Ty Carlson SP

Abstract:

Introduction: The purpose of this study was to determine if there are any factors that affect the utilization rates of regional anesthesia techniques with regards to the inpatient procedures; knee arthroplasty as inpatient, mastectomy, colectomy, and coronary artery bypass graft.

Methods: Utilizing the HCUP database for inpatient procedures and hospitalizations, data from 2020 that including ICD10 codes specific for these four procedures as well as those indicative for regional anesthesia were compared against those who did not receive regional anesthesia for the same surgical procedure codes. Data compared patients with a population size of 32,355,827. Data compared between groups included controlling for age, gender, income quartile, and insurance payor. Demographic information included age, gender, race, income quartile (fourth quartile being highest at $86,000+ and first quartile the lowest at $49,999 and below), and payor. Multivariable logistic regression was performed to determine odds of binary clinical outcomes relative to patient and hospital characteristics. All p-values 2-sided and $p<0.05$ were considered statistically significant.

Results: Race based comparisons showed no statistically significant p-value regarding group-to-group odds ratios. There were significant differences for self-pay and private insurance groups when compared to Medicare groups for individuals undergoing colectomy, OR 7.7, 6 (95% CI 1.4-42 and 1.2-29.8 respectively). For mastectomy a similar result was seen with statistically significant OR of 1.4 (95% CI 1.1-1.8). for increased utilization of regional anesthesia for private insurance as compared to Medicare. Additionally in the mastectomy group a significant OR 1.6 was seen for the fourth quartile income zip code individuals as compared to first quartile (95% CI 1.2-2.2). There was also a trend toward significance of decreased regional anesthesia in mastectomy use with the Medicaid group OR 0.7 (95% CI 0.5-1). CABG group comparisons as broken down by zip code income quartile also showed fourth quartile OR of 2.1 (95% CI 1.2-3.8). There was also statistical significance seen in the CABG and mastectomy groups when comparing age with those receiving regional anesthesia being younger; for CABG no regional mean age of 68 as compared to regional mean age 65.7(OR .98 95% CI .97-.99) and mastectomy no regional mean age 70.2 as compared to regional mean age 65 (OR .98 95% CI .97-.99).

Conclusion: There is a strong possibility that healthcare is improving equity in treatment across racial groups, but more work needs to be done to continue to investigate other socio-economic disparities and related care applications. This study indicates that those with a higher income quartile and private insurance were more likely to receive regional anesthesia, which often results in faster recovery and return to activity.

Background:

Surgery is inherently an invasive process and thus typically causes pain. Throughout the development of the specialty of anesthesiology there have been attempts to decrease pain and discomfort through the uses of medicines and alternative states of consciousness. The history of medicine does feature inequities in many aspects, notably with regards to race. Experimentation on individuals of African descent in the Tuskegee Syphilis trials are among the atrocities that helped to shape the laws regarding research and equality in the United States.

Pain control and stigma regarding pain tolerance still exist to some degree regarding races such as African American and Hispanic and there have been less than humane treatments or lack thereof applied due to these preconceived notions. A study by Todd et al. in 1993 found that Hispanic individuals that presented with long bone fractures to the emergency department at UCLA were twice as likely to not receive pain medication than their white counterparts[1]. There have been other demonstrations of inequality with administration of pain control modalities in relation to race or gender[2,3]. This inequitable treatment represents systemic racism in healthcare. More recently a similar study was completed in rural emergency departments again with long bone fracture presentation, but in children, and there were no significant differences found between racial groups[4]. Perhaps this change demonstrates improvement regarding deployment of basic medications for painful conditions seen in emergency departments. Additionally, other investigations have found no difference between compared groups with pain related treatment applications[5–7]. It stands to question if similar treatment is equitable in other departments and with regards to other specialties applying the medications.

Anesthesiology advances in treatment protocol for pain have been moving in the direction of multimodal pain treatment in order to decrease the overuse of opioids in acute settings as well as provide a more comprehensive pain control for the patient. Regional anesthesia techniques are not new but they are increasing in commonness with regards to the pain management plan for a procedure. The use of regional anesthesia may lead to faster recovery (reference here would be excellent).The purpose of this study is to determine if there are any significant differences between racial groups, income groups, or insurance payor groups and their chances of receiving any regional anesthesia techniques for surgical procedures as an inpatient. In order to standardize investigations inpatient procedures involving total knee arthroplasty (TKA), mastectomy, colectomy both hemi- and total, and coronary artery bypass graft (CABG) were selected.

Methods:

Data selected was utilized from the Healthcare Costs and Utilization Report (HCUP) Database for 2020. Utilizing International Classification of Disease Version 10 (ICD10) codes to select cases specific for each procedure; mastectomy z90.10, z90.11, z90.12, z90.13 and procedure codes beginning 0HBV0--, colectomy z90.49 and procedure codes beginning 0dTN0--, TKA procedure codes that begin 0SR--- were used in the description included the term replacement,

and CABG procedure codes that begin 02-----. For regional anesthesia application the procedure codes that begin 3E------ were selected. This identified 12,655 cases for colectomy, 215,040 cases for mastectomy, 229,825 cases for CABG, and 352,726 cases for TKA. Patient demographic, clinical, and hospital characteristics will be reported as means, standard Error for continuous variables and95% confidence intervals for categorical variables. Multivariable logistic regression will ascertain the odds of binary clinical outcomes relative to patient and hospital characteristics. All analyses will be conducted following the implementation of population discharge weights. All p-values will be 2-sided and $p<0.05$ will be considered statistically significant. Group to group comparisons were implemented using the majority group as a reference point within a variable. Total Population size of for 2020 HCUP database covers 32,355,827 total cases. Odds ratios (OR) were calculated using logistic regression adjusting for all other variables within the model.

Results:

Race based comparisons showed no statistically significant p-value regarding group-to-group odds ratios. There were significant differences for self-pay and private insurance groups when compared to Medicare groups for individuals undergoing colectomy, OR 7.7, 6 (95% CI 1.4-42 and 1.2-29.8 respectively). For mastectomy, a similar result was seen with statistically significant OR of 1.4 (95% CI 1.1-1.8). for increased utilization of regional anesthesia for private insurance as compared to Medicare. Additionally in the mastectomy group a significant OR 1.6 was seen for the fourth quartile income zip code individuals as compared to first quartile (95% CI 1.2-2.2). There was also a trend toward significance of decreased regional anesthesia in mastectomy use with the Medicaid group OR 0.7 (95% CI 0.5-1). CABG group comparisons as broken down by zip code income quartile also showed fourth quartile OR of 2.1 (95% CI 1.2-3.8). There was also statistical significance seen in the CABG and mastectomy groups when comparing age with those receiving regional anesthesia being younger; for CABG no regional mean age of 68 as compared to regional mean age 65.7(OR .98 95% CI .97-.99) and mastectomy no regional mean age 70.2 as compared to regional mean age 65 (OR .98 95% CI .97-.99). Complete results are included in Tables 1, 2, 3, and 4 below in the appendix.

Discussion:

The results of the study paint a picture of racial equality in the application of regional anesthesia utilization as there were no statistically significant difference noted in any of the four surgical procedure groups when comparing individual self-selected racial identity. Perhaps this improvement in equity as compared to other treatments and studies of the past is reflective of effort to combat racial stereotypes regarding pain tolerance. It is encouraging to see that in such a robust sample size there were no associations with racial disparity. Interestingly, there were some differences in the groups in the categories of insurance payer and zip code income quartile. These statistically significant results appear logically tied together when factoring financial considerations for resources. These are possibly made more readily available to individuals who have means to provide self-pay or private insurance and who live in

zip codes with highest mean incomes. This provides an intriguing hypothesis for a prospective study regarding differences in regional anesthesia application to individuals with different socioeconomic considerations. It is possible this reflects expectations surrounding comfort and the surgical procedures or even reimbursement obtained by the hospital systems in which these patients were treated.

Conclusion:

There is a strong possibility that anesthesia and pain control is improving in equity across racial groups, but more work needs to be done to continue to investigate other socio-economic disparities and related care applications. It will be important with each generation to continue to focus on any iniquities regarding compassionate and effective treatments to progressively improve as a profession and society.

Appendix:

Table 1

Colectomy

Total Population 12,655				
Regional Anesthesia	No	Yes	OR (95% CI)	p-value
	12590 (0.04%)	65 (0.02%)	0.43 (0.25,0.73)	0.002
Age (mean, Standard Error)	70.7 (0.3)	59.5 (5.5)	1 (0.95,1.04)	0.83
Gender (%, 95% CI)				
Male	48.6% (46.7,50.6)	46.2% (22.3,71.9)	REF	
Female	51.4% (49.4,53.3)	53.8% (28.1,77.7)	1.4 (0.,4.3)	0.86
Race (%, 95% CI)				
White	70% (67.7,72.2)	66.7% (37.5,86.9)	REF	
Black	18.4% (16.5,20.5)	25.0% (8.3,55.2)	1.2 (0.3,5.3)	0.85
Hispanic	6.9% (5.8,8.1)	0	NA	
Asian	2.2% (1.6,2.9)	0	NA	
Native American	0.5% (0.3,0.9)	0	NA	
Other	2% (1.5,2.6)	8.3% (1.2,41.4)	3.9 (0.3,5.3)	0.18
Income Quartiles (%, 95% CI)				
1	31.4% (29.0,33.9)	38.5% (17.0,65.7)	REF	
2	26.9% (24.9,29.0)	30.8% (12.0,59.1)	1.3 (0.3,2.7)	0.78
3	22.9% (21.0,24.9)	23.1% (7.6,52.2)	1 (0.2,5.5)	0.99
4	18.8% (16.8,21.0)	7.7% (1.1,39.1)	0.36 (0.03,3.80)	0.40
Primary Payer (%, 95% CI)				
Medicare	71.5% (69.7,73.3)	30.8% (12.0,59.1)	REF	
Medicaid	8.5% (7.4,9.6)	15.4% (3.9,45.1)	4.2 (0.5,35)	0.16
Private including HMO	15.2% (13.8,16.7)	46.2% (22.3,71.9)	6 (1.2,29.8)	0.03
Self-Pay	2.3% (1.7,3.0)	7.7% (1.1,39.1)	7.7 (1.4,42)	0.02
No Charge	0.2% (0.1,0.5)	0	NA	
Other	2.3% (1.8,3.1)	0	NA	

Odds Ratio calculated using Logistic Regression adjusting for all other variables within the model.
All analyses were conducted with population weights.

Table 2

Mastectomy

Total Population 215,040				
Regional Anesthesia	No	Yes	OR (95% CI)	p-value
	211845 (0.66%)	3195 (0.83%)	1.25 (1.07,1.46)	0.006
Age (mean, Standard Error)	70.2 (0.1)	65 (1.1)	0.98 (0.97,0.99)	<0.001
Gender (%, 95% CI)				
Male	1.8% (1.7,2.0)	1.6% (0.9,2.8)	REF	
Female	98.2% (98.0,98.3)	98.4% (97.2,99.1)	1.2 (0.7,2.2)	0.51
Race (%, 95% CI)				
White	73.3% (72.1,74.5)	72.5% (67.3,77.2)	REF	
Black	13.9% (13.1,14.8)	12% (9.2,15.5)	0.9 (0.7,1.2)	0.56
Hispanic	7.4% (6.7,8.2)	8.8% (6.6,11.5)	1.2 (0.9,1.6)	0.30
Asian	2.7% (2.4,3.1)	3.4% (2.1,5.6)	1.1 (0.6,1.7)	0.82
Native American	0.3% (0.2,0.4)	0.7% (0.2,1.7)	2.3 (0.9,6)	0.09
Other	2.3% (2.0,2.6)	2.6% (1.5,4.5)	1.1 (0.6,1.9)	0.71
Income Quartiles (%, 95% CI)				
1	26.7% (25.5,28.0)	20% (16.6,24.0)	REF	
2	25.5% (24.6,26.4)	24.1% (20.4,28.3)	1.2 (0.9,1.5)	0.17
3	24.2% (23.4,25.1)	23.3% (20.0,27.1)	1.1 (0.9,1.5)	0.33
4	23.5% (22.2,24.9)	32.5% (26.9,38.6)	1.6 (1.2,2.2)	0.003
Primary Payer (%, 95% CI)				
Medicare	68.5% (67.6,69.3)	54.3% (47.9,60.5)	REF	
Medicaid	7% (6.6,7.4)	5.8% (4.2,8.1)	0.7 (0.5,1)	0.07
Private including HMO	21.8% (21.0,22.6)	38.3% (32.8,44.1)	1.4 (1.1,1.8)	0.003
Self-Pay	1.2% (1.1,1.4)	0.6% (0.2,1.6)	0.5 (0.2,1.1)	0.09
No Charge	0.1% (0.1,0.2)	0	NA	
Other	1.4% (1.2,1.5)	0.9% (0.4,2.0)	0.7 (0.3,1.5)	0.34

Odds Ratio calculated using Logistic Regression adjusting for all other variables within the model.
All analyses were conducted with population weights.

Table 3

CABG

Total Population 229,825				
Regional Anesthesia	No	Yes	OR (95% CI)	p-value
	227955 (0.71%)	1870 (0.48%)	0.68 (0.49,0.93)	0.02
Age (mean, Standard Error)	68 (0.1)	65.7 (0.5)	0.98 (0.97,0.99)	<0.001
Gender (%, 95% CI)				
Male	75.7% (75.2,76.1)	77.3% (72.1,81.7)	REF	
Female	24.3% (23.9,24.8])	22.7% (18.3,27.9)	0.9 (0.7,1.2)	0.62
Race (%, 95% CI)				
White	79% (77.8,80.2)	80.2% (74.7,84.8)	REF	
Black	7.4% (6.8,8.0)	6.7% (4.2,10.6)	1 (0.6,1.6)	0.86
Hispanic	7.3% (6.6,8.0)	7.8% (5.2,11.6)	1.1 (0.7,1.7)	0.74
Asian	2.9% (2.5,3.4)	3.6% (1.8,7.1)	1 (0.5,1.8)	0.92
Native American	0.6% (0.5,0.8)	0.6% (0.2,1.9)	0.9 (0.2,3.6)	0.94
Other	2.8% (2.5,3.2)	1.1% (0.3,3.7)	0.4 (0.1,1.3)	0.11
Income Quartiles (%, 95% CI)				
1	28.5% (26.9,30.1)	23% (16.9,30.6)	REF	
2	29% (28.0,30.1)	28.2% (22.8,34.3)	1.3 (0.9,1.7)	0.11
3	23.6% (22.7,24.6)	19.2% (15.0,24.3)	1.1 (0.8,1.7)	0.56
4	18.9% (17.4,20.5)	29.5% (19.6,41.8)	2.1 (1.2,3.8)	0.01
Primary Payer (%, 95% CI)				
Medicare	61.7% (60.9,62.6)	54.3% (48.1,60.3)	REF	
Medicaid	6.9% (6.5,7.2)	7.2% (4.7,11.0)	0.9 (0.6,1.4)	0.64
Private including HMO	25.3% (24.4,26.1)	32.1% (25.7,39.3)	1.1 (0.8,1.6)	0.49
Self-Pay	2.4% (2.2,2.6)	2.1% (1.0,4.3)	0.7 (0.3,1.6)	0.46
No Charge	0..2% (0.2,0.3)	0	NA	
Other	3.5% (3.2,3.9)	4.3% (2.4,7.5)	1.4 (0.7,2.5)	0.34

Odds Ratio calculated using Logistic Regression adjusting for all other variables within the model.
All analyses were conducted with population weights.

Table 4

Knee Arthroplasties

Total Population 352726				
Regional Anesthesia	No	Yes	OR (95% CI)	p-value
	303616 (0.95%)	49110 (12.69%)	15.16 (13.02,17.66)	<0.001
Age (mean, Standard Error)	66.9 (0.1)	66.7 (0.2)	1 (1,1)	0.99
Gender (%, 95% CI)				
Male	40.5% (40.1,41.0])	39.5% (38.4,40.5)	REF	
Female	59.5% (59.0,59.9	6.5% (59.5,61.6)	1.05 (1,1.11)	0.05
Race (%, 95% CI)				
White	80.1% (79.0,81.1)	81.9% (79.5,84.1)	REF	
Black	8.9% (8.4,9.5)	8.5% (7.4,9.8)	0.9 (0.8,1.1)	0.27
Hispanic	6.5% (5.9,7.1)	6.1% (5.0,7.4)	0.9 (0.7,1.2)	0.49
Asian	1.5% (1.3,1.8)	1.2% (0.9,1.5)	0.8 (0.6,1)	0.08
Native American	0.6% (0.4,0.8)	0.5% (0.2,1.0)	0.9 (0.4,2)	0.86
Other	2.4% (2.0,2.9)	1.8% (1.3,2.6)	0.8 (0.5,1.1)	0.17
Income Quartiles (%, 95% CI)				
1	22.6% (21.4,23.8)	21.9% (19.4,24.6)	REF	
2	27.7% (26.6,28.8)	29.6% (27.3,32.0)	1.1 (0.9,1.2)	0.34
3	25.6% (24.7,26.5)	25.3% (23.7,27.0)	1 (0.8,1.1)	0.6
4	24.1% (22.3,26.0)	23.3% (19.5,27.4)	0.9 (0.7,1.2)	0.7
Primary Payer (%, 95% CI)				
Medicare	56.7% (55.8,57.6)	55.3% (53.2,57.3)	REF	
Medicaid	4.7% (4.4,5.1)	4% (3.3,4.8)	0.9 (0.7,1)	0.15
Private including HMO	33.7% (32.7,34.6)	36% (33.7,38.4)	1.1 (1,1.2)	0.22
Self-Pay	0.6% (0.5,0.8)	0.5% (0.3,0.8)	0.9 (0.6,1.4)	0.72
No Charge	0	0	2.1 (0.5,8.6)	0.32
Other	4.2% (3.9,4.5)	4.2% (3.0,5.7)	1.1 (0.7,1.5)	0.73

Odds Ratio calculated using Logistic Regression adjusting for all other variables within the model.
All analyses were conducted with population weights.

Works Cited:

1. Todd KH, Samaroo N, Hoffman JR. Ethnicity as a risk factor for inadequate emergency department analgesia. *JAMA*. 269(12):1537-1539.

2. Owusu-Agyemang P, Feng L, Porche VH, Williams UU, Cata JP. Race, ethnicity, and the use of regional anesthesia in cancer patients undergoing open abdominal surgery: A single-center retrospective cohort study. *Front Med (Lausanne)*. 2022;9. doi:10.3389/fmed.2022.950444

3. Nerb L, Burton BN, Macias AA, Gabriel RA. Racial and Ethnic Differences in the Receipt of Regional Anesthesia Among Patients Undergoing Thoracic Surgery. *J Cardiothorac Vasc Anesth*. 2023;37(2):246-251. doi:10.1053/j.jvca.2022.11.010

4. Liao L, Reyes L. Evaluating for Racial Differences in Pain Management of Long-Bone Fractures in a Pediatric Rural Population. *Pediatr Emerg Care*. 2018;37(7). doi:10.1097/PEC.0000000000001696

5. Morris T, Schulman M. Race inequality in epidural use and regional anesthesia failure in labor and birth: An examination of women's experience. *Sexual & Reproductive Healthcare*. 2014;5(4):188-194. doi:10.1016/j.srhc.2014.09.006

6. King MR, de Souza E, Rosenbloom JM, Wang E, Anderson TA. Association Between Race and Ethnicity in the Delivery of Regional Anesthesia for Pediatric Patients: A Single-Center Study of 3189 Regional Anesthetics in 25,664 Surgeries. *Anesth Analg*. 2020;131(1):255-262. doi:10.1213/ANE.0000000000004456

7. Beletsky A, Burton BN, Finneran IV JJ, Alexander BS, Macias A, Gabriel RA. Association of race and ethnicity in the receipt of regional anesthesia following mastectomy. *Reg Anesth Pain Med*. 2021;46(2):118-123. doi:10.1136/rapm-2020-101818