s specialty (ie, retina specialists received more per new patient than general ophthalmologists), the number of new contacts per provider, and the total number of new contacts in the group. Physicians were reimbursed more as they saw more new patients, but they received no additional reimbursement when they followed up with or performed procedures on patients. Again, physician reimbursement came from a limited source, and group cost savings increased the money available for physician reimbursement.

In both the FFS and CC reimbursement periods, BECN received capitated payments from the MCOs for the care of all of the beneficiaries, and those capitated payments were used to pay physicians and to reimburse facilities for the costs of providing procedures. As a result, under either methodology, if more procedures were performed, facility costs would increase and the source that BECN used to reimburse physicians would shrink.

TIMING OF REIMBURSEMENT CHANGE

The physician reimbursement methodology was changed on October 1, 1997. Physicians were officially notified of the impending change approximately 2 weeks prior to October 1, although there had been some previous discussion of changing the methodology. No changes in patient benefit structure occurred during the study period.
INDICATIONS FOR CATARACT SURGERY

The indications for ocular surgery performed on our patient population during both the FFS and CC reimbursement periods were the community standards in metropolitan St Louis as practiced by university ophthalmologists associated with Washington University, St Louis, Mo. All of the surgical procedures, including cataract surgery, were reviewed by a BECN utilization committee. The minimum criteria for cataract surgery were a visual acuity of 20/40 or less, including glare testing, and a subjective decrease in vision by the patient. Vision-related quality-of-life outcome analysis was not performed preoperatively or postoperatively.

STATISTICAL ANALYSIS

We compared the rate and associated costs of cataract surgery between the last 6 months of the discounted FFS period and the first 6 months of the CC period. We also compared the rate of noncataract surgeries in the FFS and CC periods. Intercooled Stata 8.1 statistical software (Stata Corp, College Station, Tex) was used to calculate t tests to compare means.

RESULTS

EYE SURGICAL RATES

Between April 1, 1997, and March 31, 1998, an average of 91 473 commercial beneficiaries (range, 81 737-99 887 commercial beneficiaries) and 14 084 Medicare beneficiaries (range, 12 969-15 456 Medicare beneficiaries) of a large MCO received eye care through BECN. Total membership was quite stable throughout the study period (Figure 1). New office visit rates were also stable, increasing slightly during the CC period. The FFS period was measured between April 1, 1997, and September 30, 1997. The CC period was measured between October 1, 1997, and March 31, 1998.

The mean number of cataract procedures per month per 1000 Medicare beneficiaries was 4.59 under discounted FFS and 2.37 under CC (Table 1), a difference of over 48% (P<.001). For the commercial population, monthly procedure rates per 1000 beneficiaries were 0.29 under discounted FFS and 0.13 under CC, a decrease of 55% (P<.001). The decrease in procedure rates appeared, roughly, to coincide with the date that the reimbursement methodology was changed (Figure 2).

National Medicare claims data were used to evaluate whether there were historical trends in the Medicare population that corresponded to the decreased surgical rates in BECN. We found cataract surgical rates in the national Medicare FFS population to be quite stable between 1997 and 1998. The FFS cataract surgical rates were 5.7 procedures per month per 1000 Medicare beneficiaries in 1997, and 5.4 procedures per month per

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**Table 1. Cataract Procedure Rates per Month per 1000 Beneficiaries**

<table>
<thead>
<tr>
<th>Physician Reimbursement Methodology</th>
<th>Medicare Beneficiaries</th>
<th>Commercial Beneficiaries</th>
<th>Total Beneficiaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract procedures under FFS, No./mo per 1000 beneficiaries (SE)*</td>
<td>4.59 (.27)</td>
<td>0.29 (.02)</td>
<td>0.87 (.04)</td>
</tr>
<tr>
<td>Cataract procedures under CC, No./mo per 1000 beneficiaries (SE)†</td>
<td>2.37 (.11)</td>
<td>0.13 (.02)</td>
<td>0.43 (.00)</td>
</tr>
<tr>
<td>Percentage change, % (P value)</td>
<td>−48 (&lt;.001)</td>
<td>−55 (&lt;.001)</td>
<td>−51 (&lt;.001)</td>
</tr>
</tbody>
</table>

Abbreviations: CC, contact capitation; FFS, fee-for-service.

†Contact capitation: October 1997 to March 1998.
1000 beneficiaries in 1998. In Missouri, cataract procedure rates were slightly higher than the national average. Cataract procedure rates averaged 6.3 procedures per month per 1000 Medicare beneficiaries in 1997, and they rose to 6.8 procedures per 1000 beneficiaries in 1998. Our observation of higher cataract surgical rates seen in the Medicare FFS population than in the BECN Medicare managed care population is consistent with previous research comparing Medicare managed care and traditional FFS Medicare.16

Noncataract surgical rates decreased more slowly than cataract surgical rates after the switch to CC (Table 2). In the Medicare population, noncataract surgical rates increased slightly during the CC period as compared with the FFS period. In the commercial population, noncataract surgical rates decreased by over a third, which is less than the 55% drop seen in cataract surgical rates. Overall, noncataract surgical rates fell less than 20% as compared with a drop of more than 50% in cataract surgical rates.

Low procedure rates for noncataract procedures did not allow for a statistical comparison of rates of noncataract procedures during the FFS and CC time periods. We identified several key procedures in the Medicare and commercial populations, and we present annualized rates of those procedures (Table 3). The procedures that are shown represent a broad range of both elective procedures (ie, strabismus surgical procedure) and nonelective procedures (ie, retinal detachment repair). While annualized rates decreased in some of the selected procedures in the CC time period, the magnitude of the reductions appeared to be relatively small.

### Table 2. Noncataract Surgical Rates (per Month per 1000 Beneficiaries) During Fee-for-Service and Contact Capitation Reimbursement Periods

<table>
<thead>
<tr>
<th>Physician Reimbursement Methodology</th>
<th>Medicare Beneficiaries</th>
<th>Commercial Beneficiaries</th>
<th>Total Beneficiaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncataract surgical procedures under FFS, No./mo per 1000 beneficiaries*</td>
<td>0.63</td>
<td>0.15</td>
<td>0.21</td>
</tr>
<tr>
<td>Noncataract surgical procedures under CC, No./mo per 1000 beneficiaries†</td>
<td>0.65</td>
<td>0.10</td>
<td>0.17</td>
</tr>
<tr>
<td>Percentage change, %</td>
<td>+3.2</td>
<td>−37</td>
<td>−19</td>
</tr>
</tbody>
</table>

Abbreviations: CC, contact capitation; FFS, fee-for-service.
†Contact capitation physician reimbursement: October 1997 to December 1998.

### Table 3. Annualized Rates of Selected Procedures in Medicare and Commercial Barnes Eyecare Network Populations During Fee-for-Service and Contact Capitation Reimbursement Periods

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Annualized Procedure Rate per 1000 Patients in Fee-for-Service*</th>
<th>Annualized Procedure Rate per 1000 Patients in Contact Capitation†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicare population</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fistulization of sclera for glaucoma</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Yag laser</td>
<td>2.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Vitrectomy</td>
<td>1.0</td>
<td>1.4</td>
</tr>
<tr>
<td>Penetrating keratoplasty</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Vitrectomy by laser</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Repair of entropion, blepharoplasty</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Dacrocystorhinostomy</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Commercial population</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strabismus surgical procedure</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Vitrectomy</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Fistulization of sclera for glaucoma</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Repair of retinal detachment with vitrectomy</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Vitrectomy by laser</td>
<td>0.09</td>
<td>0.04</td>
</tr>
<tr>
<td>Dacrocystorhinostomy</td>
<td>0.03</td>
<td>0.04</td>
</tr>
</tbody>
</table>

†Contact capitation physician reimbursement: October 1997 to December 1998.
COST OF CATARACT CARE

The implementation of CC substantially decreased the number of cataract procedures performed. The greatest opportunity for savings generated by CC reimbursement was through reductions in the use of surgical facility services (ie, outpatient surgical facilities and anesthesia services). Facility fees for the network decreased by 45% in the 6 months after implementing CC.

LEVEL OF PROFESSIONAL REIMBURSEMENT

Under FFS reimbursement, high resource use resulted in the need to reduce the level of reimbursement per relative value unit. Owing to savings from lower eye care costs in CC, additional funds were available for reimbursement. Overall physician reimbursement increased by almost 9% in the 6 months after CC.

COMMENT

By evaluating a single patient and provider population and varying only the physician reimbursement methodology, we present a unique opportunity to isolate the influence of provider financial incentives on the rate and costs of cataract surgery. As compared with CC, the FFS methodology is associated with a significantly higher rate of cataract surgery and related surgical costs. Our results are consistent with those seen by Goldzweig et al,16 who found that patients enrolled in FFS received cataract surgery at approximately twice the rate of patients enrolled in managed care. The BECN administrators theorized that under FFS from a capitated source, network doctors would work together to manage the use of elective services. However, use of the most costly elective procedure (cataract surgery) remained high, even as provider reimbursement levels decreased.

We also found that cataract surgical rates decreased more dramatically than other ophthalmologic procedures after implementing CC. Cataract surgery is almost always an elective procedure, can be performed quickly with few complications, and the exact timing of surgery is subject to both the surgeon’s judgment and influence. The finding that cataract surgery was more responsive to reimbursement methodology than other procedures supports the hypothesis that elective procedures are more responsive to physician incentives than nonelective procedures.

One study limitation is the lack of controls for variables known to increase the prevalence of cataracts, such as age, sex, and duration of diabetes mellitus.22 We believe that the stability of the patient population during the study period supports the use of a pre-post study design, and it is quite unlikely that sicker patients, or those more likely to need cataract surgery, selected other health plans on the basis of the reimbursement strategy for their ophthalmologists. In fact, the short time frame of this study decreases the likelihood that patients were aware of and selected their health plans on the basis of the reimbursement methodology of their physicians.

Unfortunately, our data did not allow us to determine the exact number of patients who entered and exited BECN during the study period, and we cannot rule out the possibility that some patients exited the program when physician reimbursement changed. However, the institution of capitated physician reimbursement only applied to the ophthalmologists at BECN, not to those in the MCO in general. Therefore, we believe that it is quite unlikely that patients selected their health plan on that basis. It is possible that patients left BECN because they were denied surgery during the CC period and saw a provider outside of the network. Our data does not allow us to definitively say that patients were not receiving care elsewhere. Rather, we can only comment on procedure rates of physicians practicing in the network.

Another limitation is the possibility that differences observed between FFS and CC were related to pent-up demand for cataract surgery at the onset of the contract that was met during the early FFS portion of the study. Yet, there seems to be a strong correlation between the decrease in cataract surgical rates and the implementation of CC, with maintenance of this decrease over time. Nonetheless, we are unable to rule out the possibility that pent-up demand had some influence on surgical rates during the FFS period.

Another concern is that we are measuring the short-term effects of a change in physician reimbursement methodology and that all of the patients with cataracts will receive procedures eventually, with reimbursement methodology only serving to either delay or accelerate the timing of the surgical procedure. In addition, by delaying cataract surgery, intervening mortality may influence overall cataract surgical rates. Considering that many patients with cataracts are elderly with multiple medical problems23 and that patients with cataracts have higher mortality than patients without cataracts,24,25 there is reason to believe that by postponing elective surgical procedures, intervening mortality may influence overall surgical rates. Further study is necessary to determine whether patients are receiving cataract surgeries later or are not receiving them at all under CC.

Our data cannot determine whether there is overuse in FFS reimbursement or whether there is underuse in CC. Further research is needed to better understand the influence of financial incentives on health care quality. Ultimately, we must assess how physician reimbursement influences clinical outcomes such as vision-related quality of life. Only by assessing clinical outcomes can we determine whether patients enrolled in FFS were exposed to unnecessary risks or whether the clinical benefits of the interventions outweighed those risks. Further research should also investigate whether practice patterns were disproportionately influenced for patients with specific clinical or demographic characteristics. A better understanding of the influence of different physician reimbursement methodologies on the equity of care would be instructive. As enthusiasm for linking physician reimbursement to the quality of care grows, more health plans will likely use quality standards to reward physicians in addition to a baseline of either FFS or fixed-payment methodologies. More study is needed to evaluate the relationship between costs, quality, and combinations of physician reimbursement incentives and methodologies.
Submitted for Publication: October 14, 2004; final revision received February 3, 2005; accepted February 4, 2005. Correspondence: William Shrank, MD, MSHS, Division of Pharmacoepidemiology and Pharmacoeconomics, Brigham and Women's Hospital, Harvard Medical School, 1620 Tremont St, Boston, MA 02120 (wshrank@partners.org).

Financial Disclosure: None.

REFERENCES


Announcement

Clinical Trials Registration Required. In concert with the International Medical Committee of Journal Editors, Archives of Ophthalmology will require, as a condition of consideration for publication, registration of clinical trials in a public trials registry (such as http://ClinicalTrials.gov). Trials must be registered at or before the onset of patient enrollment. This policy applies to any clinical trial starting enrollment after March 1, 2006. For trials that began enrollment before this date, registration will be required by June 1, 2006. The trial registration number should be supplied at the time of submission. For details about this new policy see the editorials by DeAngelis et al in the September 8, 2004 (2004;292:1363-1364), and June 15, 2005 (2005;293:2927-2929) issues of JAMA, and Levin et al in the September 2005 (2005;123:1263-1264) issue of ARCHIVES. For information on how we define a clinical trial, see Levin et al in the September 2005 (2005;123:1263-1264) issue. Also see the Instructions to Authors on our Web site (http://www.archophthalmol.com).