Price Transparency and Healthcare Cost:
An Evaluation of Commercial Price Variation for Obstetrical Services

F. Lee Revere, PhD[1]
Rigoberto I. Delgado, PhD[1]
Elifnur Yay Donderici, MS[1]
Trudy Millard Krause, DrPH[1]
Michael D. Swartz, PhD[1]

[1]The University of Texas Health Science Center at Houston, School of Public Health

ABSTRACT

Price transparency has gained momentum in commercial healthcare markets in an effort to educate consumers and influence purchasing decisions. The presumed outcome is lower healthcare costs to the consumer and reduced variation in service pricing. This research evaluates regional and carrier variation in commercial insurance reimbursement amounts for routine obstetrical (OB) services across Texas. The existence of variation in prices for routine services between carriers and/or regions suggests price transparency may be able to influence healthcare costs through consumer awareness. Four common obstetric procedures are analyzed: vaginal and cesarean delivery, and ultrasound pregnant first trimester and post first trimester. Results from weighted linear mixed models show significant variation in reimbursement amounts across carriers. Regional price variation is significant for vaginal and cesarean delivery; however, both ultrasound procedures show less evidence of regional variation. The potential impact of carrier market share and the concentration of OB providers is evaluated and found to have no significant effect on mean payment for any of the services studied. Reimbursement amounts vary significantly by insurance carrier, irrespective of market share or concentration of OB providers. This suggests price transparency policies may provide the needed impetus for reducing healthcare costs by expanding consumer awareness that encourage prices to regress to the mean.

INTRODUCTION

The Affordable Care Act enhances the Public Health Service Act by awarding grants to states to establish Data Centers that collect, analyze, and disseminate healthcare pricing data to the public.[1] Publication of this information is intended to control healthcare costs by helping the public better understand price differences for medical procedures in a given region, or for a specific hospital, insurer, or provider. Ultimately, transparency in average provider reimbursement rates is intended to encourage public scrutiny that will presumably bring prices to a mean through traditional market forces and/or contracting practices.

Empirical research on the effect of price transparency on healthcare cost inflation is limited, and the evidence to date is mixed. A study of New Hampshire's 2007 HealthCost price transparency program found no decrease in prices one year after the release of information.[2] In contrast, another study concluded that price transparency legislation reduced prices charged for common, uncomplicated, elective procedures by an average of six percent.[3] Yet that study found no evidence of decreased variation in procedure specific pricing.[3] Regional variation may also be important, but was not addressed in the New Hampshire study. Increased emphasis on price transparency highlights the need to better understand factors contributing to reimbursement rate variation. Without clarity on the possible contribution of carrier and geographic region, policy makers lack evidence to support targeted price transparency policies and consumers may find it difficult to use price data to make decisions.

This study focuses on the reimbursement amounts for four physician-based obstetrical (OB) services in Texas. Although some variation exists in the cost of care across geographical regions in Texas, these differences should be minimal for the selected services. Evaluating the reimbursement rates, or "allowed amounts," by region and carrier provides some insight into existing variation across routine services that should be similar in price. Allowed amounts

represent the total contracted amount that carriers will reimburse providers, inclusive of patient obligation, which allows valid comparisons between carriers. The level of variation in allowed amounts can also indicate the extent of potential savings to consumers if prices regressed to the mean – a presumed outcome from price transparency.

LITERATURE REVIEW

Prior studies identify price differences in healthcare services and economic factors influencing the variation. The literature largely concentrates on variation in Medicare spending[4-8] for acute and chronic conditions, rather than on specific procedures. Results from studies of episodes based on diagnoses show that variation in condition-based expenditures is largely a function of diagnosis, severity of illness,[4] likelihood of surgery, cost per episode, and geography.[6] In particular, cost differences for medical care between geographic regions can fluctuate from 34 to 68 percent.[7]

Fewer studies evaluate price variation for commercially insured individuals. Indeed, variation patterns in Medicare spending do not always generalize to the under 65 population.[9–13] Wide disparities seen in annual Medicare spending per member in the border cities of McAllen and El Paso, Texas, for example, were not reflected in the same communities for the under-65 Blue Cross Blue Shield population;[10] yet, other studies indicate greater spending variation in the commercially insured for heart disease,[12] and even negative correlations between the under-65 population expenditures and Medicare spending.[9] Furthermore, provider reimbursements have been shown to have a significant impact on regional spending variation for the commercially insured.[13] When considering the contribution of type of service to average annual spending per member, allowed amount is an important contributor of inpatient spending while utilization explains variation in outpatient and professional spending for commercial payers.[11] Furthermore, provider reimbursements, which are generally procedural based, have been shown to have a significant impact on regional spending variation for the commercially insured.[13]

RESEARCH AIM

Price variation for routine services is not well understood and there is limited access to data needed for analysis. This research has two aims. First, to understand better price variation between carriers and regions in Texas using commercial carrier claims data. Second, to measure the effect of provider and payer market share on price variations. Doing so provides baseline information and establishes a foundation for further studies to evaluate the impact of price transparency policies, aimed at reducing healthcare costs, on healthcare pricing and resultant consumer cost savings.

There are two contributing factors that are hypothesized to influence prices for routine OB services: commercial carrier market share and the number of OB providers within a defined geographic region. The market share of a commercial carrier is thought to provide a measure of negotiation power contributing to lower allowed amounts paid to providers. The degree of OB provider concentration within each geographic region can also affect prices.

METHODS

Retrospective analysis of commercial carriers' (de-identified) claims data was conducted for the years 2012 and 2013. These data were provided by the Texas Department of Insurance (TDI) and

represent Preferred Provider Organizations (PPOs) and Point of Service plans (POS) for commercial carriers with 10,000 or more lives. These plans represent approximately 30 percent of insured Texans. Another 39 percent of Texans are covered by self-insured employers under the Employee Retirement Income Security Act (ERISA), and therefore those claims were not required to be reported to TDI. However, self-insured group health plans typically contract with an established carrier as an Administrative Service Organization (ASO) to deliver administrative services to the plan such as claims processing and the use of the established provider network.[15] The ASO generally applies the same provider contracting rates to the self-insured claims as to the fully-insured claims. Therefore, the carrier submitted rates can be assumed to be reflective of both fully-insured plans and self-insured plans in Texas. The remaining 31 percent of insured Texans are covered by public plans.

Data were analyzed at the carrier and region level; TDI defines eleven regions in Texas. Because carriers are required to submit data for the January 1-June 30 period, only 6 months of data per year was obtained. The study included only in-network allowed amounts. Out-of-network amounts were excluded because carriers do not have fixed contracted rates with out-of-network providers, creating tremendous variation among payment rates. Four professional, high-volume OB services were selected for the study: 1) routine obstetrical care including vaginal delivery antepartum and postpartum care (referred to as a global code covering "vaginal delivery", CPT[©] code 59400); 2) routine obstetrical care including cesarean delivery, antepartum and postpartum care (referred to as a global code covering "cesarean delivery" CPT[©] code 59510); 3) ultrasound first trimester (CPT[©] code 76801); and, 4) ultrasound after first trimester (CPT[©] code 76805). Regional claims volume was used as a proxy for carrier market share within the region. The supply, or number, of OB providers within each TDI region was estimated using the Obstetrical/Gynecological ratio of providers per 10,000 females as reported by the Texas Medical Society.

Statistical Analysis
For each of the four OB procedures, the mean in-network allowed amount was analyzed using a weighted linear mixed model. Data for 2012 and 2013 were analyzed independently, resulting in eight models. All models were estimated using PROC MIXED in SAS 9.3 (Cary NC) and the model assumptions were assessed graphically. Weights, defined as the square root of the inverse of total claims, were used to correct for modeling the average. The Akaike's Information Criterion (AIC), an index that measures how well the model explains the variation in the data, was used to select the best model.[14] Random effects for variation within region and payer and fixed effects for carrier market share and supply of OB providers for each TDI region were included in the model; Wald Statistics were calculated for each using a 0.05 level for significance. Percent of variation due to region was computed as the variance estimate for the random effect of region, divided by the total estimated variance, and similarly for carrier. Variation in mean allowed amounts per region was graphed. To better understand variation among carriers and maintain confidentiality, the carriers were categorized into one of six clusters based on their mean allowed amounts by CPT[®], by year.

RESULTS
Annual changes in the payments were evaluated and it was found that mean allowed amount for each OB procedure decreased between 2012 and 2013 (Table 1). The greatest change was in the

global codes for pre- and post-partum care (59400 and 59410), a decrease of 12 percent, while ultrasound procedures only dropped between 2 and 4 percent. Additionally, the volume of claims reviewed increased across the two years. The number of claims increased between 21 and 27 percent for pre- and postpartum care. The increase was considerably higher for ultrasound procedures-first trimester (84 percent) than post-trimester (23 percent).

Table 1: Variation in Allowed Amount by CPT, by Year

|	Pre- and Postpartum Care				Ultrasound - Pregnant, single gestation			
	Obstetrical vaginal delivery (CPT 59400)		Cesarean delivery (CPT 59510)		First trimester (CPT 76801)		After first trimester (CPT 76805)	
	2012	2013	2012	2013	2012	2013	2012	2013
Mean Allowed Amount	$2,298	$2,029	$2,472	$2,178	$130.50	$127.99	$145.56	$139.63
percent change	*-11.7%*		*-11.9%*		*-1.9%*		*-4.1%*	
Standard Error - Mean Allowed Amount	3.21	5.31	5.14	7.69	0.40	0.21	0.31	0.27
Total Claims	8,374	10,610	5,455	6,604	9,080	16,701	15,525	19,039
percent change	*26.7%*		*21.1%*		*83.9%*		*22.6%*	

Regional and Payer Descriptive and Comparative Analyses

Figures a-d show the variation within each TDI geographic region by year for mean allowed amounts and number of submitted claims. Regions were ordered according to population size, with the smallest urban areas shown to the left of the graph. Reimbursements for global pre- and post-partum care (Figures 1a, b) were highest in the West Texas and Northwest Texas region and lowest in the large Gulf Coast region, which includes Houston. In West Texas the allowed amount for a vaginal delivery was 54 percent higher than in the Gulf Coast, while the allowed amount for Cesarean delivery in Northwest Texas was approximately 75 percent higher than in the Gulf Coast region. Thus, tremendous variation exists between regions in Texas, with larger urban areas having lower reimbursement rates.

Figure 1a: Regional Variation in Mean Allowed Amount and Number of Submitted Claims

Obstetrical pre- and postpartum care and vaginal delivery (CPT 59400)
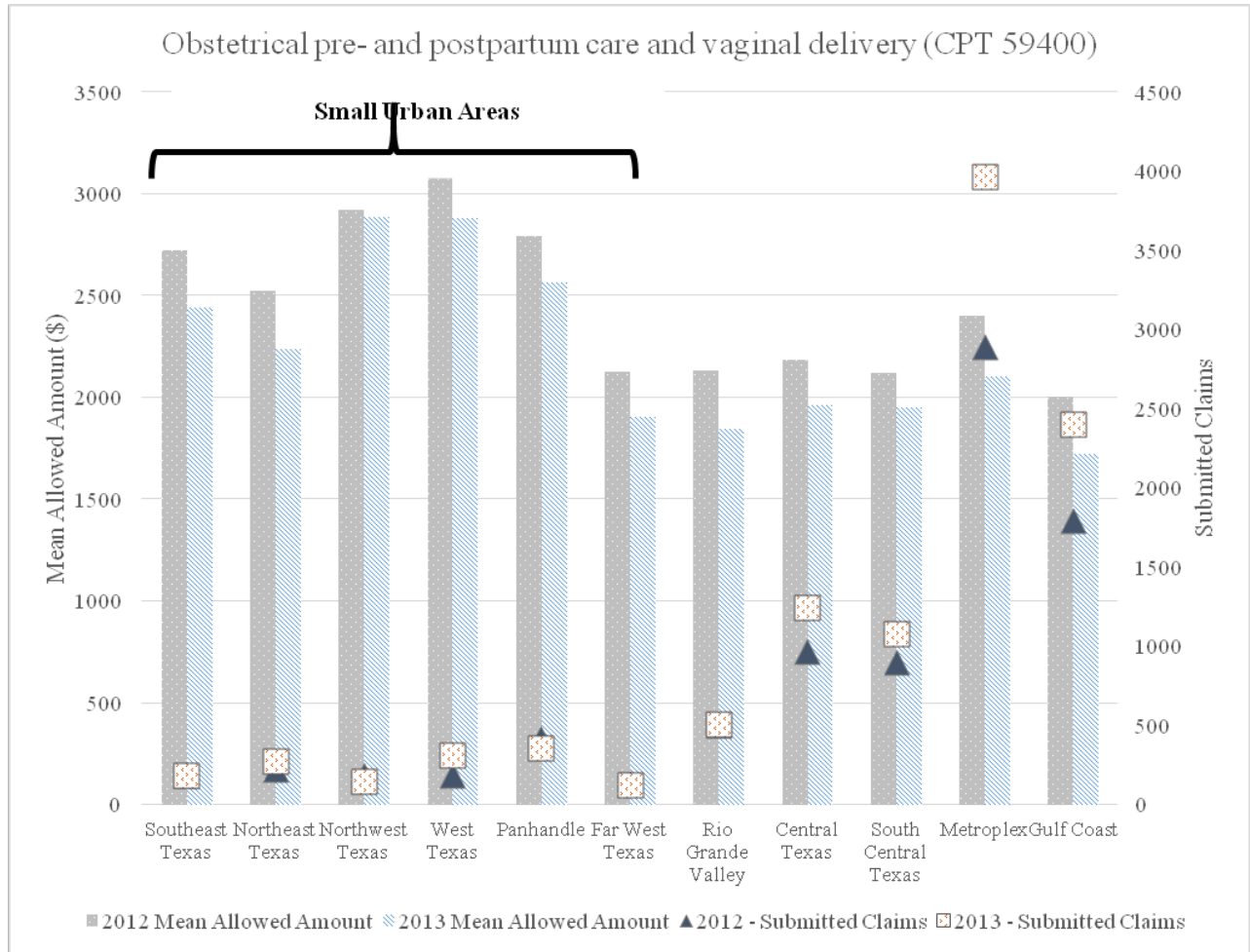
Figure 1b: Regional Variation in Mean Allowed Amount and Number of Submitted Claims
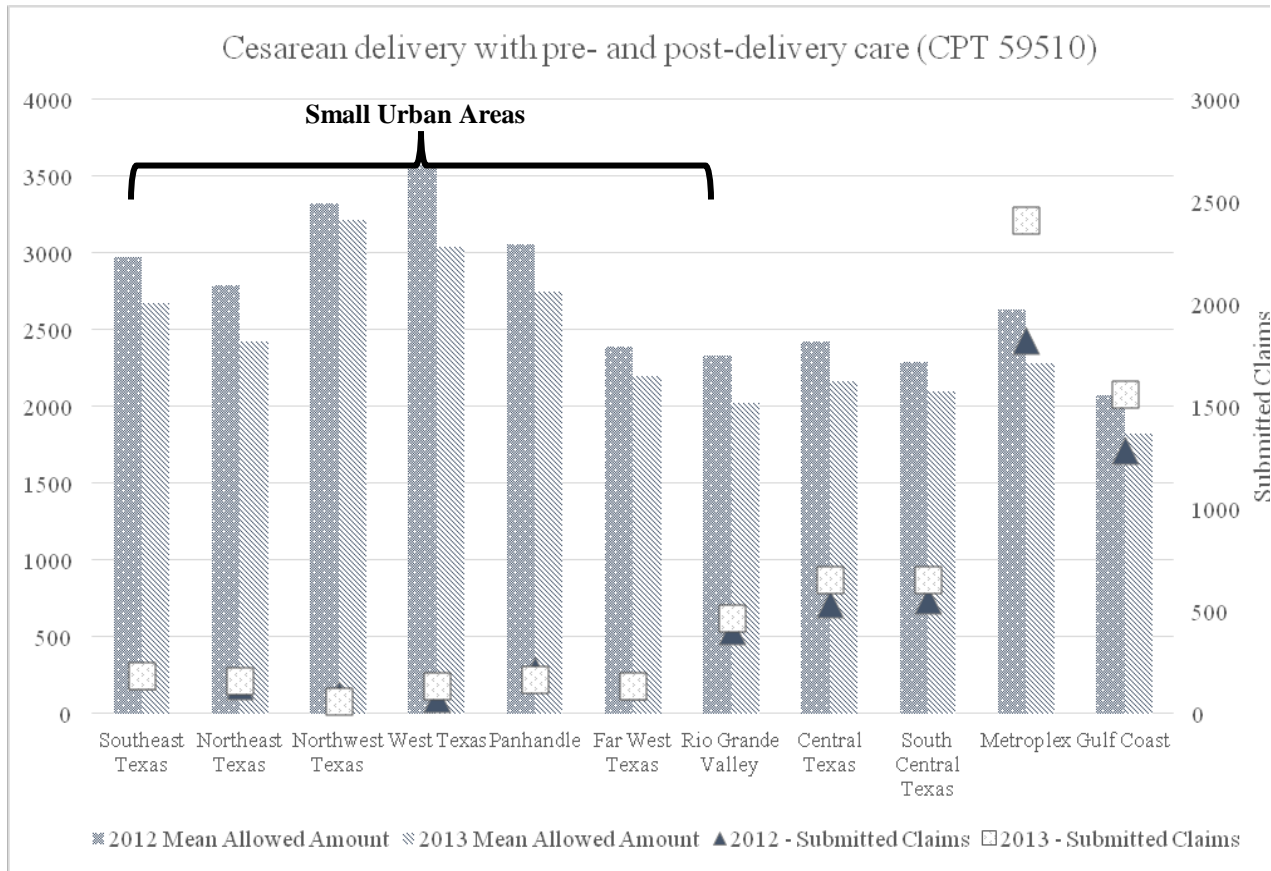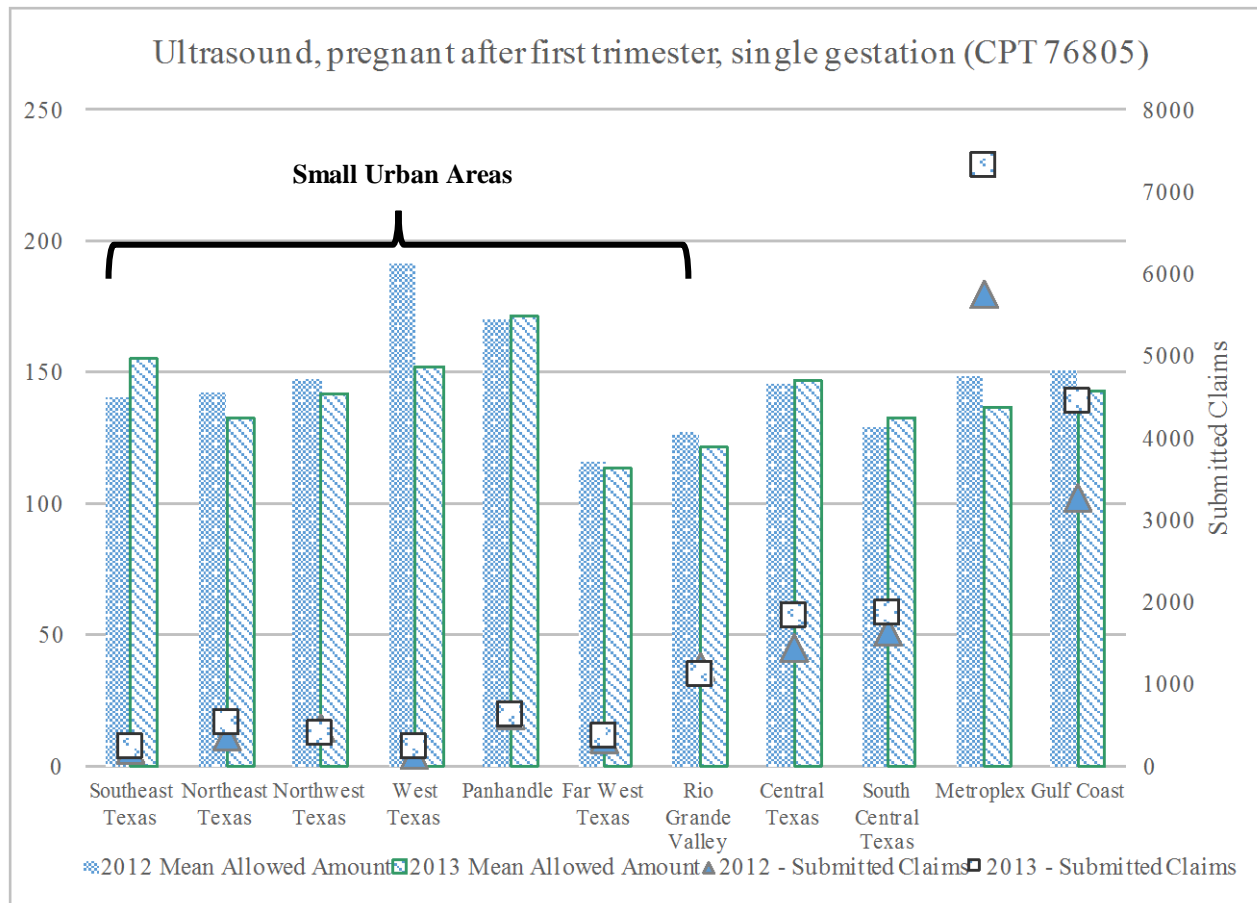

Results for ultrasound procedures (Figure 1c-d) show a different pattern. In 2012 the highest mean allowed amount for pregnancy ultrasounds was in West Texas, which was 50 percent higher than the Rio Grande Valley, both low population density regions. In 2013 the rates in West Texas decreased while those in the Southeast increased. Highest mean allowed amounts for a pregnancy ultrasound first trimester and post first trimester were in the Southeast region and the Panhandle, respectively, while lowest rates were in the Rio Grande Valley and Far West Texas. Thus, the difference in ultrasound allowed amounts for 2013 decreased to approximately 27 percent (first trimester) and 34 percent (after the first trimester).

Figure 1c: Regional Variation in Mean Allowed Amount and Number of Submitted Claims

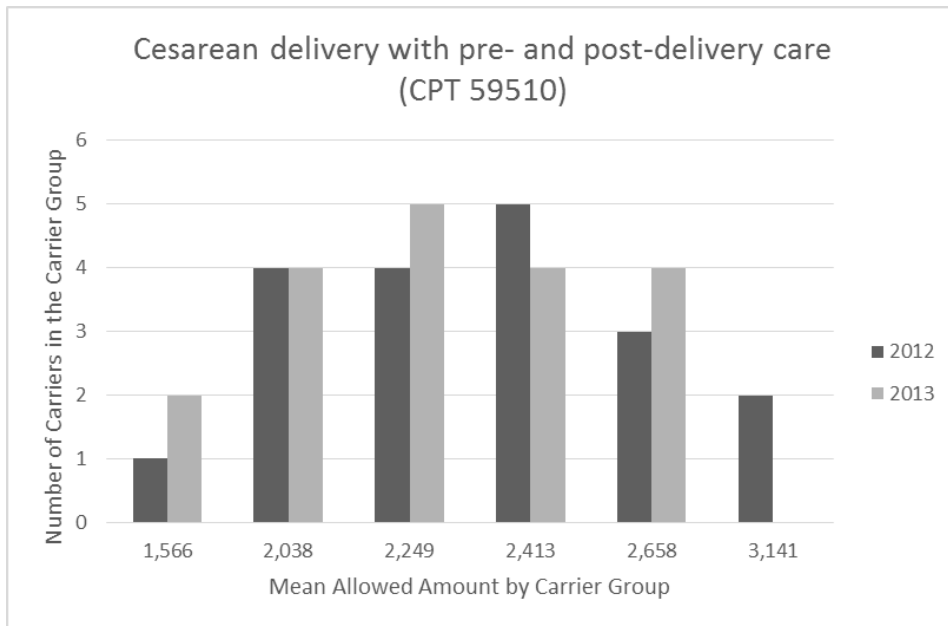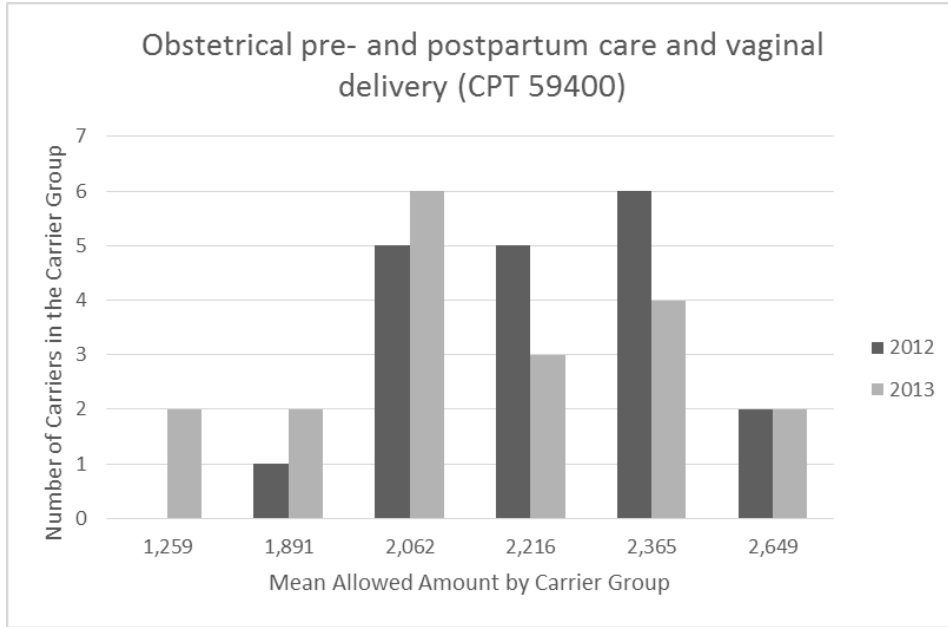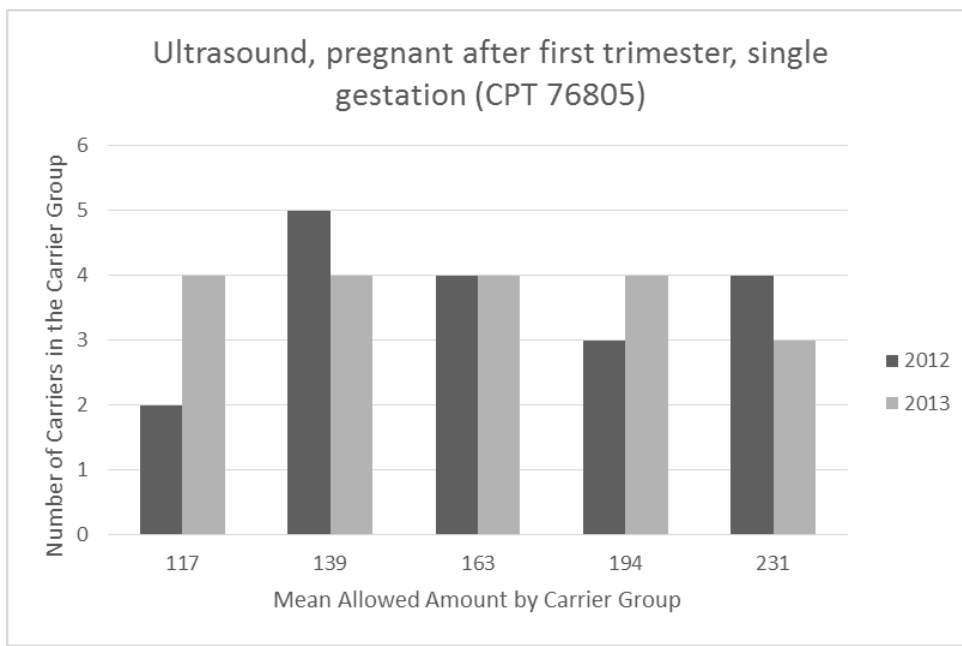
Ultrasound, pregnant first trimester, single gestation (CPT 76801)
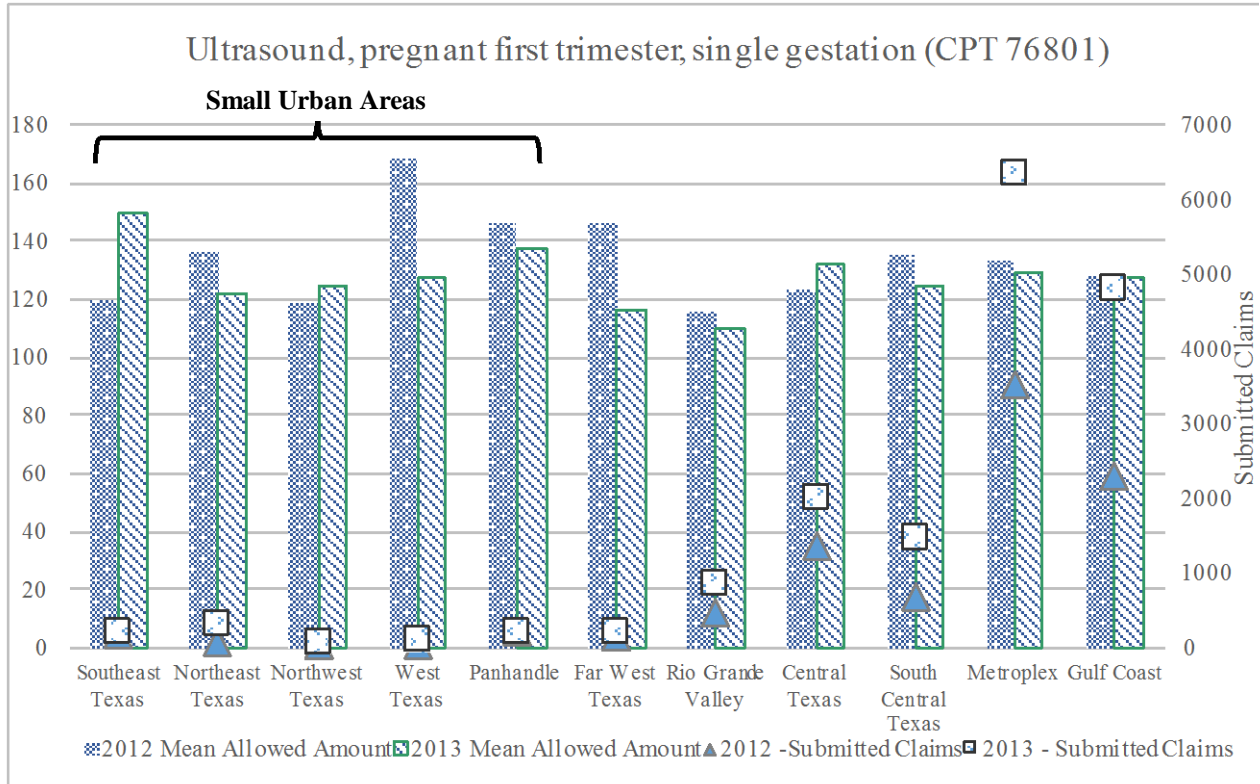
Figure 1d: Regional Variation in Mean Allowed Amount and Number of Submitted Claims
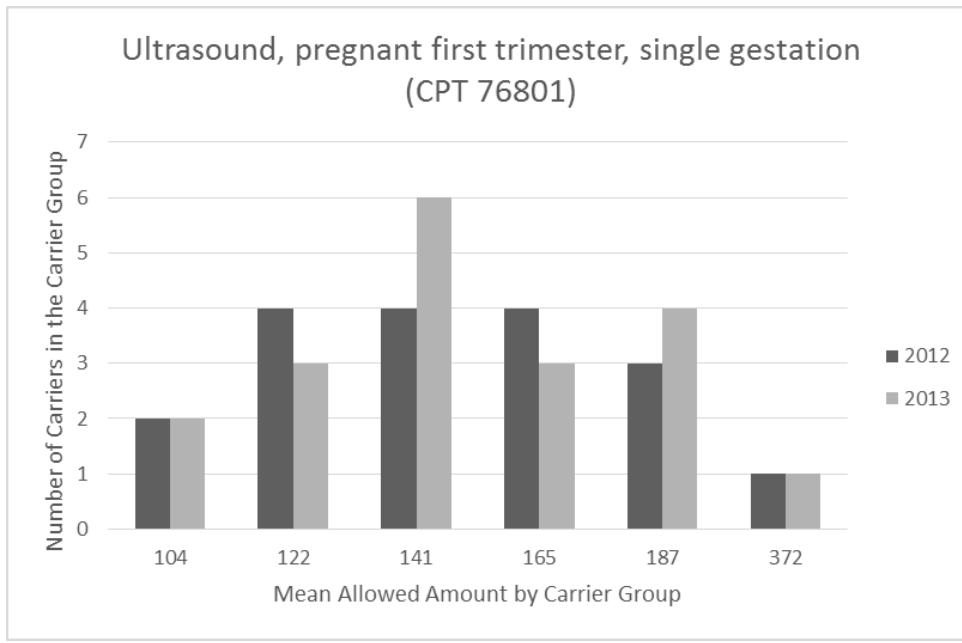

Ultrasound, pregnant after first trimester, single gestation (CPT 76805)

The number of carriers and mean allowed amounts within each of the six clusters is shown in Figure 2a-d. In 2012, allowed amounts for vaginal delivery among the 16 carriers ranged from $2,062 to $2,365 (Figure 2a). By 2013, four carriers reimbursed below $2,000 per procedure. For Cesarean delivery (Figure 2b), there was an overall decrease in reimbursements, with two carriers reimbursing over $3,100 in 2012 but none in 2013, when the number of carriers with reimbursements below $2,000 increased to two. Despite considerable differences between regions, the majority of carriers within a region reimburse within 15 percent of each other for vaginal delivery and 30 percent for cesarean delivery. For ultrasounds, the shift of carriers between reimbursement clusters is moderate. In 2012 and 2013, 12 carriers reimbursed between $122 to $165 for a first trimester ultrasound, and 12 carriers reimbursed between $139 and $194 for ultrasound after the first trimester.

Figure 2a-d: Carrier Variation

Obstetrical pre- and postpartum care and vaginal delivery (CPT 59400)

Cesarean delivery with pre- and post-delivery care (CPT 59510)

Ultrasound, pregnant first trimester, single gestation (CPT 76801)

Number of Carriers in the Carrier Group (y-axis)
Mean Allowed Amount by Carrier Group (x-axis)

Mean Allowed Amount	2012	2013
104	2	2
122	4	3
141	4	6
165	4	3
187	3	4
372	1	1

Ultrasound, pregnant after first trimester, single gestation (CPT 76805)

Number of Carriers in the Carrier Group (y-axis)
Mean Allowed Amount by Carrier Group (x-axis)

Mean Allowed Amount	2012	2013
117	2	4
139	5	4
163	4	4
194	3	4
231	4	3

2012: 19 carriers submitted data on vaginal and cesarean delivery; 18 carriers submitted data on ultrasound procedures

2013: 19 carriers submitted data

Modeling Results:

Tables 2 and 3 report the statistical models for each procedure for 2012 and 2013 data. Models for the two delivery care procedures included a random effect for region and carrier. For vaginal delivery, the variance component of region is significant at the 0.05 level in both years, while the variance component of carrier is marginally significant (p=0.052) in 2012 and significant in the 2013 model. Forty-one percent of the total variation in mean allowed amounts is due to region, while 18 percent is due to the carrier in the 2012 model. In the 2013 model, region and carrier

each account for 43 percent of total variation. For Cesarean delivery, both the variance component of region and carrier were significant in 2012 and 2013, with 35 percent and 43 percent of the total variation attributed to region in 2012 and 2013, respectively. The same procedure showed 26 and 30 percent of the variation in mean allowed amounts explained by carrier in 2012 and 2013, respectively. The percentage of market share held by a carrier and the concentration of OB providers failed to explain any of the variation.

The best model included only a random effect for carrier for ultrasound both in the first trimester and after. For ultrasound in the first trimester, 79 percent of the variation in mean allowed amounts is due to the carrier, but only 25 percent of the variation (and only marginal significance) after the first trimester. The variation attributed to carrier is not significantly explained by percent carrier market share, or OB density in the region.

Table 2: Statistical Models - Vaginal and Cesarean Delivery

	Obstetrical pre- and postpartum care and vaginal delivery (CPT 59400)						Cesarean delivery with pre- and post-delivery care (CPT 59510)					
	2012 Data			2013 Data			2012 Data			2013 Data		
Procedure	Estimate	(std err)	P-value	Estimate	(std err)	P-value	Estimate	(std err)	P-value	Estimate	(Std Err)	P-Value
Fixed effects (SE)												
Intercept	2406.74	(112.75)	<0.0001	2328.81	(143.78)		2563.36	(115.48)	<0.0001	2530.6	(152)	<0.0001
Carrier market share	Not Significant			Not Significant			Not Significant			Not Significant		
Regional supply of OB's	Not Significant			Not Significant			Not Significant			Not Significant		
Error Variance												
Region	90314	(51701)	0.04	135134	(63115)	0.016	81314	(46667)	0.041	160076	(80418)	0.023
Carrier	38931	(23950)	0.052	136087	(51901)	0.004	60212	(32896)	0.034	113003	(52443)	0.016
Residual	88736	(13404)	<0.0001	41581	(6006.1)	<0.0001	92561	(14309)	<0.0001	99806	(14661)	<0.0001
% variation due to region	41.4			43.2			34.7			42.9		
% variation due to carrier	17.9			43.5			25.7			30.3		

As seen in Table 3, ultrasound procedure models for 2013 included both region and carrier variables, but region was not included for 2012. Carrier was significant in both 2012 and 2013. In 2013, allowed amount variation for first trimester ultrasound procedures is 10 percent due to the region and 54 percent due to carrier. For ultrasound procedures post first trimester, 22 percent of the variation in allowed amounts is attributed to the region while 38 percent of the variation is attributed to the carrier. In all models, the variation was not explained by the carrier's percent of market share or the concentration of OB providers.

Table 3: Statistical Models – Ultrasound first and post trimester of pregnancy

	Ultrasound, pregnant first trimester, single gestation (CPT 76801)						Ultrasound, pregnant after first trimester, single gestation (CPT 76805)					
	2012 Data			2013 Data			2012 Data			2013 Data		
Procedure	Estimate	(std err)	P-value	Estimate	(Std Err)	P-value	Estimate	(std err)	P-value	Estimate	(Std Err)	P-value
Fixed effects (SE)												
Intercept	173.9	(18.46)	<0.0001	173.4	(21.01)		167.04	(8.95)	<0.0001	176.6	(14.34)	<0.0001
Carrier market share	Not Significant			Not Significant			Not Significant			Not Significant		
Regional supply of OB's	Not Significant			Not Significant			Not Significant			Not Significant		
Error Variance												
Region	not selected			992.9	(738.9)	0.106	not selected			902.63	(583.04)	0.061
Carrier	5131.5	(2068.04)	0.007	5151.03	(2032.25)	0.006	615.88	(496.92)	0.108	1589.85	(766.88)	0.019
Residual	1406.5	(207.7)	<0.0001	3453.78	(478.71)	<0.0001	1851.55	(253.43)	<0.0001	1703.05	(221.05)	<0.0001
% variation due to region				10.3						21.5		
% variation due to carrier	78.5			53.7			25.0			37.9		

DISCUSSION

Current efforts to provide healthcare cost information to consumers have highlighted the importance of understanding price variation. Evaluating allowed reimbursed amounts by region and carrier provides some insight into market forces shaping the cost of healthcare. Variation in allowed amounts between carriers for the selected OB services was expected to be limited because OB providers are typically paid on a fee schedule presumed to be relatively stable across carriers. Hospital reimbursement amounts were excluded from this research due to the different (complex) processes followed in negotiating reimbursement rates.

In Texas, the reimbursement amounts for the selected OB procedures decreased between 2012 and 2013, indicating provider payments may be decreasing in the aggregate. The study period is too short, however, to determine if this is a permanent trend. The volume of claims submitted to TDI increased between 2012 and 2013. However, it is difficult to ascertain if the increase is due to better carrier reporting, providers aiming to maintain revenue levels in an environment of reduced reimbursement rates, or an increase in the number of covered lives.

Graphical analysis shows large variation in reimbursement amounts between regions, but relatively less variation between carriers within regions. These observations are supported by the statistical models. Interestingly, the percentage of market share held by a carrier and the OB provider supply failed to explain variation in reimbursement amounts in any model when carrier and region are considered. However, using only 6 months of data for each of the two years may hide seasonal patterns or mask the effect of other factors not captured in the market proxies.

The results show interesting differences between the four OB services studied. Unlike vaginal and Cesarean delivery, variation in mean allowed amounts for ultrasound is explained by carrier alone and not by region, with smaller standard deviations. This could indicate segmentation in the OB field where ultrasound procedures are seen more like commodities – with a trend towards close pricing across Texas – while vaginal and cesarean delivery still function with continued regional and carrier price differentiation. Consequently, it is possible to assume that care delivery will continue to show higher reimbursement rates in less populated regions compared to large urban areas.

With focus on price transparency, it is important to consider the nature of information provided to consumers and its influence on purchasing decisions. OB procedures are considered services consumers can easily understand and have relative control over provider selection. For price transparency to be meaningful to the consumer, and to potentially reduce healthcare spending, consumers need to be aware of the impact their carrier has on the cost via their negotiated allowed amounts. Results from this study indicate that careful selection of a carrier may result in lower costs, assuming that consumers have a choice of carrier. Geographic region is also an important factor, but consumers are not positioned to impact regional cost variation. Many commercial carriers are in a favorable position, providing coverage across geographical regions or the entire state, as is the case in Texas. Standardizing fee schedules across regions may prove beneficial for carriers and consumers alike. Additionally, it is apparent there is considerable competition in the Texas healthcare market, both among commercial carriers and providers. Historically, commercial carriers have been seen as "price setters" and physicians as "price takers" for most services. Given this assertion, the results of this research suggest some carriers

are better able to set lower reimbursement rates than others. The ability to do appears to be independent of market share or physician supply.

CONCLUSION

Attempts to increase healthcare system efficiency through price reporting suggest the need to examine the causes of price variation. Results of this study indicate considerable provider payment rate variation for common OB procedures in Texas. Variation exists across regions for the global delivery episodes, but not for single ultrasound procedures. Provider concentration and carrier market share were not significant factors in reimbursement variation. The results of this study suggest that a more comprehensive approach to price transparency might be necessary to inform consumer decisions. Consumers seeking information on healthcare costs for a specific procedure may find it problematic to make meaningful comparisons due to the relationship between costs, carriers and geographic location. Policies aimed at decreasing healthcare costs through price transparency must consider each of these factors in designing mechanisms to influence consumer behavior in order to result in cost savings to the consumer.

Corresponding author: Lee Revere, PhD
1200 Herman Pressler Street, RAS W338, Houston Texas 77030
Telephone: (713) 500-9199; Fax: 713/500-9171
Frances.L.Revere@uth.tmc.edu

Conflict of interest statement: The Authors declare that there is no conflict of interest.
Number of figures, and tables: 8; 5 figures and 3 tables

REFERENCES

1. Love, D., Custer, W., Miller, P. All-payer claims databases: state initiatives to improve healthcare transparency. *Issue Brief (Commonwealth Fund)*. 2010; *99*, 1–14.
2. Tu HT, Lauer JR. Impact of health care price transparency on price variation: the New Hampshire experience. *Issue Brief Cent Stud Health Syst Change*. 2009;(128):1-4. http://www.ncbi.nlm.nih.gov/pubmed/19908405. Accessed August 25, 2015.
3. Christensen HB, Floyd E, Maffett MG. The Effects of Price Transparency Regulation on Prices in the Healthcare Industry. *SSRN Electron J*. May 2013. doi:10.2139/ssrn.2343367.
4. Austin, D. R., and L. C. Baker. "Less Physician Practice Competition Is Associated With Higher Prices Paid For Common Procedures." Health Affairs 34.No. 10 (2015): 1753-760. Print.
5. Axelrod DA, Dzebisashvili N, Lentine K, et al. Assessing variation in the costs of care among patients awaiting liver transplantation. *Am J Transplant*. 2014;14(1):70-78. doi:10.1111/ajt.12494.
6. Fisher ES, Bynum JP, Skinner JS. Slowing the growth of health care costs--lessons from regional variation. *N Engl J Med*. 2009;360(9):849-852. doi:10.1056/NEJMp0809794.
7. Hadley J, Reschovsky JD, O'Malley JA, Landon BE. Factors associated with geographic variation in cost per episode of care for three medical conditions. *Health Econ Rev*. 2014;4:8. doi:10.1186/s13561-014-0008-4.
8. Reschovsky JD, Hadley J, O'Malley AJ, Landon BE. Geographic variations in the cost of treating condition-specific episodes of care among Medicare patients. *Health Serv Res*. 2014;49(1):32-51. doi:10.1111/1475-6773.12087.
9. Robinson JC. Variation in hospital costs, payments, and profitabilty for cardiac valve replacement surgery. *Health Serv Res*. 2011;46(6pt1):1928-1945. doi:10.1111/j.1475-6773.2011.01288.x.
10. Chernew ME, Sabik LM, Chandra A, Gibson TB, Newhouse JP. Geographic correlation between large-firm commercial spending and Medicare spending. *Am J Manag Care*. 2010;16(2):131-138. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3322373&tool=pmcentrez&rendertype=abstract. Accessed September 9, 2015.
11. Franzini L, Mikhail OI, Skinner JS. McAllen And El Paso revisited: Medicare variations not always reflected in the under-sixty-five population. *Health Aff (Millwood)*. 2010;29(12):2302-2309. doi:10.1377/hlthaff.2010.0492.
12. Franzini L, White C, Taychakhoonavudh S, Parikh R, Zezza M, Mikhail O. Variation in inpatient hospital prices and outpatient service quantities drive geographic differences in private spending in Texas. *Health Serv Res*. 2014;49(6):1944-1963. doi:10.1111/1475-6773.12192.
13. Philipson TJ, Seabury SA, Lockwood LM, Goldman DP, Lakdawalla DN. Geographic Variation in Health Care: The Role of Private Markets. *Brookings Pap Econ Act*. 2010:325-361. http://www.brookings.edu/~/media/projects/bpea/spring-2010/2010a_bpea_philipson.pdf. Accessed September 9, 2015.
14. White C. NIHCR: Health Status and Hospital Prices Key to Regional Variation in Private Health Care Spending. *NICHR Res Br No7*. 2012. http://www.nihcr.org/Spending_Variation.html. Accessed September 9, 2015.

15. Bell BA, Ene M, Smiley W, Schoeneberger JA. A Multilevel Model Primer Using SAS® PROC MIXED. *SAS Glob Forum*. 2013:1-19. http://www.mendeley.com/research/multilevel-model-primer-using-sas-proc-mixed/. Accessed September 10, 2015.