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RESEARCH ARTICLE

Does Enrollment in High-Deductible Health Plans Encourage Price Shopping?

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Objective. To investigate whether enrollment in high-deductible health plans (HDHPs) led enrollees to choose lower-priced providers for office visits and laboratory tests.

Study Setting. Claims data from more than 40 large employers.

Study Design. We compared the change in price for office visits and laboratory tests for enrollees who switched to HDHPs versus enrollees who remained in traditional plans. We estimated separate models for enrollees who changed providers versus those who remained with the same provider to disentangle the effects of HDHPs on provider choice and negotiated prices.

Data Collection. Claims data from 2004 to 2010 on 1.8 million enrollees.

Principal Findings. After enrollment in HDHPs, 28 percent of enrollees changed physicians for office visits (compared to 19 percent in the Traditional Plan group, $p < .01$); however, this did not result in a statistically significant reduction in price for office visits. About 25 percent of enrollees changed providers for laboratory tests (compared to 23 percent in the Traditional Plan group, $p < .01$), resulting in savings of about $2.09 or a 12.8 percent reduction in price per laboratory test. We found that HDHPs had lower negotiated prices for office visits but not for laboratory tests.

Conclusions. High-deductible health plan enrollment may shift enrollees to lower cost providers, resulting in modest savings.

Key Words. High-deductible health plans, price shopping, benefit design, value, transparency

As a percentage of GDP, health care expenditures in the United States are the highest of any nation (Sood et al. 2015; Semigran et al. 2017) (Andersen et al. 2000; Andrulis 1998). In an effort to decrease spending, many employers and insurers now offer high-deductible health plans (HDHPs), in which enrollees pay the full cost of their medical care out of pocket until they reach their deductible. From 2006 to 2015, HDHP enrollment rose from 4 to 24 percent of employees with employer-sponsored insurance (Claxton et al. 2015).

The high cost sharing associated with HDHPs is intended to create an incentive for enrollees to reduce health care spending and make "value-based" decisions. Many studies have found that higher cost sharing results in reduced health care spending (Manning et al. 1987; Finkelstein et al. 2012). In addition, research specific to HDHPs has consistently demonstrated a reduction in medical spending for patients (Lo Sasso et al. 2004; Parente, Feldman, and Christianson 2004; Feldman and Parente 2010; Beeuwkes et al. 2011; Haviland et al. 2012, 2016).

However, exactly how HDHPs reduce spending remains unclear. Health care spending equals price times quantity. Therefore, there are two channels through which HDHP enrollment could result in lower spending: reduced utilization or lower prices. While prior research has consistently demonstrated reduced utilization after HDHP enrollment (Wharam et al. 2007, 2008, 2011a,b; Beeuwkes et al. 2011; Haviland et al. 2011), there is less evidence that HDHP enrollment leads consumers to price shop for health care services. HDHP enrollment is associated with greater utilization of lower cost pharmaceuticals (Haviland et al. 2011; Huckfeldt et al. 2015). However, it is easier to price shop for pharmaceuticals given that generics represent clear low-cost alternatives. Therefore, it is unclear whether the findings on pharmaceuticals generalize to other parts of health care. Looking at a broader set of services, Sood et al. (2013) find no evidence of price shopping for eight of nine services considered. Similarly, Sinaiko, Mehrotra, and Sood (2016) use data from a national survey to show that HDHP enrollees were no more likely than traditional plan enrollees to consider other providers or compare prices across providers when they last sought health care (Sinaiko, Mehrotra, and Sood 2016). However, both studies used cross-sectional data and thus results could be biased due to unobserved differences in preferences for price shopping between HDHP and traditional plan enrollees (selection bias). Moreover, prior work was unable to fully account for potential differences in negotiated prices between HDHP and traditional plans. Prices can vary both across

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insurers and within plans for the same insurer. For a given employer, one insurance carrier might pay a different price than another carrier for the same service at the same provider. Additionally, prices might vary across plans within the same insurance carrier. For example, a high-deductible plan with a narrow network might pay less than a low-deductible plan with a wider network. Therefore, price shopping could be masked by different negotiated prices in HDHPs versus traditional plans. A recent working paper using a pre/postdesign and data from one employer also finds evidence that HDHPs lower health care costs through reduced utilization rather than price shopping (Brot-Goldberg et al. 2015). However, it is unclear whether these findings generalize to other employers and whether a pre/postdesign is adequate to address bias due to other changes in health benefits at this employer.

To address these limitations of the prior literature, we estimate the impact of HDHP enrollment on prices paid for office visits and laboratory tests. We focus on these services because they are common, typically elective, lower cost (and therefore under the deductible), and in prior work, patients are likely to search for these services using price transparency tools (Whaley et al. 2014). We use a unique longitudinal dataset that allows us to follow individuals after they switch plans, minimizing selection bias. Moreover, our data allow for identification of provider switching, which helps differentiate any price-shopping effects from negotiated price differences.

METHODS

Data and Sample

We used longitudinal claims data from 2004 to 2010 compiled by a health benefits consulting company (Ingenix, the predecessor of OptumInsight, a subsidiary of UnitedHealth Group). The data consist of administrative insurance claims from more than 40 large national employers. We restricted the sample to two sets of enrollees: those who were enrolled in a traditional plan in the first, "pre," year and switched to a HDHP in the second, "post," year (HDHP group) and those who were enrolled in a traditional plan in both years (Traditional Plan group). Enrollees who switched between traditional plans from pre- to postyear are included in the traditional plan group. We define markets from the patient perspective as a unique combination of plan and hospital referral region (HRR). That is, all patients enrolled in a plan and living in the same HRR are considered a unique market. Henceforth, we will use the term "plan-HRR" for

these units. We further limited our sample to plan-HRRs that in the preperiod included both HDHP and Traditional Plan group enrollees. We excluded enrollees older than 65 due to Medicare eligibility. After these inclusion and exclusion criteria, our sample size was 1.8 million enrollees.

As we want to evaluate whether enrollees switch or change providers for office visits between the pre- and postperiods, we restricted the sample to those who had at least one primary care physician office visit in both years. By focusing on office visits for primary care physicians, we exclude provider switching due to requiring specialist care. We defined primary care physicians as physicians with specialties in family practice, general preventive medicine, internal medicine, general pediatrics, geriatrics, and adolescent medicine. We identified claims for office visits using Current Procedure Technology (CPT) codes of 99201–99205 (new office visits) and 99211–99215 (established office visits) (Table S1 in Appendix SA2). For laboratory tests, different services vary dramatically from both clinical and cost perspectives. Patients may switch providers simply because the previous provider does not provide a particular service or the patients prefer to do different tests in different facilities. To exclude patients switching laboratory providers based on test availability or other clinical considerations, we restricted the sample to those who had exactly the same laboratory test service (that have the same CPT code) in both the pre- and postyears. An enrollee could be counted multiple times if more than one service (same CPT code) is observed in both periods. For example, if an enrollee received a thyroid function test in the pre- and postperiods and also received a cholesterol check in the pre- and postperiods, then the enrollee will appear in the data four times. We identified claims for laboratory tests using the Berenson-Eggers Type of Service (BETOS) codes (T1A, T1B, T1C, T1D, T1E, T1F, T1G, T1H), which cover a range of clinical categories of CPT codes (Table S1 in Appendix SA2). We also restricted the sample to enrollees in plan-HRRs for which at least eight different providers (primary care physicians or laboratory providers) are observed to be providing services in order to focus on plan-HRRs where enrollees had a wide choice of providers. Note that in this study, we refer to both physicians (clinical providers) and laboratory providers as "provider." Finally, we excluded enrollees with negative prices or prices greater than the 99th percentile of the price distribution, resulting in 408,000 enrollees and 389,000 enrollees in the office visit and laboratory test sample, respectively. Figures S1 and S2 and Tables S1–S3 in Appendix SA2 describe the study sample in greater detail.

Key Variables

Deductible. High-deductible health plans are defined as individual plans with deductibles greater than or equal to $1,000 or family plans with deductibles greater than or equal to $2,000. Any non-HDHPs are defined as traditional plans. The deductibles were calculated empirically, based on the pattern of claims within a health plan with at least 100 enrollees (Appendix SA3). Table 1 shows the average deductibles of the included plans in the pre- and postperiods for the HDHP and Traditional Plan groups. Unfortunately, we do not know whether enrollees had associated Health Savings Accounts.

Primary Provider. We considered whether enrollees changed their "primary provider" between the pre- and postyears. We defined the most frequently visited provider (primary care or laboratory provider) by each patient in a particular year as the primary provider. Different locations of the same provider chain count as the same provider. If there were more than one provider that fit this criterion (i.e., a patient visited two or more providers the same number of times in a particular year), then the last visited frequent provider in the preyear or the first visited frequent provider in the postyear was assigned as the patient's

Table 1: Average Deductibles in Pre- and Postperiod by Plan Type and Study Group

	Pre *Mean (SD), $*	*Post* *Mean (SD), $*
Office visits sample		
Individual plan		
HDHP group	263 (249)	1,497 (601)
Traditional plan group	263 (249)	266 (251)
Family plan		
HDHP group	568 (534)	3,032 (1,107)
Traditional plan group	568 (534)	551 (507)
Laboratory tests sample		
Individual plan		
HDHP group	247 (236)	1,525 (630)
Traditional plan group	247 (236)	260 (241)
Family plan		
HDHP group	520 (509)	3,059 (1,141)
Traditional plan group	520 (509)	547 (500)

Notes. The average deductibles are calculated at the plan level. In the preperiod, all plans are traditional plans, and within each plan-HRR, enrollees from both HDHP and Traditional Plan group are in the same plan so the deductibles are equal between the two groups. In the postperiod, enrollees in the HDHP group switched to HDHPs, while enrollees in the Traditional Plan group remained in traditional plans, so the deductible is much higher in the HDHP group.

primary provider. As the provider ID is consistent over time and across plans, we were able to identify whether a patient changed providers after HDHP enrollment. It is possible that for some enrollees, the primary provider in the postperiod was used in the preperiod but was not identified as the primary provider. In a sensitivity analysis, these enrollees are not counted as switching providers.

Dependent Variables: Price of Service. We calculated the price as the sum of the amount paid for the visit by the enrollee and the health plan. We used average prices if an enrollee used the same provider for the same service multiple times within the same year. One issue was that for office visits, different CPT codes have different prices. Consider a patient who had an office visit with provider A in the preperiod and provider B in the postperiod. However, provider A used CPT code 99213 (the most common CPT code) to bill for the office visit, while provider B used CPT code 99215. The change in CPT code should reflect that the providers delivered different levels of service during the office visits. So to estimate the pure change in price due to switching from provider A to provider B, we need to know what provider B would have been paid for CPT code 99213. We compute this by estimating what the provider was paid for office visits with CPT code 99213 from other patients in the same plan-HRR in the same year. If provider B did not have any claim for office visits with CPT code 99213, then we estimate what would have been paid for CPT code 99213 by multiplying what was paid for CPT code 99215 in a specific plan-HRR with the ratio of CPT code 99213 to CPT code 99215 prices (calculated using claims across plan-HRRs in a year). This assumes that the ratio of prices for CPT code 99213 and CPT code does not vary substantially across providers, which we found to be the case (Table S4 in Appendix SA2). For laboratory tests, we used actual prices because we required patients to receive laboratory tests with the same CPT codes in both the pre- and postperiods.

It is possible that provider B actually delivered the same level of service as provider A but used a lower-priced CPT code. If the patient switched providers for this reason, then it constitutes "price shopping" that would not be identified using our approach. While we recognize this may not be feasible for a patient, we conducted a sensitivity analysis where we used actual prices as the outcome for office visits.

Study Design and Empirical Approaches

We are interested in determining whether enrolling in a HDHP led enrollees to choose lower-priced providers. A simple approach would compare prices

paid by enrollees in HDHPs to prices paid by enrollees in traditional plans. However, this naïve approach may yield biased estimates for two reasons:

1. HDHP enrollees may be more cost conscious and have a higher propensity to price shop even prior to enrollment in an HDHP.
2. There may be differences in negotiated prices between HDHPs and traditional plans. To address these biases, we estimated difference-in-difference (DD) and difference-in-difference-in-differences (DDD) models. The unit of analysis is enrollee-service-period.

First, consider enrollees from both groups who switched providers between the pre- and postperiods (Switchers). Note that, by design, enrollees in the HDHP group and enrollees in the Traditional Plan group are exposed to the same choice set of in-network providers and prices in the preyear as they are in the same plan-HRR. Thus, any price difference between the two groups of enrollees in the preperiod will only reflect differences in provider choice due to differing provider preferences. Next, using the postperiod data, we compared prices paid by HDHP enrollees to prices paid by traditional plan enrollees controlling for preplan-HRR- and year-fixed effects. The price difference in the postperiod captures three effects: (1) impact of HDHP enrollment on choice of providers, (2) pre-existing differences in preferences for providers, and (3) differences in negotiated prices between HDHPs and traditional plans. Assuming that differences in provider preferences are time invariant (i.e., the second effect), subtracting the preperiod price difference from the postperiod price difference yields the DD estimate for Switchers, which captures two effects: impact of HDHP enrollment on price shopping and negotiated price difference.

Now, consider enrollees who did not switch providers between the pre- and postperiods (Non-Switchers). For Non-Switchers, the DD estimate will reveal differences in negotiated prices between HDHPs and traditional plans. This is because between the pre- and postperiods Non-Switchers in the HDHP group change plans but not providers and Non-Switchers in the Traditional Plan group change neither plans nor providers. Thus, the pre-to-postchange for the HDHP group includes both medical price trends and changes due to differences in negotiated prices in HDHPs, while the pre-to-postchange for the Traditional Plan group includes just medical price trends; thus, the DD isolates the change due to different negotiated prices.

The DDD estimate is the DD estimate for Switchers (which includes both the price impact of HDHP enrollment on choice of providers and the effect of HDHPs on negotiated prices) less the DD estimate for Non-Switchers

(which only includes the HDHP negotiated price effect). Thus, the DDD estimate isolates the effects of HDHP enrollment on changing providers. If this estimate is negative, it implies that HDHP enrollment leads beneficiaries to choose lower cost providers. We call this the price-shopping effect.

The study framework is shown in Figure 1. The regressions in pre- and postperiods control for year-fixed effects and preplan-HRR-fixed effects. The key effect of interest is the coefficient on HDHP cohort variable. The difference in this coefficient between the pre- and postperiods is the DD estimate. And the difference between the DD estimate for Switchers versus Non-Switchers is the DDD estimate. Standard errors are clustered by preplan-HRRs.

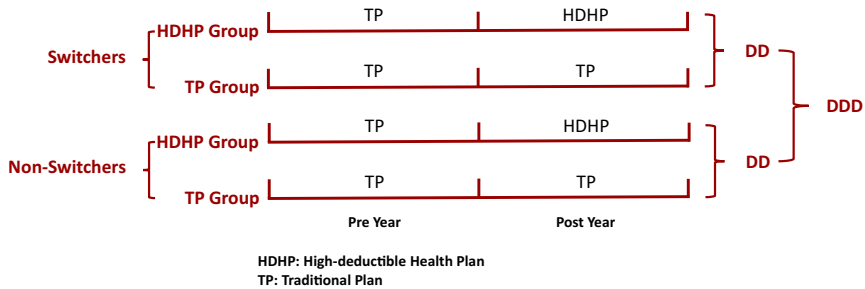
In addition to savings due to price shopping alone, we are also interested in the overall price savings from HDHP enrollment. Notice that DD estimates for Switchers and Non-Switchers represent the effects of HDHP enrollment on prices, for those who switched providers and those who did not, respectively. Using the two DD estimates and proportions of HDHP enrollees who did or did not switch providers, we calculated an overall price effect of HDHP enrollment.

RESULTS

Sample Characteristics

The baseline characteristics of the enrollees in the office visit and laboratory test samples are shown in Table 2. For the office visit sample, the mean age and the gender distribution are similar to the privately insured population

Figure 1: Study Design [Color figure can be viewed at wileyonlinelibrary.com]



Notes. Switchers are those who switched providers from pre- to postperiod, whereas Non-Switchers are those who did not switch providers from pre- to postperiod.

observed in the nationally representative Medical Expenditure Panel Survey (MEPS) (Table S5 in Appendix SA2). HDHP group enrollees tend to be older than Traditional Plan group enrollees. Gender distribution and three-digit ZIP code level socioeconomic characteristics are generally balanced, except that HDHP enrollees tend to have lower income and are less likely to have a bachelor's degree (which is consistent with lower income families enrolling in HDHPs due to lower premiums). The patterns are similar for the laboratory tests sample.

Results for Office Visits

Twenty-eight percent of HDHP enrollees changed physicians, compared to 19 percent in the Traditional Plan group ($p < .01$). Among those who

Table 2: Baseline Characteristics for the Study Sample

Variables	*Total Sample n = 407,934*	*HDHP Group n = 78,313*	*Traditional Plan Group n = 329,621*	*p-value*
Office visits sample				
Age*, mean (SD)	37 (19)	41 (20)	36 (19)	.007
Male (%)	46.43	45.45	46.66	<.01
Socioeconomic characteristics*				
Advanced degree, mean(SD)	0.10 (0.03)	0.10 (0.03)	0.10 (0.03)	.217
Bachelor's degree, mean(SD)	0.19 (0.05)	0.17 (0.05)	0.19 (0.04)	.024
High school graduate, mean(SD)	0.58 (0.07)	0.60 (0.07)	0.57 (0.07)	.013
No high school diploma, mean(SD)	0.13 (0.04)	0.13 (0.03)	0.14 (0.04)	.383
Income ($), mean(SD)	55,777 (8,892)	53,025 (9,751)	56,431 (8,547)	.017
Poverty rate, mean(SD)	0.14 (0.04)	0.15 (0.05)	0.14 (0.04)	.084
Homeowner, mean(SD)	0.66 (0.09)	0.67 (0.08)	0.66 (0.09)	.535
	n = 389,103	*n = 60,907*	*n = 328,196*	
Laboratory tests sample				
Age*, mean (SD)	45 (14)	47 (14)	44 (14)	.004
Male (%)	41.75	41.73	41.75	.834
Socioeconomic characteristics*				
Advanced degree, mean(SD)	0.11 (0.04)	0.10 (0.04)	0.10 (0.04)	.351
Bachelor's degree, mean(SD)	0.19 (0.05)	0.18 (0.05)	0.20 (0.04)	.047
High school graduate, mean(SD)	0.57 (0.07)	0.59 (0.07)	0.56 (0.07)	.040
No high school diploma, mean(SD)	0.13 (0.04)	0.13 (0.03)	0.13 (0.04)	.496
Income ($), mean(SD)	56,382 (9,653)	53,593 (10,310)	56,891 (9,440)	.027
Poverty rate, mean(SD)	0.14 (0.04)	0.15 (0.05)	0.13 (0.04)	.066
Homeowner, mean(SD)	0.65 (0.10)	0.65 (0.10)	0.65 (0.09)	.687

Notes. The socioeconomic characteristics are at the three-digit zip code level.
*Standard errors for t-tests are clustered at the three-digit zip code level.

switched providers, 43 percent switched to a lower-priced provider in the HDHP group and 36 percent switched to a lower-priced provider in the Traditional Plan group ($p < .01$). Table 3 presents the office visit regression results. For Switchers, there was no statistically significant difference in the price of an office visit (column 1) in the preperiod between HDHP and Traditional Plan groups, indicating no pre-existing differences in physician preferences. In the postperiod (column 2), the price received by physicians from HDHP enrollees was $2.74 lower than the price received from the Traditional Plan group ($p < .01$). As a result, the DD estimate (column 3) shows that switching to HDHPs was associated with a $2.91 reduction in price ($p < .01$). As discussed earlier, this price reduction captures both the price-shopping effect and the negotiated price difference between HDHPs and traditional plans.

For the enrollees who did not switch providers, the DD estimate shows that switching to HDHPs was associated with a $2.17 reduction in price ($p < .01$) which implies that negotiated prices for office visits were $2.17 less in HDHPs than traditional plans. We also investigated whether

Table 3: Price Difference between HDHP and Traditional Plan Group in Pre- and Postperiod by Switching Provider or Not

	Difference between HDHP and Traditional Plan Enrollees Prior to HDHP Enrollment (1)	*Difference between HDHP and Traditional Plan Enrollees Post-HDHP Enrollment (2)*	*DD Estimate (3)*	*DDD Estimate (4)*
Office visits				
Switchers	0.17	−2.74***	−2.91***	−0.74
	0.27	0.77	0.76	0.48
Non-Switchers	0.12	−2.04***	−2.17***	
	0.16	0.7	0.7	
Laboratory tests				
Switchers	0.58*	−1.59***	−2.17***	−2.09***
	0.31	0.50	0.56	−0.54
Non-Switchers	−0.15	−0.23	−0.09	
	0.16	0.29	0.28	

Notes. Regressions in pre- and postperiod controls for year-fixed effects and preplan-HRR-fixed effects. DD models control for year-fixed effects, preplan-HRR-fixed effects, interaction terms of year-fixed effects with post, and interaction terms of preplan-HRR-fixed effects with post. DDD model is a fully interacted factorial model, and the coefficient of interaction between study group, post, and switching provider is the DDD estimate. Standard errors are in parentheses and clustered by preplan-HRRs, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. The average price in baseline is $61.49 for office visits and $16.38 for laboratory test.

DD, difference-in-difference; DDD, difference-in-difference-in-difference or triple difference.

HDHP and traditional plan enrollees paid different prices to the same provider in the postperiod. We could only do this analysis for providers who saw both HDHP and traditional plan enrollees. The results from this analysis also show that HDHP enrollees pay less for office visits. However, the point estimate ($1.01, $p < .01$) is smaller. Combining the DD estimates for Switchers and Non-Switchers yields the overall price saving effect. The estimates show that Switchers (28 percent of the HDHP population) experienced a $2.91 reduction in price and Non-Switchers (72 percent of the HDHP population) experienced a $2.17 reduction in price. So the overall or weighted average price savings was $2.38 ($p < .01$), which was 3.87 percent of the baseline price of an office visit.

The difference between the two DD estimates yields the DDD estimate (column 4), which shows that price savings due to HDHP enrollees to choosing lower cost providers were not statistically significant. Juxtaposing the overall price savings effect with the DDD effect suggests that overall price savings arise from lower negotiated prices for HDHPs rather than HDHP enrollees choosing lower cost providers. The regression results using actual prices that do not account for changes in CPT codes are similar to the results presented above (Table S6 in Appendix SA2).

Results for Laboratory Tests

Twenty-five percent of HDHP enrollees changed laboratory test providers, compared to 23 percent in the Traditional Plan group ($p < .01$). Among those who switched providers, 48 percent switched to a lower-priced provider in the HDHP group and 42 percent switched to a lower cost provider in the Traditional Plan group ($p < .01$). As shown in Table 3, among those who switched providers, there was a $0.58 ($p < .1$) marginally statistically significant difference in the price of laboratory tests between HDHP and Traditional Plan groups in the preperiod. In the postperiod (column 2), the price received by providers from the HDHP group was $1.59 lower than that received from the Traditional Plan group ($p < .01$). The DD estimate (column 3) shows that for Switchers, enrolling in a HDHP was associated with a $2.17 reduction in price ($p < .01$).

For the enrollees who did not switch providers, the DD estimate shows that switching to HDHPs was associated with similar laboratory test prices for HDHPs and traditional plans. The DDD estimate (column 4) shows that the price-shopping effect of HDHP enrollment on laboratory tests reduced the price by $2.09 (or 12.8 percent of the baseline average price) ($p < .01$). Finally,

the overall price savings of HDHP enrollment was \$0.61 ($p < .01$) or 3.72 percent of the baseline average price.

In the sensitivity analysis where enrollees whose primary provider in postperiod was also used in the preyear but was not the primary provider in the preyear were not counted as switching. These results were consistent with the primary analysis (Table S7 in Appendix SA2).

DISCUSSION

In this article, we found mixed evidence on the impact of HDHP enrollment on price shopping for health care. We did not detect price shopping for office visits; however, our results suggest that enrollment in HDHPs led consumers to choose lower cost providers for laboratory tests, resulting in a 12.8 percent reduction in price. These findings suggest that, for some types of care, HDHP enrollment not only reduces costs through reducing health care utilization as previously documented, but also by shifting utilization to lower cost providers. The results are similar in magnitude to the study by Whaley et al. (2014) looking at the same services which showed that use of an online price information platform led to a 13.9 percent decrease in the price paid for laboratory tests (Whaley et al. 2014).

The lack of price shopping for an office visit might be due to a variety of factors. First, office visits—unlike laboratory tests—might vary substantially in terms of quality. Given the lack of systematic information on physician quality, patients might be reluctant to switch providers. In contrast, laboratory tests might be viewed as more of a commodity and therefore patients might be more likely to switch providers. We find that among patients who changed their laboratory provider, only one in five also changed their physician at the same time, suggesting that shopping for laboratory providers is distinct from shopping for a physician. Second, patients might care more about continuity of care for office visits and thus might be reluctant to change physicians (Mehrotra et al. 2017). A previous study that examined the effect of tiered physician networks found little evidence of enrollees changing physician (Sinaiko and Rosenthal 2014). Third, price dispersion or the opportunity for price shopping is typically lesser for office visits compared to laboratory tests. For office visits, the 75th percentile price is only 29 percent higher than the 25th percentile price, while for laboratory tests, the 75th percentile price is nearly 300 percent higher than the 25th percentile price. This difference is striking, but comparable to results from other studies documenting price

variation among commercially insured individuals. For example, a study of prices for outpatient and hospital services paid by the three largest commercial insurers in Massachusetts found that the highest priced providers had prices that were two to four times those of the lowest priced providers (Commonwealth of Massachusetts Health Policy Commission 2016). In the Los Angeles and San Francisco Bay Area regions, insurers paid anywhere from $128 to $694 for screening mammograms and between $624 and $2,925 for lower-back MRIs (Aliferis 2015). It is unclear why health plans tolerate such a price variation. Some of these differences may be driven by the built-in price differential between services provided in different settings. For example, hospital outpatient departments typically charge more than stand-alone ambulatory clinics. Similarly, physician offices typically charge more for laboratory services compared to chain laboratory service providers. Another potential explanation is that certain providers possess greater bargaining power with health plans; for example, health plans may feel pressured to include "branded" providers despite their high costs. More research is needed to understand the determinants and persistence of price variation for commercial insurers.

Finally, price shopping may be less frequent for office visits because it may be more difficult to obtain information on physician prices than on laboratory tests. National chains dominate the market for laboratory tests, and shopping for laboratory tests might mean switching from one national chain to another or from an unaffiliated provider to a chain.

The results also suggest another channel through which HDHPs may reduce health care costs: lower negotiated prices for HDHPs compared to traditional plans. Patients in HDHPs face significant cost sharing and thus might be more price-sensitive. Providers, perhaps recognizing this higher price sensitivity of HDHP patients, appear to be more willing to offer discounts to insurance carriers that predominantly offer HDHPs. However, our findings are mixed as we observe significantly lower negotiated prices for office visits but not for laboratory tests. Future research should explore this issue fully.

Our findings have several implications. First, this work suggests that the trend toward greater cost sharing and high-deductible health plans may lead to shifts toward lower cost providers. However, the magnitude of these changes is modest and therefore likely explains only a small fraction of the savings observed when patients switch to a HDHP. Moreover, it is unclear whether shifting HDHP enrollees to lower cost providers results in a loss in quality of care, either because lower priced providers might be lower quality

providers or due to the disruption in continuity of care. Although there is little evidence that price and quality are related (Massachusetts Division of Health Care Finance and Policy 2011; Hussey, Wertheimer, and Mehrotra 2013), such a relationship could exist in some circumstances.

Second, HDHPs may also induce providers to lower their negotiated prices to improve their market share. This effect was the only driver of reductions in office visit prices for HDHP enrollees in our analysis. The magnitude of savings through this mechanism might rise substantially with the diffusion of HDHP plans within a market and with greater price transparency.

The scope of this work is limited in several ways. First, switching to HDHPs or staying in traditional plans is not random, so our results could be biased as unobserved preferences related to plan choice could also be related to propensity for price shopping. Nonetheless, this issue is at least partly addressed by our preperiod analysis which reveals that there were no pre-existing differences in the preference for price shopping between our HDHP and Traditional Plan groups. However, we cannot rule out the possibility that individuals' preference for price shopping changed the same time they changed health plans. Second, what we label as "price shopping" is consumers in HDHPs switching to lower-priced providers at a higher rate than consumers in traditional plans. It is possible that some of these decisions are not initiated by consumers but by health plans changing the composition of in-network providers. However, we do not find any evidence that providers in HDHPs are systematically cheaper than providers in traditional plans (Table S8 in Appendix SA2). Third, these data are from 2004 to 2010, which might not accurately reflect the current state of price-shopping behavior. Since that time, several price transparency initiatives have been implemented and price information may have become easier to obtain. However, recent estimates are that relatively few patients utilize price transparency initiatives. For example, a recent nationally representative survey found that among respondents who searched for out-of-pocket costs before using health care, 72 percent called their provider or plan directly to get price information and only 25 percent reported using a price transparency website (Mehrotra et al. 2017). Fourth, we only look at the effect of price shopping in the first year after switching to a HDHP; effects might be different in the longer run. Fifth, we only focus on laboratory tests and office visits and results might not generalize to other services. Finally, we are unable to examine effects on quality of care, downstream costs, and health.

CONCLUSIONS

Prior work suggests that HDHP enrollment leads to cost saving and that this is partly driven by forgone care by HDHP enrollees. This work shows that a portion of the savings are the result of HDHP enrollees shifting to lower cost providers and the result of lower prices offered by providers. However, the magnitude of these savings is modest.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the supporting information tab for this article:

Appendix SA1: Author Matrix.

Appendix SA2:

Figure S1: Number of Enrollees Included in the Cohorts for Office Visits and Lab Tests.

Figure S2: Geographic Distribution of HRRs Included in the Study.

Table S1: CPT Codes Included in the Analysis.

Table S2: Number of Plans and Plan-HRRs in Pre and Post Period.

Table S3: Distribution of Enrollees per Plan and Plan-HRR.

Table S4: The Distribution of the Price Ratio between CPT Code 99213 and Other Evaluation and Management Office Visit CPT Codes.

Table S5: Baseline Characteristics for Privately Insured Population in the United States.

Table S6: Price Difference between HDHP and Traditional Plan Group in Pre and Post Period by Switching Provider or Not, Using Actual Prices.

Table S7: Price Difference between HDHP and Traditional Plan Group in Pre and Post Period by Switching Provider or Not, Sensitivity Analysis.

Table S8: The Average Price of the In-Network Providers in Traditional Plans and HDHPs.

Appendix SA3: Deductible Calculation.