

# Reference-Based Pricing: An Evidence-Based Solution for Lab Services Shopping

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**R**eference-based pricing (RBP) systems are generally based on the premise that a common reimbursement level can be established for a group of comparable healthcare services while not compromising quality.<sup>1,5</sup> Traditionally, RBP has focused on pharmaceuticals to control expenditures<sup>1,3</sup> by promoting the shift to prescribing less costly medications with equivalent efficacy and safety.<sup>5</sup> A reimbursement level is established for a group of medications that are clustered according to some equivalence criteria, with a reference price established for each cluster. Third-party payers reimburse only the reference price for medications within specific clusters.<sup>1,3,5</sup> For charges that exceed the reference price, members pay an out-of-pocket expense that is not reimbursable by health savings accounts or health reimbursement accounts (HRAs), and do not receive rebates for charges below the reference price.<sup>1,3,5</sup>

Multiple evaluations of RBP demonstrate significant reductions in the use of higher-priced medications and increased use of fully covered medications, including calcium channel blockers,<sup>6</sup> angiotensin-converting enzyme inhibitors,<sup>7-9</sup> proton pump inhibitors,<sup>10</sup> nitrates,<sup>11</sup> and nonsteroidal anti-inflammatory drugs.<sup>12</sup> Systematic reviews conclude that RBP is associated with increased prescribing of reference medications, decreased expenditures, no adverse health effects, no increase in healthcare utilization, small reductions in medication prices, and decreased use of higher-cost medications.<sup>13,14</sup> While the evidence is limited regarding the impact of RBP on health outcomes, no statistically or clinically significant differences have been reported for hospitalization rates, utilization of emergency services, and mortality.<sup>3,13</sup>

Revenue, spending, and the number of lab tests in the United States have steadily increased in the past decade,<sup>15</sup> with approximately 240,000 private laboratories<sup>15,16</sup> performing almost 7 billion tests and revenues projected at \$52 billion in 2007 alone.<sup>15</sup> Out-of-pocket expenditures, including payment for lab services, rose 4.8% in 2012, with 28% of these costs associated with outpatient services, including

## ABSTRACT

### Objectives

To determine the effect of reference-based pricing (RBP) on the percentage of lab services utilized by members that were at or below the reference price.

### Study Design

Retrospective, quasi-experimental, matched, case-control pilot evaluation of an RBP benefit for lab services.

### Methods

The study group included employees of a multinational grocery chain covered by a national health insurance carrier and subject to RBP for lab services; it had access to an online lab shopping tool and was informed about the RBP benefit through employer communications. The reference group was covered by the same insurance carrier but not subject to RBP. The primary end point was lab compliance, defined as the percentage of lab claims with total charges at or below the reference price. Difference-in-difference regression estimation evaluated changes in lab compliance between the 2 groups.

### Results

Higher compliance per lab claim was evident for the study group compared with the reference group (69% vs 57%;  $P < .05$ ). The online shopping tool was used by 7% of the matched-adjusted study group prior to obtaining lab services. Lab compliance was 76% for study group members using the online tool compared with 68% among nonusers who were subject to RBP ( $P < .01$ ).

### Conclusions

RBP can promote cost-conscious selection of lab services. Access to facilities that offer services below the reference price and education about RBP improve compliance. Evaluation of the effect of RBP on higher-cost medical services, including radiology, outpatient specialty, and elective inpatient procedures, is needed.

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### Take-Away Points

This study is a pilot evaluation of the effect of reference-based pricing (RBP) on consumers' compliance with lab services at or below the reference price.

- Interventions to promote the control of healthcare costs, and not compromise quality, are essential during this time of healthcare reform.
- This study adds to existing literature on RBP by extending its application beyond pharmaceuticals to include lab services.
- Our results suggest a favorable impact of RBP on lab compliance, and suggest that RBP may have a similar effect on utilization rates for more costly medical services, such as radiologic and inpatient procedures.

labs.<sup>17</sup> Significant variations in prices for the same lab test are evident in a state-by-state comparison. For example, the cost of a complete blood count ranged from \$6.50 to \$10.86 in 2007.<sup>18</sup> To our knowledge, the value of RBP for controlling costs associated with lab testing has not been evaluated. We conducted a pilot evaluation to compare lab compliance between members subject to an RBP benefit and members not subject to RBP.

## METHODS

From January 2010 through December 2011, a national health insurance carrier collaborated with a multinational grocery chain to conduct a retrospective, matched, case-control pilot evaluation of an RBP intervention for lab services. This was an effort to minimize cost variations by establishing reference prices that were similar to the median price point across markets. The RBP benefit was implemented by an employer with approximately 25,000 lives covered by the payer, with the benefit available to all eligible members with employer-sponsored coverage (this was the study group). The reference group was covered by the same payer but had no RBP benefit from any payer during the study. Review and approval of the study was provided by the payer's legal counsel and their Consumer Health Engagement Steering Committee, and the employer's health research team.

A total of 492 current procedural terminology (CPT) codes were subject to the RBP benefit, and based on non-urgent or emergent lab services. Excluded CPT codes included pathology; labs performed in physician offices, emergency departments, outpatient surgical centers, and urgent care centers; genetic tests; labs performed for mental health, substance abuse, oncology, dialysis, and infertility; and all inpatient labs. All claims from Wyoming, Montana, Nebraska, and Oregon were excluded because they were not subject to the national-base RBP values, and the lab network in these states, which are primarily rural, was not as extensive as those in other states.

### Study Population

Inclusion criteria for the study and reference groups were primary subscribers and their dependents, with one of the 492 lab CPT codes subject to RBP, who had a consumer-directed health plan (CDHP) through their employer. Study participants were residents of the United States and had active private health insurance from the same payer for all of 2011 and at least 3 months in 2010; this allowed for

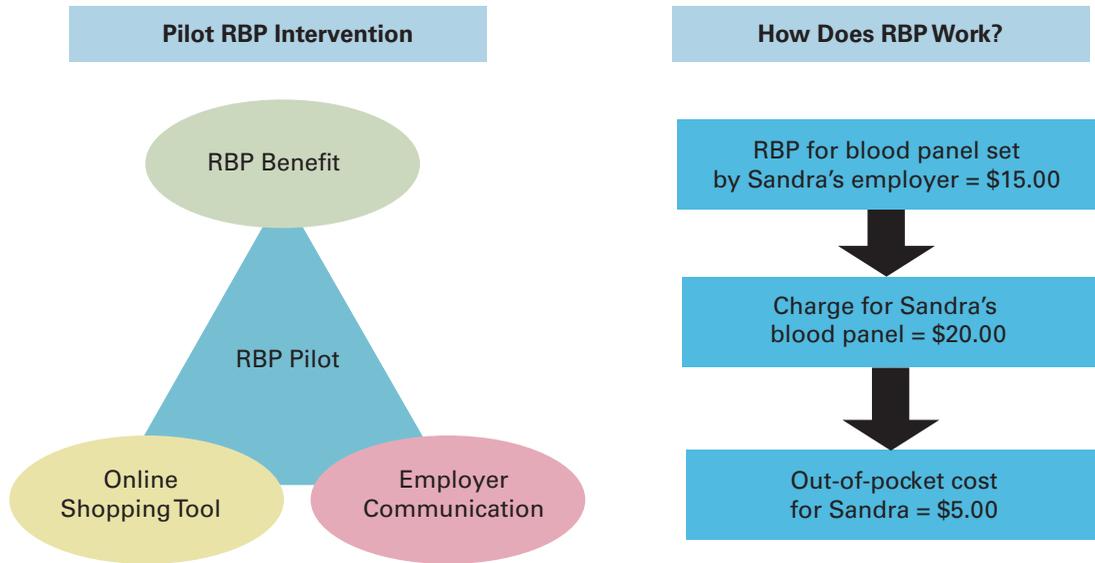
an accurate assessment of pre-intervention lab use and health risk. We collected 15 months of pre-intervention data characterizing demographic and clinical variables, medical costs, and healthcare utilization for the study and reference groups, with neither group subject to RBP for any healthcare services during this period.

### Matching Methodology

Matching members of the study and reference groups were based on an iterative and flexible process (Multi-Pass), similar to other validated retrospective matching methods without replacement.<sup>19,20</sup> We calculated 11 matching algorithms to identify the best match between the 2 groups. Selection of the matched set of members was based on: 1) the degree of variance within and between the study and reference populations, 2) the percentage of study group members matched with the reference group, and 3) the extent to which the matched study group mirrored all members in the unmatched study sample, which ensured that characteristics of the study group were not significantly different from those of the entire population of members subject to RBP.

Baseline matching variables included: age; gender; total medical costs (TMC); pre-intervention lab compliance; lab CPT code; household income; major diagnosis; utilization rates for inpatient, outpatient, and lab services; out-of-pocket cost share at the time of service; coverage under a CDHP; and 3-digit zip code. These variables represented the demographic, healthcare utilization, access, and health risk factors thought to be associated with lab compliance, and minimized the likelihood of pre-intervention differences between the 2 groups. Inclusion of major diagnosis and inpatient utilization rates increased the likelihood that baseline health risk was equivalent between the 2 groups. Our comparison of baseline episodic risk group revealed no significant differences between the study and reference groups, further confirming comparability of health risk status between the 2 groups.

■ **Figure 1.** Intervention Components With Example of Reference-Based Pricing (RBP)



Successful matches of eligible lab claims were achieved for 79.55% of the 4363 claims in the study group, the lowest degree of variance for all between-group differences ( $P > .05$ ). There was not a 1:1 match between the study and reference group participants because the matching process considered both claims and demographic characteristics. For example, males were matched with males with an identical CPT code. This made it possible for multiple claims per member to be matched, although no single member comprised more than 3% of matched claims.

All matching variables, with the exception of baseline compliance, were based on claims experience from January 1, 2010, through March 14, 2011. Baseline compliance was defined as the percentage of lab claims per member with charges at or below the reference price for the interval of January 1, 2010, through December 31, 2010.

### Reference-Based Pricing Intervention

Members of the study group who obtained services that exceeded the reference price were responsible for paying the price differential as an out-of-pocket expenditure rather than using resources from health funds, such as an HRA. No rebate was offered when services were obtained at or below the reference price.

Study group members also had access to a free online shopping tool (Figure 1) that allowed them to enter lab-related text such as “lab,” “cost of lab,” and “blood panel.” This generated a display of information about the cost, location, and type of lab services in their geographic area and was intended to help members make informed choices about where to obtain services.

The reference group had no access to the RBP benefit from any payer during the study, received no information about RBP from their employer, and did not have access to an online lab shopping tool. Both groups remained in a CDHP with access to the same network of lab providers under the same payer. All lab providers met quality standards established by the payer, and participants were not denied access to any test or lab.

### Study End Points

The primary study end point was lab compliance rate, defined as the percentage of claims for lab services that were at or below the reference price for each unique member in the study and reference groups during the intervention period of March 15, 2011, through December 31, 2011. Secondary outcomes were utilization rates for the online shopping tool, average out-of-pocket charges exceeding the reference price, and TMC. Use of the online shopping tool was defined as the percentage of members in the study group who accessed the tool before their first date of lab service. The average out-of-pocket charge was the average difference between the charge and the associated reference price. Total medical costs were the total of charges for facility, professional, and lab services.

### Statistical Analysis

We assumed there would be a 4.5% to 5% absolute increase in lab compliance, a conservative estimate based on RBP pharmacy studies.<sup>6-12</sup> Based on a power of 0.80 and a 2-sided  $P$  value of .05, the estimated sample size to achieve statistical significance was 4331 subjects.

■ **Table.** Post Matching Characteristics of Study and Reference Groups: January 1, 2010, to March 14, 2011

Characteristic	Group		P
	Study (n = 3471)	Reference (n = 3471)	
Male, %	47.0	47.0	1.00
Age, mean (SD); median	51 (10); 52	51 (10); 52	.27
Household income in 2010, mean (SD); median	75K (30K); 70K	77K (32K); 71K	
Number of office visits, PMPM	0.73 (1.1)	0.71 (1.2)	.47
Number of inpatient visits, PMPM	<1.0	<1.0	.65
Number of lab claims, PMPM	0.23 (0.6)	0.22 (0.06)	.08
Major diagnosis, %			
Heart/circulatory	9.0	10.0	.08
Lower respiratory	3.0	3.0	1.0
Gastrointestinal	2.0	2.0	1.0
Total eligible charges, \$ in Q1, mean (SD)	715 (3.4K)	694 (3.2K)	.08
ERG, mean (SD)	2.8 (5.9)	2.9 (6.1)	.17

ERG indicates episode related group; PMPM, per member per month.  
<sup>a</sup>Per member per month estimates were used to report health services utilization trends as standard health insurance utilization reporting.

We evaluated the change in lab compliance between the study and reference groups using the difference-in-differences regression model estimation with bootstrapped standard errors.<sup>21</sup> To estimate lab compliance for the pre-intervention period, we applied the 2011 lab-referenced prices against the 2010 claims as a proxy for what the reference-based prices would have been in 2010. Difference-in-difference regression estimated changes in TMC by comparing charges during the pre-intervention period with those incurred during implementation of the RBP intervention.

Demographic and clinical variables, lab compliance rates, and TMC were analyzed with  $\chi^2$  tests for discrete variables, one-way analysis of variance for normally distributed continuous variables, and the Wilcoxon and Mann-Whitney test for skewed distributions of continuous variables. Alpha was set to 0.05 for all analyses, which were performed with SAS software version 9.1 (SAS Institute Inc, Cary, North Carolina).

## RESULTS

### Baseline Characteristics and Online Intervention Use

There were 4363 employees and dependents in the study group during the pre-intervention period, for a total of 20,144 lab claims including only the 492 lab CPT codes subject to RBP. A total of 83,059 reference group members (employees and dependents) had lab claims during the baseline period, with a total of 405,784 eligible lab claims

limited to the eligible lab CPT claims. The demographic and clinical characteristics of the 2 groups were similar after matching (**Table**).

### Lab Compliance

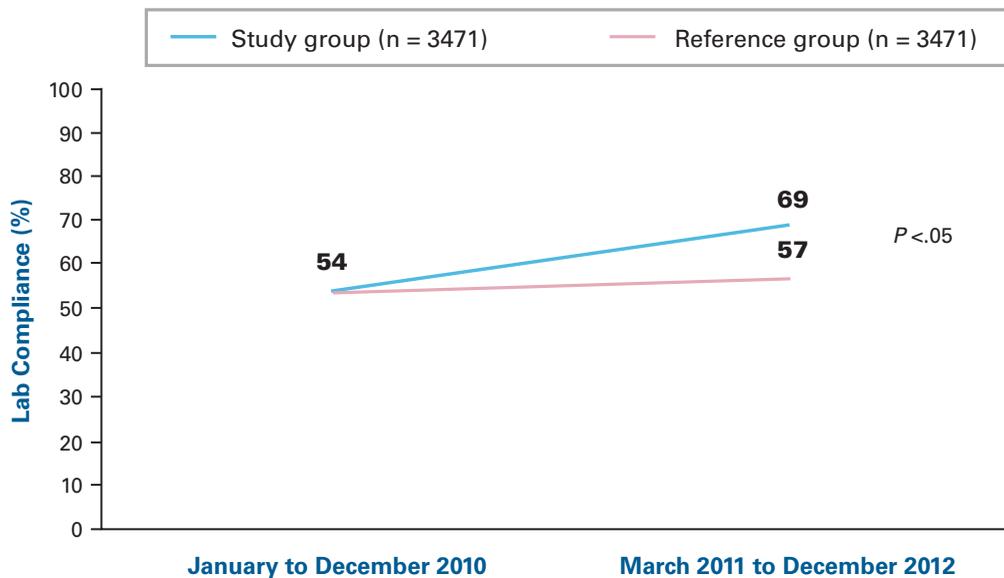
The overall pre-intervention lab compliance rate was 54%. During the intervention period, this rate increased to 57% in the reference group compared with 69% in the study group ( $P < .01$ ; **Figure 2**). The online tool was used by 7% of the study group before their first lab claim. Lab compliance was 76% for users of this tool compared with 68% for study group members who did not use the tool ( $P < .01$ ) and 57% in the reference group with no access to the tool ( $P < .01$ ; **Figure 3**). Women were more likely to use the online tool (55% compared with 45% males;  $P < .05$ ), with no other significant demographic or clinical differences between users and nonusers.

There was a 4% relative decrease in per member per year (PMPY) RBP lab utilization for the study group, from 0.52 during the pre-intervention interval to 0.50 during the intervention. Lab utilization PMPY for the reference group increased from 0.51 to 0.54 from the pre-intervention to the intervention period. The difference in PMPY expenditures between the study and reference groups during the intervention period was not significant ( $P = .12$ ).

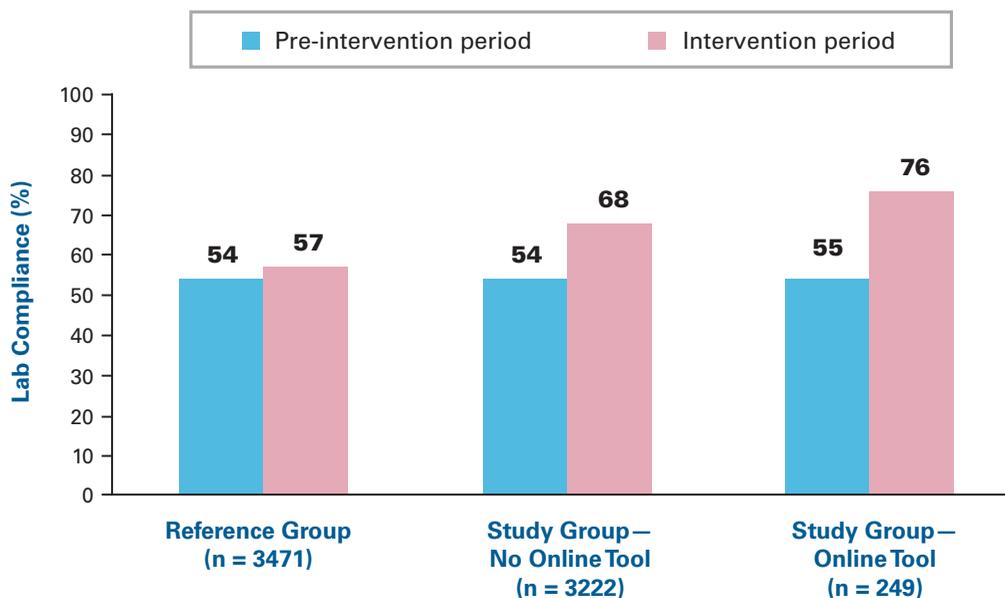
### Medical Costs

The increase in lab compliance among the study group was equivalent to a \$4.45 decrease (SD, \$7.16) in the average lab unit cost relative to the reference group

■ **Figure 2.** Effect of Reference-Based Pricing Benefit on Lab Compliance



■ **Figure 3.** Lab Compliance Levels Associated With Utilization of Online Tool

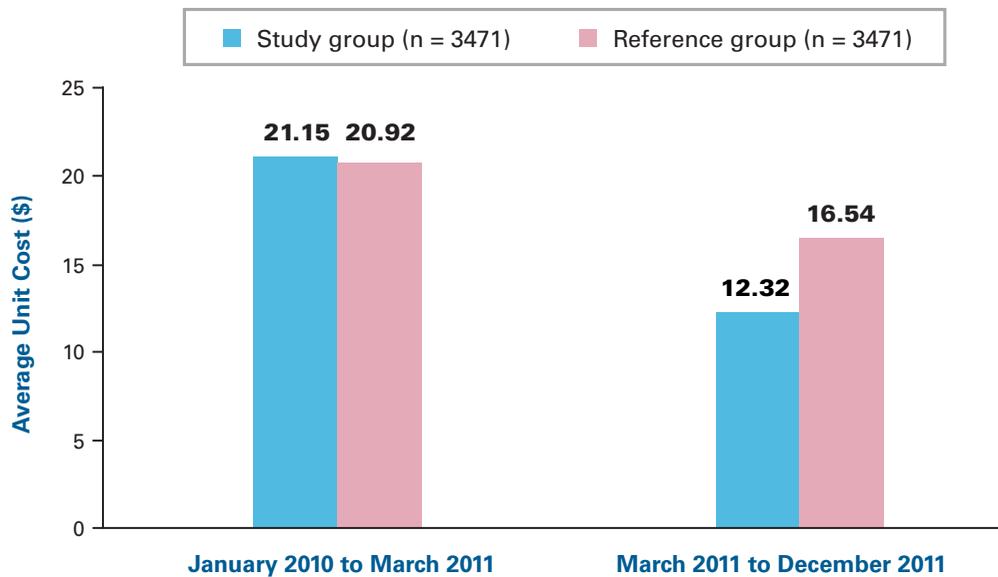


( $P = .04$ ) (Figure 4). Out-of-pocket costs associated with lab noncompliance were not significantly different, at a mean of \$20 (SD, \$21) and \$21 (SD, \$24) in the study and reference groups, respectively ( $P = .954$ ). We found no statistically significant differences in costs per member per month between the 2 study groups, with a mean change between the pre-intervention and intervention period of \$12.79 for the study group and \$10.86 for the reference group.

## DISCUSSION

This pilot evaluation demonstrated significantly greater lab compliance among members with the RBP benefit (69%) compared with those not subject to RBP (57%). Members subject to the RBP benefit who did not use the online shopping tool had a higher lab compliance rate (68%) than the reference group (57%). This suggests that the RBP benefit, when paired only with employer com-

■ **Figure 4.** Average Unit Cost per Lab Claim



munication, increased member compliance with preferred labs.

Members subject to RBP who used the online tool had higher lab compliance (76%) compared with members who did not use the tool (68%). However, access to the tool was not randomly assigned within the study group. Therefore, due to selection bias, it is not possible to make conclusive statements on the impact of the tool on compliance. In the absence of an effective communication strategy, most CDHP designs that combine co-insurance reductions and access to a healthcare shopping tool fail because the consumer is unaware of the benefit and/or the shopping tool to facilitate their choice of service providers.<sup>17</sup>

The CPT codes included in the RBP benefit accounted for \$2.12 million in total lab costs, while the TMC for all healthcare services for the study group employer was \$170.36 million. Therefore, RBP-eligible lab costs represented only 1.25% of TMC for the employer. From the employer's perspective, this would be equivalent to a savings of \$577,970 if members had engaged in selective lab shopping behaviors. Greater savings may be achieved when RBP is applied to medical services that are more costly than lab services, such as radiology or inpatient services.

The average out-of-pocket charge for members who did not comply with the RBP benefit was \$20.46, a relatively low financial penalty. This underscores the importance of aligning the RBP benefit with consumer-selected health services that are associated with the possibility of substantial savings, such as more costly radiology or in-

patient services. However, the employer chose to introduce members to RBP by using lower-cost lab services as a phased approach that will support the transition to RBP for more costly services.

Costs of the average unit per lab claim declined in both groups, suggesting that there was an overall decrease in prices across the market during the intervention. However, the regression analysis revealed a significantly greater decrease for the study group compared with the reference group, suggesting that the cost reduction was due, in part, to RBP.

### Study Limitations

The utilization rate for the online tool was low at 7%. While the entire study group was exposed to the employer's communication campaign about the RBP benefit, we could not directly measure the degree to which members received, understood, or interpreted this information. Limited resources prevented us from surveying members of the study and reference groups to identify factors associated with their selection of lab services. Research to understand the effects of provider practices on members' lab utilization behaviors, such as unnecessary versus appropriate lab ordering, would have enhanced our understanding of the role of RBP in cost-containment for lab services.

The 10 most frequently utilized labs in the United States for 2007 were basic and comprehensive metabolic panels; lipid panel; urinalysis with scope, automated with

scope, or without scope; glycated hemoglobin; thyroid assay; complete blood count; and prothrombin time.<sup>18</sup> Similarly, the top 3 labs in our study were a lipid panel, comprehensive metabolic panel, and prostate-specific antigen test, accounting for 55.9% of all tests performed during the intervention. This suggests that the majority of labs subject to RBP did not fall under a bundled CPT and matching on specific CPT codes increased the risk of missing a set of CPT codes associated with a single diagnosis.

While we did not achieve 100% lab compliance, research shows that cost, physician characteristics,<sup>22</sup> and convenient access to care<sup>23</sup> influence consumers' choice of healthcare services. As an example of convenience, a member could have required 2 labs with only 1 of them covered by RBP. The member might have declined the RBP benefit, thereby resulting in a lower lab compliance rate. This issue will be informed by future research examining factors that influence consumers' selection of lab providers.

As a pilot evaluation of the effect of RBP on lab compliance, we restricted our study group to members affiliated with a single employer offering RBP. This limits the generalizability of our results and introduces a possible risk of selection bias. However, the large sample size and rigor of our matching algorithm suggest that RBP may improve lab compliance. Future studies by the payer will incorporate multiple employer groups to minimize selection bias and improve the generalizability of results.

### Directions for Future Research

To control the costs of pharmaceuticals,<sup>1-3,6-12</sup> RBP has been established as a successful intervention. To our knowledge, this study is the first to evaluate the impact of RBP on lab services. However, the RBP benefit was limited to commodity services, and future research should consider the impact of RBP on more expensive specialty labs, such as genetic testing.

The RBP cost share amount in this study resulted in fairly nominal expenses to the consumer. It will be informative to evaluate the effect of RBP on more costly healthcare services, such as radiology and inpatient procedures, because research has shown that price elasticity in the form of co-insurance payments affects consumers' utilization of medical services.<sup>24,25</sup> The payer initiated a pilot test of RBP for radiology services in 2012. Findings from our lab and radiology studies will clarify the impact of RBP on utilization rates for low- and high-cost healthcare services.

Since the lab compliance rate was higher among members who used the tool compared with those who did not use the tool, we assume that the online shopping tool

affected the choice of labs in the study group. Future investigations by the payer will integrate a 2 x 2 factorial design in which members will be randomly assigned both the online tool and RBP. This will allow us to assess the independent effects of the online tool and RBP, as well as the interaction of the 2 interventions on lab compliance.

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