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CORRELATES OF CARE COSTS FOR HYSTERECTOMY AND UTERINE ARTERY EMBOLIZATION IN THE UNITED STATES

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ABSTRACT

Uterine gynecological procedure cost differences are important components of considerations for affordability, care access and quality. To achieve affordability, equity, and inclusion, reducing disparities, care distribution and cost correlates are important considerations for decision-making. This study determines and compares the distribution, cost and correlates, of Uterine Artery Embolization and classical Abdominal Hysterectomy by region, race, payor, complications, length of stay, and referral source. **Study Design:** The 2004 -2008 National Hospital Discharge data sets for Hysterecstomy and Uterine Artery Embolization were trimmed and categorized. Crosstabs determined cost distributions by region, place/location, age, race, income, education, length of stay, and payor. Multinomial Logistic Regression analyses determined correlates for all stratified factors. **Results:** Relationships between race, payor, length of stay, region, income, and care cost showed different regional patterns. All regions were less likely than the West to be more expensive. African Americans were more likely to pay below $20,000.00. White and Hispanic women were more likely to be on private, HMO or self-pay. One hospital day's stay cost less than three or more days, Emergency room referrals were less likely to pay below $30,000.00. For hysterectomy, minor complications were more likely to cost below $20,000.00. UAE cost more than Hysterectomy (mean difference: $4,223.52). **Conclusion:** With significant disparity between regions, especially at low cost levels, and race, further research needs to determine cost correlates background/context for affordability, material hardship, multi-sectorial policy, workforce development, and other social determinants. A clear epidemiological picture of uterine fibroids, through appropriately vigilant surveillance, is needed.

KEYWORDS: Uterine Fibroids; Hysterectomy; Uterine Artery Embolization; Epidemiological Surveillance; Care Cost; Care Access.

INTRODUCTION

Burden of Uterine Fibroids

Even though the epidemiological profile of the most common, and questionably the most significant gynecological issue in the United States is unclear, especially outside metropolitan statistical areas,[2] fibroids still remain the most common everyday benign tumor among women.[7] The distribution of care is skewed toward the urban setting, and access is doubtful for rural dwellers (those who live outside metropolitan statistical areas). The current standard of care does not include early detection as a surveillance issue,[8] or encourage treatment until the condition has begun to produce severe symptoms and signs,[9] possibly increasing the cost of care.

It has been reported that the epidemiological profile of uterine fibroids in rural America is unknown,[2] with current prevalence uncertain. This puts women in this setting at increased risk for infertility, dyspareunia, dysmenorrhea, menorrhagia, abortion, premature delivery and post-partum hemorrhage among many other health issues related to uterine fibroids. In addition, since according to the U.S census[3] the prevalence of poverty is higher outside of the metropolitan statistical areas than inside (16.5% vs 14.5% in 2015), the risk of restricted access to care (currently the only way to address fibroids after they occur) for this condition becomes heightened among rural women.

This risk is even higher, when it is considered that normal clinical diagnostic procedures and approaches cannot differentiate uterine sarcoma, a malignancy, from uterine fibroids[1] without a pathology examination under the microscope.

Fibroid Management

Many management options are now available for uterine fibroids (including hysterectomy, myomectomy, uterine artery embolization and others), using various types and levels of invasive procedures. These procedures are designed to remove the benign tumor and allow patients to enjoy a modicum of normal life without the stress of pain, bleeding and suffering during the normal functions of menstruation, child bearing and sexual intercourse.[7] Of these procedures, the most commonly accepted and applied are hysterectomy, by far the leading procedure, and uterine artery embolization coming a distant second.

The regional distribution of management approaches, with regard to hysterectomy and uterine artery embolization, indicates that there were more hysterectomies in the south than other regions. Among rural women, African American women, especially those in lower income levels, bear a disproportionate burden of hysterectomies for fibroids.[2]

Care and Cost of Care Distributions

Access is a set of specific systems, demographic and behavioral factors related to acquiring care, including insurance coverage, transportation, and availability of care in the form of location, facilities and personnel.[17,18] A critical factor that runs through access issues is cost.[33] In addition to these factors are economic affordability,[2,37,38] which is closely related to cost of living in rural settings. These factors significantly influence a person's considerations in making choices between health care and other obligations, their decision making, and whether they act, to access care. Thus, the cost of health care becomes important, based on these considerations. Differences in cost of health care, such as uterine gynecological procedures, can therefore have significant impact on access, constituting an important component of considerations for care access and sometimes quality.[2,5,6] The affordability factor becomes even more important, when recent policies that address affordability are under review.[4]

Costs Distribution

The distribution of costs for both abdominal hysterectomy (A-HYS) and uterine artery embolization (UAE) has been reported to differ by region and location, payor and complications.[2] Glass Lewis and Ekúndayò reported, using the 2004-2008 hospital discharge data, that mean cost of both UAE and A-HYS were significantly higher in the urban than rural setting (urban=$17,611.03, rural=$13,387.54, cost differential=$4,223.49), even though the data indicate large differences in procedure volume between the urban and rural settings (urban=120,025 vs rural=12,761, urban-to-rural ratio =9.41:1). Also, it was shown that regional distributions were widely diverging. For example, UAE cost in the Northeast region was much higher in the rural setting *"notwithstanding the large differences in frequency"* than the urban (rural=$30,307.88, urban=19,971.66, differential=$10,336.22; urban procedures=1,943, rural procedures=7, urban: rural ratio=388.6:1), while in the South region, the opposite occurred (rural $13,169.94, urban=20,985.01, differential=$7,815.07; procedure volume: rural=2, urban=334, ratio=1:167). On the other hand, A-HYS costs were the opposite of UAE.

Care Distribution

According to Glass Lewis and Ekúndayò, the distribution of care varied by race, primary payer, and household income.[2] The authors reported that a very high proportion of hysterectomies performed in the rural setting in the Southern region (92.08%) were on Black women, while nearly half of rural women who experienced A-HYS in the south had household incomes less than $38,999, compared to only 22.3% of urban women who underwent the same procedure. In addition, the primary payor was private/HMO, with medicare/medicaid coming a *"distant second"*.

The literature has not reviewed these issues in disparities and differences in significant depth. Even though the research and practice have focused mainly on care efficiencies relating to cost, those underlying factors that may drive utilization and distribution of care have not been examined.

Study Purpose

Having identified these significant differences in care and cost distribution, it is important to identify the driving influences and their dynamics. What is unclear in the literature are the dynamics of these racial and geographical differences. These dynamics can provide insight which may explain more clearly, the connection between the type of procedure and costs. For example, the key questions to ask may include who was more likely to pay at what cost levels, for what procedures, in what setting? What strata of care characteristics, such as hospital stay, referral and complications were more likely to drive what cost levels? The purpose of this study was to determine and compare the cost characteristics of UAE and A-HYS by region, race, severity, payor, length of stay, and referral source.

It is important to determine these factors for the purpose of more specifically tailoring needs to care distribution and cost, to make both more affordable and effective, to reduce disparities and inequity in fibroid care.

MATERIALS AND METHODS

Materials

The study population, sample, variables, trimming procedures, and cost have been described elsewhere.[2] Diagnostic codes, racial distribution and stratification, income stratification, hospital location and primary payer stratifications have been described as well. This paper describes the selection procedure for hypotheses testing between the factors. It also describes the multinomial

logistic regression routines used to determine the likelihood of cost level predictors and their relationships.

Methods

Stratification:

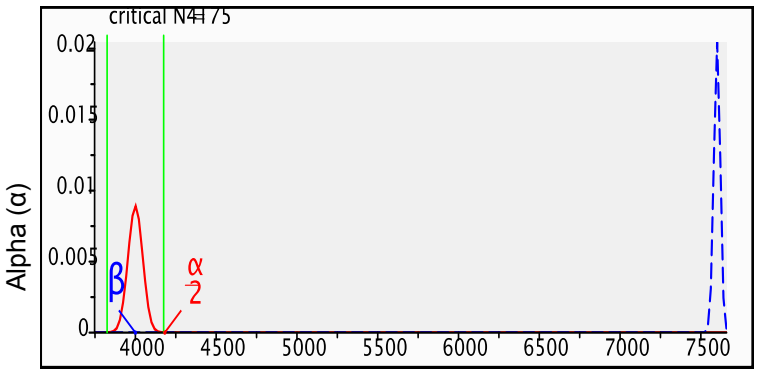
After trimming as described,[2] cost sample in the range of $5,000.000 to $50,000.00 was sub-stratified into "less than $10,000.00," "$10,001.00-$20,000.00," "$20,001.00-$30,000.00," and "$30,001.00+". The highest category was combined because the group above $40,000.00 was too small to be analyzed as reference for the other categories. Race was categorized as White, Black or African-American, Hispanic, and Others. The "Others" category consisted of Native Americans, Asians, Hawaiians and Pacific Islanders, Alaskan Natives and others of unknown racial classification, with sample sizes too small proportionally to individually constitute comparable groups on their own. However, combined in this way, they formed a group comparable in size to the other sub-groups. The "Other" racial group was the reference category. With regard to complications, there were two categories: minor, and moderate/major/extreme, with the minor category being the majority of cases, while the moderate/major/extreme cases formed the reference category. Regarding primary payor, the highest proportion in rural and urban settings was the Private/HMO/Self-pay group; while the "other" category had the smallest proportions and was used as the reference group. For length of stay, there were three categories: 1 day, 2-3 hospital days, and greater than 3 days as the reference category. Referral source was categorized as emergency room, routine visit, birth or other medical indication, leaving the other/unknown group as the reference category.

Sample size for multivariate analyses

After selection and trimming as described,[2] to obtain some sample comparability for analysis, a power analysis was performed to determine adequate random sample selection from hysterectomy cases. Based on a power calculation of 0.9999-1.0000, giving a moderate effect size of 0.45, and an alpha error of 0.0001, the upper critical N was 4,175 (lower critical N=3,825).

To enhance analytical precision without compromising the integrity of comparability, a sample size of 8,000 cases was randomly selected from the hysterectomy cases, giving a comparable final sample of 9,948 cases, consisting of 8,000 (80.4%) hysterectomy and 1,948 (19.6%) UAE cases respectively, with UAE cases being 24.35% of hysterectomy cases.

To determine comparability after random selection, age parameters for A-HYS and UAE cases were compared with those for the whole population in the data set (table 1).



Critical and Actual N

Figure 1: Range of values for central and non-central distributions for one sample case binomial test to determine power and critical sample size (G*Power 3.1.7.)

Data Analysis

Multinomial logistic regression analyses were performed to determine for each cost stratum, the parameter estimates and odds for UAE and abdominal hysterectomy individually, for differences by region, race category, insurance coverage type/payor, complications, length of stay and referral source. To calculate the parameter estimates, we used the log linear model.[10,16,11,12,13,15] that utilizes the equation for coefficient transformation for *K*-1 independent two-way regressions in: $P(Y_i=K) = \frac{e^{\beta'_k \cdot X_i}}{\sum_{k=1}^{K-1} e^{\beta'_k \cdot X_i}}$, or $P(Y_i=K) = \frac{1}{1+\sum_{k=1}^{K-1} e^{\beta'_k \cdot X_i}}$, where *P* is the stratum probability of a K stratum of Y, when there are K distinct

strata of Y and K predictors with a softmax function of *softmax*(k, x_1 ..., x_n) for the gradient-log- normalizer of the categorical probability distribution.[14]

Parameter estimates were analyzed at four cost levels (less than $10,000, $10,001-20,000; $20,001-$30,000, $30,001 and above), with cost level of $30,001 and above as the reference cost, using multinomial logistic regression to estimate exponents, odds ratios with point and interval estimates of significance. Estimates were analyzed for region, race, insurance type/payor, length of stay, referral source and adverse complications.

RESULTS AND DISCUSSION

Results

Care Distribution

As reported elsewhere,[2] procedures across the U.S. were distributed by region (Northeast, Midwest, South and West), and location (rural or urban). Overall 118,082 hysterectomies were performed on fibroids in the urban setting in the period 2004-2008 (according to hospital discharge data). The largest number of A-HYS procedures was in the urban south at 48,870 (more than twice any other region), while 12,756 were performed in the rural setting (47.8% in the south region), with an overall mean cost of $17,555.39 in urban settings, and $13,838.59 in the rural. One thousand, nine hundred and forty three (1,943) uterine artery embolization (UAE) procedures were performed in the urban setting, with only 5 (after trimming) in the rural areas (3 Northeast and 2 South), thus rural UAEs were excluded from further analyses due to very low numbers. The overall mean cost of UAE was $20,992.56 in the urban area and $23,452.70 rural.

Trimming and Selection

After trimmings and selections, the selected samples were highly comparable by age with the total population of A-HYS and UAE cases in the data. As shown in table 1, the parametric features were not significantly different.

Table 1: Distribution of Age Parameters for Patient Samples for Hysterectomy and Uterine Artery Embolization from the Selected Urban Sample*.

	Uterine Artery Embolization (UAE)				Hysterectomy (AHYS)			
	n	Mean	Med	Std. Dev	n	Mean	Med	Std. Dev
Untrimmed	2,352	43.69	44.00	3.934	140,726	43.81	44.00	3.901
Trimmed	1,948	43.68	44.00	3.927	130,914	43.80	44.00	3.906
Randomly Selected (A-HYS)	-	-	-	-	8,000	43.56	44.00	3.940

Med: Median, Std. Dev: Standard Deviation
Data Source: National Hospital Discharge, 2004 - 2008

Odds Estimates

For cost, parameter estimates, odds and significance by region, race, insurance type/payor, length of stay, referral source and adverse complications are shown in tables 2 through 7.

Region

For UAE, estimates indicated that odds were highly significant in the other regions compared to the West, with the Northeast indicating higher odds ratio values than the others, for costs to be generally below $30,000 overall, than to be above $31,000 (Table 2). In the Northeast region, the odds of the cost being less than $10,000 rather than $30,001 and above were much higher than for the West region (OR=7.980; ρ=0.000). For the same cost levels, the Midwest (OR=4.091, ρ=0.001) and South regions (OR=5.885, ρ=0.000) compared to the West region. The same odds patterns were shown in the same regions for cost levels of $10,001 through $20,000 (at ρ=0.000 respectively, Northeast: OR=3.566, Midwest: OR=4.909, South: OR=3.585). The patterns were repeated at the $20,001-$30,000 level compared to $30,001 and above when compared to the West, in the Northeast (OR=2.340, ρ=0.000), Midwest (OR=2.177, ρ=0.001) and South (OR=2.370, ρ=0.000).

Regarding A-HYS, estimates indicated that odds were highly significant in the other regions, with the Midwest indicating higher odds ratio values than the others, compared to the West, for costs to be generally below $30,000 overall, than to be above $31,000 (Table 4). At a significance level of 0.000, the odds of the cost being less than $10,000 rather than $30,001 and above were higher in the Northeast, (OR=6.375), Midwest (OR=8.254) and South regions (OR=5.851), compared to the West region. The same odds patterns were shown in the same regions for cost levels of $10,001 through $20,000 (at ρ=0.000 respectively, Northeast: OR=2.869, Midwest: OR=5.711, South: OR=3.447). The patterns were repeated at the $20,001-$30,000 level compared to $30,001 and above when compared to the West, in the Northeast (OR=1.912, ρ=0.000), Midwest (OR=2.584, ρ=0.000) and South (OR=2.019, ρ=0.000).

Race and Ethnicity

By race and ethnicity, the parameter estimates only showed significantly higher odds for African American patients compared to "other" race/ethnicity category at costs below $20,000 for UAE when measured against costs above $31,001. For A-HYS on the other hand, the odds were significantly less among Hispanic patients (table 3).

For UAE, the odds for African American patients to have paid less than $10,000 compared to $30,001 and above were significantly more (OR=2.447, ρ=0.000) than for "Other Race category. At the $10,001-$20,000 cost level, African Americans (OR=1.684, ρ=0.002) and Whites (OR=1.430, ρ=0.028) were significantly more likely than "Other" race category to have paid compared to paying $31,000 and above. No race/ethnicity category showed any significant difference at any cost level, compared to the "Other" race category (table 3) at the $21,001.00 through $30,000.00 level when compared to $31,000.00 and above level.

On A-HYS (table 3), for Hispanics, the odds were significantly less to have paid less than $10,000 (OR=0.490, ρ=0.000) and $10,001-$20,000 (OR=0.490, ρ=0.000) compared to $30,001 and above than for "Other Race category. Also, at the $10,001-$20,000 cost level, White (OR=0. 768, ρ=0.009) and Black (OR=0.742, ρ=0.011) patients were less likely compared "Other" race category to have paid to $31,000 and above.

Insurer/Payor

With regard to Insurer/Payor (table 4), analysis did not indicate any significant Odds Ratios at any cost levels among the three insurer categories for UAE (table 2). For A-HYS (table 4), Medicare/Medicaid/No charge was less likely than other payor category at the $10,001-$20,000 level than the over $31,000 level (OR=0.595, ρ=0.042).

Length of Stay

Analyses indicated that length of stay was significantly related to costs for both UAE and A-HYS at cost levels below $30,000.

For UAE, estimates indicated that odds were highly significant for 1day hospital stay (OR=6.042, ρ=0.000), compared to 3 or more days, for costs to be generally below $30,000 overall, than to be above $31,000 (Table 5). In the one-day hospital stay category, the odds of the cost being less than $10,000 rather than $30,001 and above were not significantly higher than for the more than 3 days stay category (OR=2.296; ρ=0.139). The Odds (ρ=0.000) at cost levels of $10,001 through $20,000 for 1 day stay (7.128), and 2 day stay (4.196) were significantly higher than for the 3-days or more stay. The same pattern is indicated for cost level $20,001-$30,000, showing significantly (ρ=0.000) higher odds for one day stay (OR=3.926) and, 2-3 days: OR=3.362) than the 3 or more days stay.

Regarding A-HYS (table 5), estimates indicated that odds were highly significant in the shorter stay categories compared to the over three days stay. However, 2-3 day stays indicated higher odds than one day stay categories at levels below $30,000. At ρ=0.000 for the less than $10,000 1 hospital day stay category (OR=3.174) and the 2 day stay category (OR=4.430), the odds of the cost were higher than for $30,001and above, compared to the over 3 hospital days stay. Also for at the $10,000-$20,000 level, the one (OR=1.803; ρ=0.000) and 2 days (OR=2.449; ρ=0.000) stay categories were significantly more likely than the over 3 days or more stay category. The patterns were repeated at the $20,001-$30,000 level compared to $30,001 and above when compared to the over 3 days stay group, in the 1 day stay group (OR=1.363, ρ=0.031), and 2-3 days stay group (OR=1.520, ρ=0.000).

Referral Source

Referral sources included three categories of sources from which the patients were referred that resulted in either UAE or A-HYS. These were (1) Emergency Room or ER, (2) Routine consultations for other medical or gynecological conditions, Childbirth and other medical conditions, and (3) Other none medical or unknown conditions or situations. The third category was used as the referral group. The emergency room referrals were significantly less likely to cost in the low ranges than other none medical referrals (Table 6).

For UAE, the ER group was consistently significantly less likely to have paid $10,001-$20,000 (OR=0.181, ρ=0.000) and $20,001-$30,000 (OR=0.406, ρ=0.017) than over $30,001 compared to the third category of referrals.

For A-HYS the Routine and Other Gynecological/Birth and Other medical referral group was significantly more likely to have cost less than $10,000 than $30,001 and above compared to the third group (OR=2.204, ρ=0.000). For the other two cost levels of $10,001-$20,000, and $20,001-$30,000 the ER referral group compared to the third category of referrals, was consistently significantly less likely to have paid over $30,000 (OR=0.417, ρ=0.000, and OR=0.340, ρ=0.000 respectively). However, the Routine and Other Gynecological/Birth and Other medical referral group was also significantly less likely compared to the Other non-clinical setting referral source, to have paid $20,001-$30,000 than $30,001 and above (OR=0.743, ρ=0.016).

Adverse Complications

With regard to adverse complications, the pattern was different for both UAE and A-HYS. UAE showed no significant odds at any cost level, between the two categories. However, A-HYS indicated significant (ρ=0.000) higher odds for minor complications over the moderate/major/ extreme variety at both the less than $10,000 (OR=1.956) and $10,001-$20,000 (OR=1.588) levels.

DISCUSSIONS

In this paper we identify the key findings, discuss their individual significance and the implications. We then discuss their collective and impact implications with regard to care, health outcomes and social determinants, the health professions and their focus.

Key findings

We identified some key relationships that can help clarify some important issues related to the focus of care, care distribution, planning and administration. These have implications for care, and may impact the sector, practice focus, and the health professions with regard to population health.

Care Distribution

First, the distribution of health care, with regard to the management of fibroids requires awareness, especially in policy, practice and economics. Care in the regions differs significantly in availability and type of care for the various diagnoses of fibroids. As indicated elsewhere,[2] the fundamental issues of disease prevalence, its distribution, and that of care, are unclear since data are not available. In addition, the data indicate that both A-HYS and UAE tended to be less expensive where they are more numerous (e.g. in the South) than where they are not (Tables 2 and 4).

Race

For hysterectomy, Hispanic women were less likely to pay at a lower cost level (less than $10,000.00) while at the middle cost level ($20,001.00-$30,000.00) everyone White, African American and Hispanic Women were all less likely to pay than the "Other" group. However, for UAE, African American women were more likely to pay at the lower level. At the middle cost level, for this procedure, both White and African American women were more likely to pay.

Payor

Only for A-HYS were Private//HMO/Self-Pay categories significantly less likely to pay than the "other" payor category.

Length of Stay

For UAE, patients who stayed for only 1 day in hospital were significantly more likely to pay less than $30,001.00, while for A-HYS, patients who stayed for one day were only more likely to pay in the less than $10,000 cost range.

Table 2: Odds Ratios of Uterine Artery Embolization (UAE), for Total Charge in 4 levels by Region, Race and Payor for Selected Urban Sample*.

Cost Level	Region					Race					Payor				
	Categories	**OR**	**95% CL**		***ρ***	**Categories**	**OR**	**95% CL**		***ρ***	**Categories**	**OR**	**95% CL**		***ρ***
			LL	**UL**				**LL**	**UL**				**LL**	**UL**	
Less Than $10,000	**Intercept**	-	-	-	0.000	**Intercept**				0.000	**Intercept**	-	-	-	1.000
	Northeast	7.980	3.857	16.512	0.000	**White**	1.189	0.740	1.911	0.474	**M-care/M-caid/NC**	0.689	0.220	2.161	0.523
	Midwest	4.091	1.774	9.432	0.001	**African American**	2.447	1.572	3.810	0.000	**Priv/HMO/Self-Pay**	0.570	0.196	1.654	0.301
	South	5.885	2.610	13.269	0.000	**Hispanic**	0.816	0.325	2.047	0.664	**Other - Ref Cat.**	-	-	-	-
	West - Ref cat.	-	-	-	-	**Other - Ref cat.)**	-	-	-	-					
$10,001-20,000	**Intercept**	-	-	-	0.135	**Intercept**	-	-	-	0.000	**Intercept**				0.008
	Northeast	3.566	2.442	5.206	0.000	**White**	1.430	1.040	1.965	0.028	**M-care/M-caid/NC**	0.601	0.239	1.514	0.280
	Midwest	4.909	3.151	7.648	0.000	**African American**	1.684	1.218	2.329	0.002	**Priv/HMO/Self-Pay**	0.809	0.342	1.914	0.629
	South	3.585	2.270	5.662	0.000	**Hispanic**	1.162	0.660	2.046	0.602	**Other - Ref Cat.**	-	-	-	-
	West - Ref cat.	-	-	-	-	**Other - Ref cat.**	-	-	-	-					
$20,001-30,000	**Intercept**	-	-	-	0.328	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.796
	Northeast	2.340	1.606	3.409	0.000	**White**	0.932	0.668	1.302	0.680	**M-care/M-caid/NC**	0.914	0.306	2.728	0.872
	Midwest	2.177	1.376	3.445	0.001	**African American**	1.038	.738	1.459	0.832	**Priv/HMO/Self-Pay**	1.591	0.571	4.432	0.374
	South	2.370	1.493	3.763	0.000	**Hispanic**	1.146	.645	2.034	0.643	**Other - Ref Cat.**	-.	-	-	-
	West - Ref cat.	-	-	-	-	**Other - Ref cat.**	-	-	-	-					

* n=1,948

a. The reference cost category is: $30,001+; M-care: Medicare; M-caid: Medicaid; NC: No Charge; Priv: Private; HMO: Health Maintenance Organization; ref. cat.: reference category for determinant; *ρ:*statistical significance; OR: Odds Ratio; CL: Confidence Limits; LL: Lower Limit; UL: Upper Limit.

Table 3: Odds Ratios of Uterine Artery Embolization (UAE), for Total Charge in 4 Categories by Length of Stay, Referral Source and Adverse Complications for Selected Urban Sample*.

[a]Cost Level	Length of Stay					Referral Source					Adverse Complications				
	Categories	OR	95% CL		ρ	Categories	OR	95% CL		ρ	Categories	OR	95% CL		ρ
			LL	UL				LL	UL				LB	UB	
Less Than $10,000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.298	**Intercept**	-	-	-	0.004
	1 Hosp. Day	3.529	2.077	5.997	0.000	**Emergency Room**	0.487	0.203	1.166	0.106	**Minor**	1.250	0.741	2.109	0.402
	2+ Hosp. Days (ref cat)	-	-	-	-	**Routine/Birth/OCS**	0.711	0.450	1.124	0.144	**Mod/Maj/Ext (ref cat)**	-	-	-	-
						ONCS (ref cat)	-	-	-	-					
$10,001-20,000	**Intercept**	-	-	-	0.352	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.001
	1 Hosp. Day	2.586	1.885	3.548	0.000	**Emergency Room**	0.181	0.078	0.420	0.000	**Minor**	1.402	0.965	2.036	0.076
	2+ Hosp. Days (ref cat)	-	-	-	-	**Routine/Birth/OCS**	1.256	0.875	1.801	0.216	**Mod/Maj/Ext (ref cat)**	-	-	-	-
						ONCS (ref cat)	-	-	-	-					
$20,001-30,000	**Intercept**	-	-	-	0.429	**Intercept**	-	-	-	0.008	**Intercept**	-	-	-	0.187
	1 Hosp. Day	1.708	1.238	2.357	0.001	**Emergency Room**	0.406	0.194	0.849	0.017	**Minor**	1.378	0.923	2.056	0.116
	2+ Hosp. Days (ref cat)	-	-	-	-	**Routine/Birth/OCS**	1.126	0.770	1.647	0.541	**Mod/Maj/Ext (ref cat)**	-	-	-	-
						ONCS (ref cat)	-	-	-	-					

* n=1,948

a. The reference cost category is: $30,001+; Hosp.: Hospital, OCS: Other Clinical Setting; ONCS: Other Non-Clinical Setting; ref. cat.: reference category for determinant; Unk.: Unknown; Mod.: Moderate; Maj.: Major; Ext.: Extreme; ρ: statistical significance OR: Odds Ratio; CL: Confidence Limits; LL: Lower Limit; UL: Upper Limit

Table 4: Odds Ratios of Abdominal Hysterectomy (AHYS), for Total Charge in 5 Categories by Region, Race and Payor for Selected Urban Sample*.

Cost Level	Region					Race					Payor				
	Categories	**OR**	**95% CL**		***ρ***	**Categories**	**OR**	**95% CL**		***ρ***	**Categories**	**OR**	**95% CL**		***ρ***
			LL	**UL**				**LL**	**UL**				**LL**	**UL**	
Less Than $10,000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.000
	Northeast	6.431	4.812	8.595	0.000	**White**	1.063	0.852	1.326	0.589	**M-care/M-caid/NC**	0.755	0.437	01.304	0.313
	Midwest	8.254	5.987	11.379	0.000	**African American**	0.903	0.696	1.170	0.438	**Priv/HMO/Self-Pay**	0.679	0.416	1.110	0.122
	South	5.851	4.560	7.507	0.000	**Hispanic**	0.490	0.353	0.679	0.000	**Other - Ref Cat.**	-	-	-	-
	West - Ref cat.	-	-	-	-	**Other - Ref cat.)**	-	-	-	-					
$10,001-20,000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.000	**Intercept`**	-	-	-	0.000
	Northeast	2.894	2.273	3.686	0.000	**White**	0.771	0.632	0.940	0.010	**M-care/M-caid/NC**	0.595	0.361	0.981	0.042
	Midwest	5.711	4.348	7.503	0.000	**African American**	0.742	0.589	0.934	0.011	**Priv/HMO/Self-Pay**	0.652	0.416	1.021	0.061
	South	3.447	2.835	4.191	0.000	**Hispanic**	0.468	0.355	0.616	0.000	**Other - Ref Cat.**	-	-	-	-
	West - Ref cat.	-	-	-	-	**Other - Ref cat.**	-	-	-	-					
$20,001-30,000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.000
	Northeast	1.929	1.480	2.514	0.000	**White**	0.829	0.663	1.037	0.100	**M-care/M-caid/NC**	0.845	0.487	1.467	0.551
	Midwest	2.584	1.918	3.483	0.000	**African American**	1.097	0.851	1.414	0.476	**Priv/HMO/Self-Pay**	0.787	0.479	1.292	0.344
	South	2.019	1.629	2.502	0.000	**Hispanic**	0.985	0.733	1.325	0.921	**Other - Ref Cat.**	-.	-	-	-
	West - Ref cat.	-	-	-	-	**Other - Ref cat.**	-	-	-	-					

* n=8,000

a. The reference cost category is: $30,001+; M-care: Medicare; M-caid: Medicaid; NC: No Charge; Priv: Private; HMO: Health Maintenance Organization; ref. cat.: reference category for determinant; *ρ:*statistical significance; OR: Odds Ratio; CL: Confidence Limits; LL: Lower Limit; UL: Upper Limit

Table 5:
Odds Ratios of Abdominal Hysterectomy (AHYS), for Total Charge in 5 Categories by Length of Stay, Referral Source and Adverse Complications for Selected Urban Sample*.

[a]Cost Level	Length of Stay					Referral Source					Adverse Complications				
	Categories	**OR**	**95% CL**		***ρ***	**Categories**	**OR**	**95% CL**		***ρ***	**Categories**	**OR**	**95% CL**		***ρ***
			LL	**UL**				**LL**	**UL**				**LB**	**UB**	
Less Than $10,000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.500	**Intercept**	-	-	-	0.013
	1 Hosp. Day	1.487	1.138	1.943	0.004	**Emergency Room**	0.710	0.379	1.332	0.286	**Minor**	1.960	1.581	2.431	0.000
	2+ Hosp. Days (ref cat)	-	-	-	-	**Routine/Birth/OCS**	2.208	1.666	2.928	0.000	**Mod/Maj/Ext (ref cat)**	-	-	-	-
						ONCS (ref cat)	-	-	-	-					
$10,001-20,000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.000
	1 Hosp. Day	1.218	0.952	1.559	0.116	**Emergency Room**	0.417	0.255	0.682	0.000	**Minor**	1.591	1.325	1.910	0.000
	2+ Hosp. Days (ref cat)	-	-	-	-	**Routine/Birth/OCS**	1.030	0.823	1.290	0.796	**Mod/Maj/Ext (ref cat)**	-	-	-	-
						ONCS (ref cat)	-	-	-	-					
$20,001-30,000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.000	**Intercept**	-	-	-	0.000
	1 Hosp. Day	1.162	0.885	1.526	0.279	**Emergency Room**	0.340	0.191	0.605	0.000	**Minor**	1.197	0.978	1.465	0.082
	2+ Hosp. Days (ref cat)	-	-	-	-	**Routine/Birth/OCS**	0.744	0.584	0.948	0.017	**Mod/Maj/Ext (ref cat)**	-	-	-	-
						ONCS (ref cat)	-	-	-	-					

* n=1,948
a. The reference cost category is: $30,001+; Hosp.: Hospital, OCS: Other Clinical Setting; ONCS: Other Non-Clinical Setting; ref. cat.: reference category for determinant; Unk.: Unknown; Mod.: Moderate; Maj.: Major; Ext.: Extreme; *ρ*:statistical significance OR: Odds Ratio; CL: Confidence Limits; LL: Lower Limit; UL: Upper Limit

Referral Source

For UAE, patients referred from emergency rooms were significantly less likely to pay in the $10,001.00-$30,000.00 range than those referred from other non-clinical settings. However, for A-HYS, patients referred from routine/birth and other clinical settings were more likely to pay less than $10,000 and less likely to pay in the between $20,001.00 and $30,000.00. Those referred from the ER for this procedure were less likely to pay less than $30,001.00 and more.

Complications

Analysis indicates that those with minor complications in A-HYS procedures were more likely to pay in the lower cost ranges than those with moderate, major or extreme complications.

The data indicate that regional distribution of care was the most strongly significant determinant of care cost level for both procedures. What explains this pattern is unclear and can only be a matter of conjecture at this point.[21,22,30,32,34,37] It could have been the relative differences in volume of procedure, which may be following normal economic rules of lower costs for more service/product. On the other hand, such issues as the logistics of access, including affordability, may be significantly driving these patterns.

With regard to race, the data indicate that African American patients were more likely to pay less. However, what needs to be clarified are the correlates of these payment levels. It is known according to the U.S. Census Bureau that African American households generally earn significantly less than other households, especially White households, while unemployment rates have for generations, been much higher among the African American population than any other, especially Whites, regardless of region or setting/location (rural or urban). How these impact care directly or indirectly raises questions that need answers. For example, is this a question of affordability[35, 40] or of material hardship,[26] or both; especially when looked at in the context of significantly lower numbers of procedures in the rural setting? With low affordability levels, it may be safe to assume that material hardship may likely be a significant factor, especially compounded by lack of epidemiological data on the distribution of fibroids among women in the rural setting. The issue of affordability for this population also brings to prominence, the question of care seeking and utilization due to low affordability. However, it is known that African Americans' experience of racism is a key determinant of quality of life through several mechanisms that impact income, and therefore affordability.[20,31,33,39] Thus, it is important to determine at what specific points these mechanisms impact health seeking and utilization among African American women, who experience racism, especially from their own perspectives. The issue of employability may be a significant factor in the employment rates identified by the U.S. Census Bureau. However, employability can be a result of social determinants, such as education and its quality, access and availability, household stability, location and many other factors.[3] Many of these factors can be driven by policy, systems and environmental factors that present in built environments[19,23] and practice patterns[24] especially with regard to the highly skewed pattern of hysterectomies in the south and among African American women.

CONCLUSION

Many health and health care impacting policies have changed in the last 30 years relating to affordability, access, quality and cost.[29,36] Some of them are outside the health sector and cut across several sectors, such as education, technology, business practice and law.[25] These have resulted in some significant shifts in the picture of disparities and inequities.[27,28] However, it is still safe to conclude that there is much to do, to significantly impact fibroid and related gynecological health outcomes. Among these is the need for responsive and vigilant epidemiological surveillance for fibroids with a much finer grain of clarity than is currently the case. These may include distribution by race and location. Further, the significantly skewed distribution of care availability in rural areas may be exacerbating the condition of women with fibroids. There is therefore the need to identify some of the business and other factors that drive this distribution, including addressing economic and logistical as well as market considerations to improve care access for rural women. In addition, significant attention needs to be paid to patterns of practice, requiring vigilance in health care, on indications for unnecessary procedures. These procedures may be based on material hardship for the practitioner, as well as policies and processes that exacerbate the risk for disenfranchisement and powerlessness for the patient. This can be a significant issue for the patient, who may be experiencing significant material hardship, pain and suffering that they cannot report due to fear of losing their wombs, especially among women of childbearing age. This brings to prominence the question of training and cultural competence as well as implicit bias among practitioners, among other systemic and behavioral considerations. There is therefore need for research enterprise that looks at these questions from a transdisciplinary, trans-field, trans-sector, interprofessional, collaborative perspective, and which can proffer effective solutions to these important issues.

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