Racial vs. Economic Barriers to Ambulatory Surgery Usage in the United States

DRAFT

Independent Analysis of HCUP NASS 2020 Dataset
US Dept. of Health and Human Services
Agency for Healthcare Research and Quality (AHRQ)
Healthcare Cost and Utilization Project (HCUP)
National Ambulatory Surgery **Sample** (NASS)

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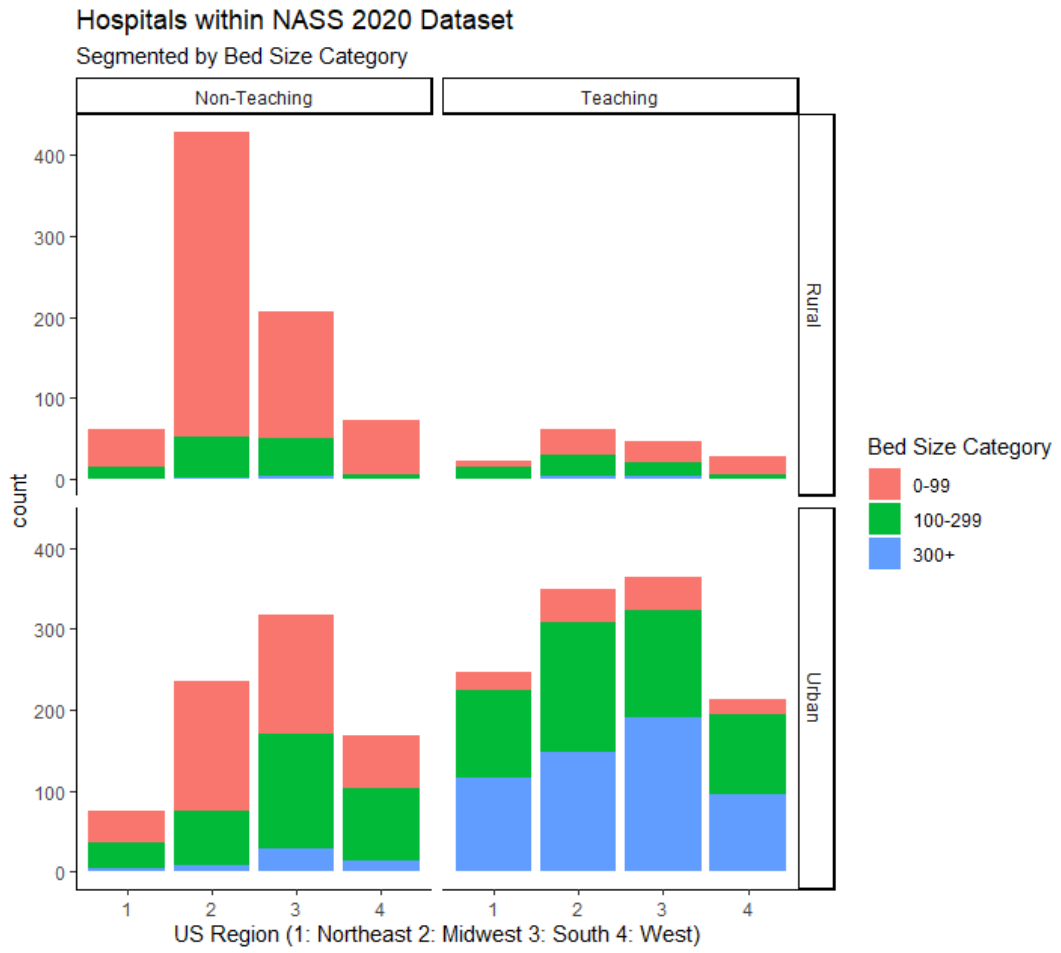
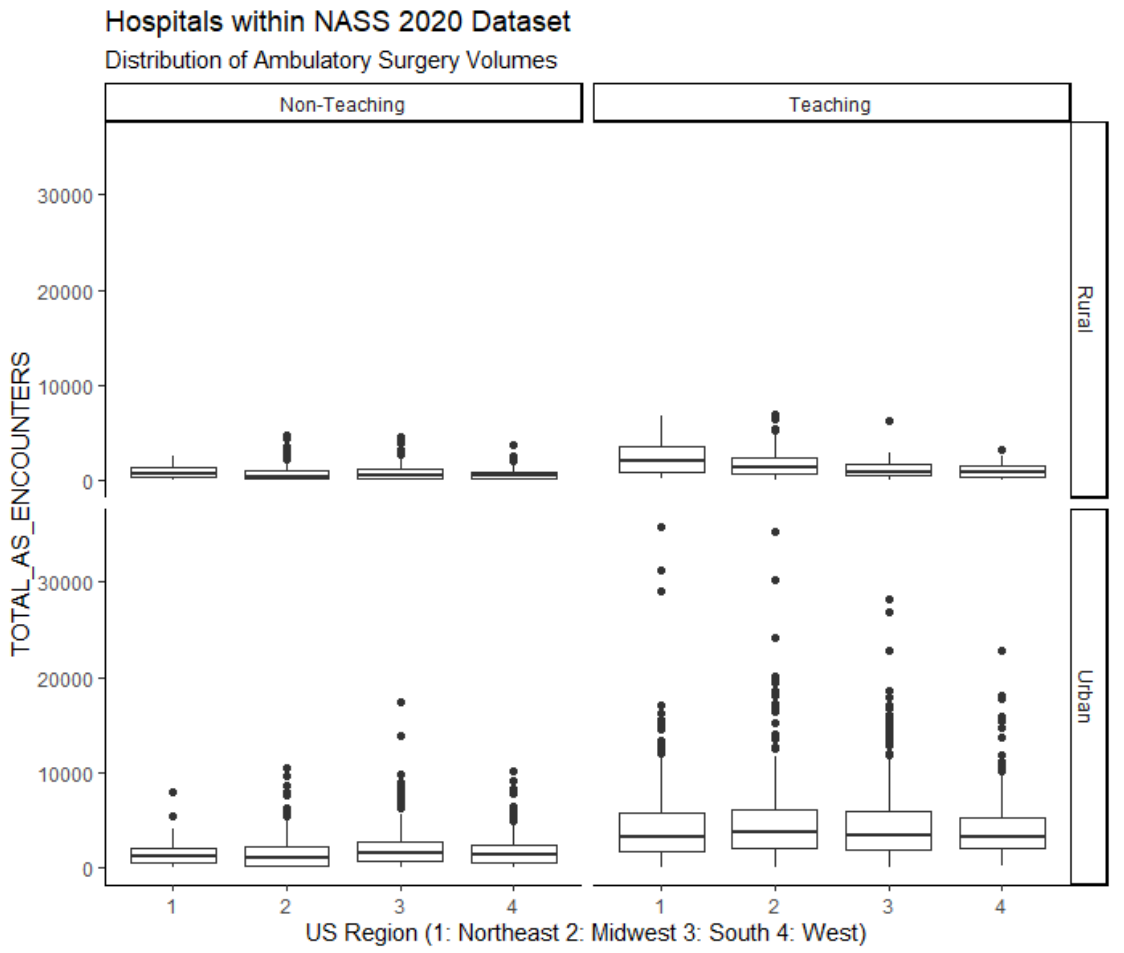
HCUP NASS 2020 dataset includes ~3k US community-hospital owned ambulatory surgery institutions of varying classes. Volumes of Institutions are generally in line, with exception of few large urban centers.

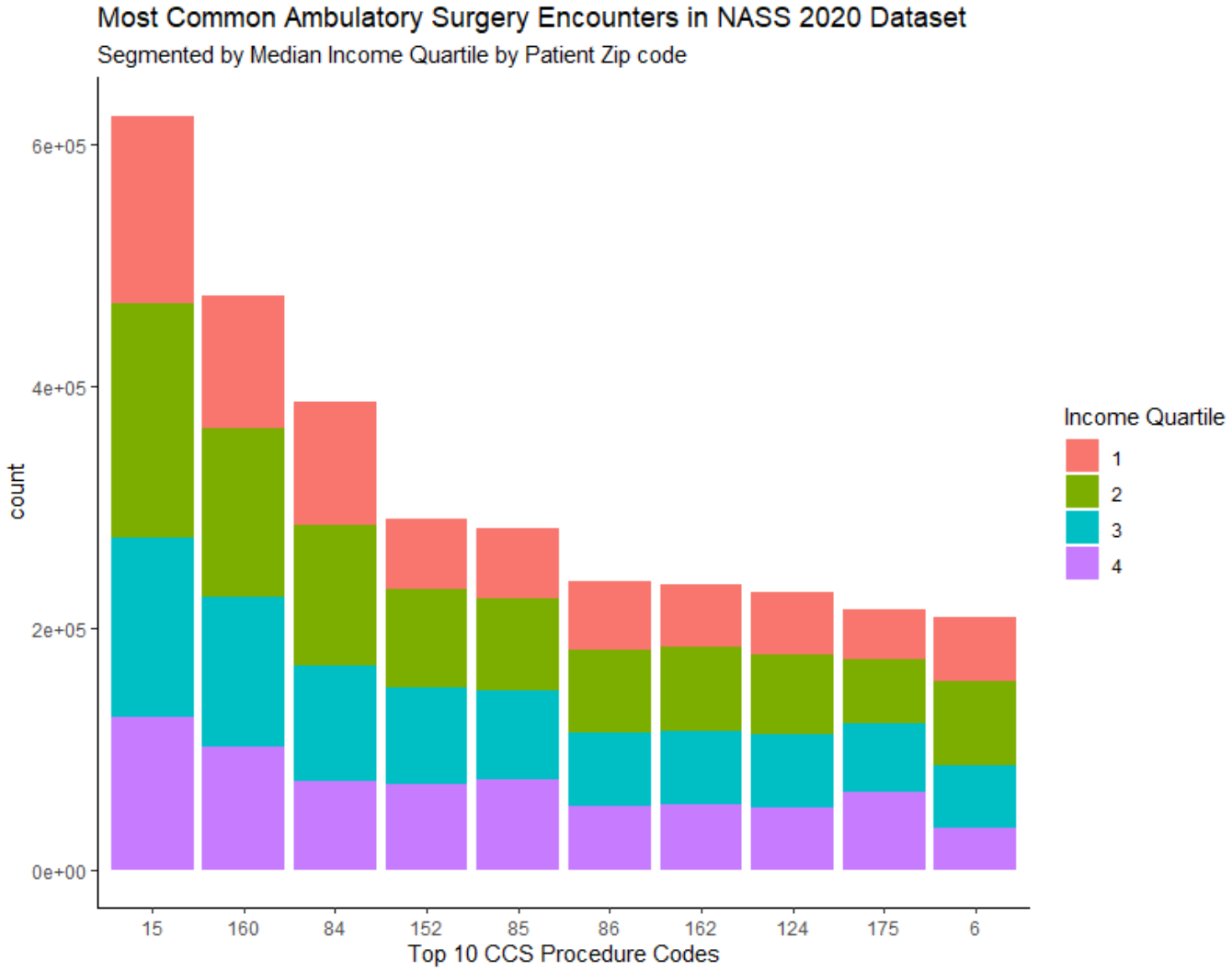




Total Institutions: **2,899**

Total 2020 Ambulatory Encounters: **7,828,310**

The 10 most common ambulatory surgical encounters in the HCUP NASS 2020 data set account for 41% of all encounters, and show good distribution across all income quartiles.



10 Most Common Procedure Encounters:

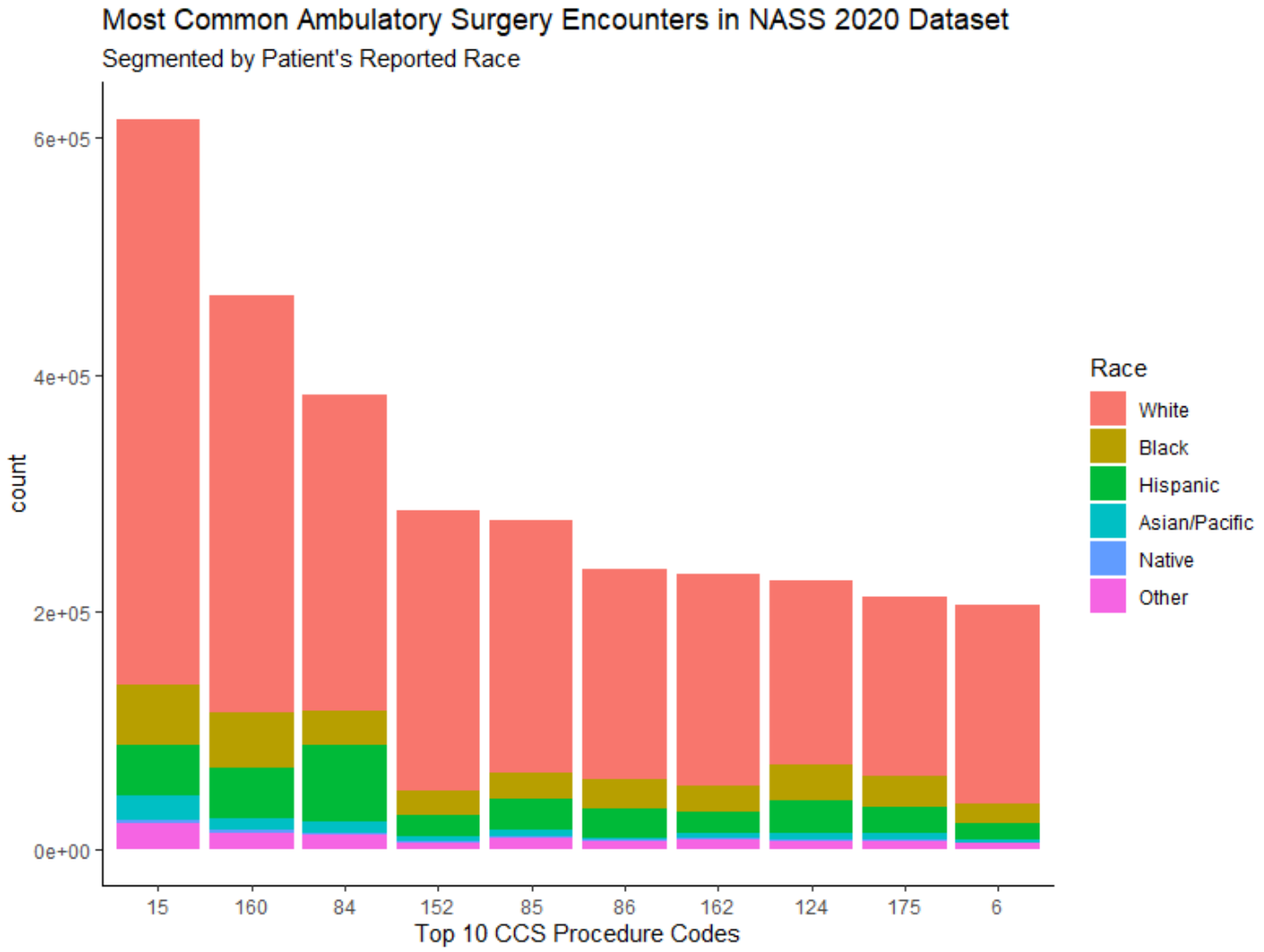
3,223,125

% of NASS 2020 Encounters Data covered:

41%

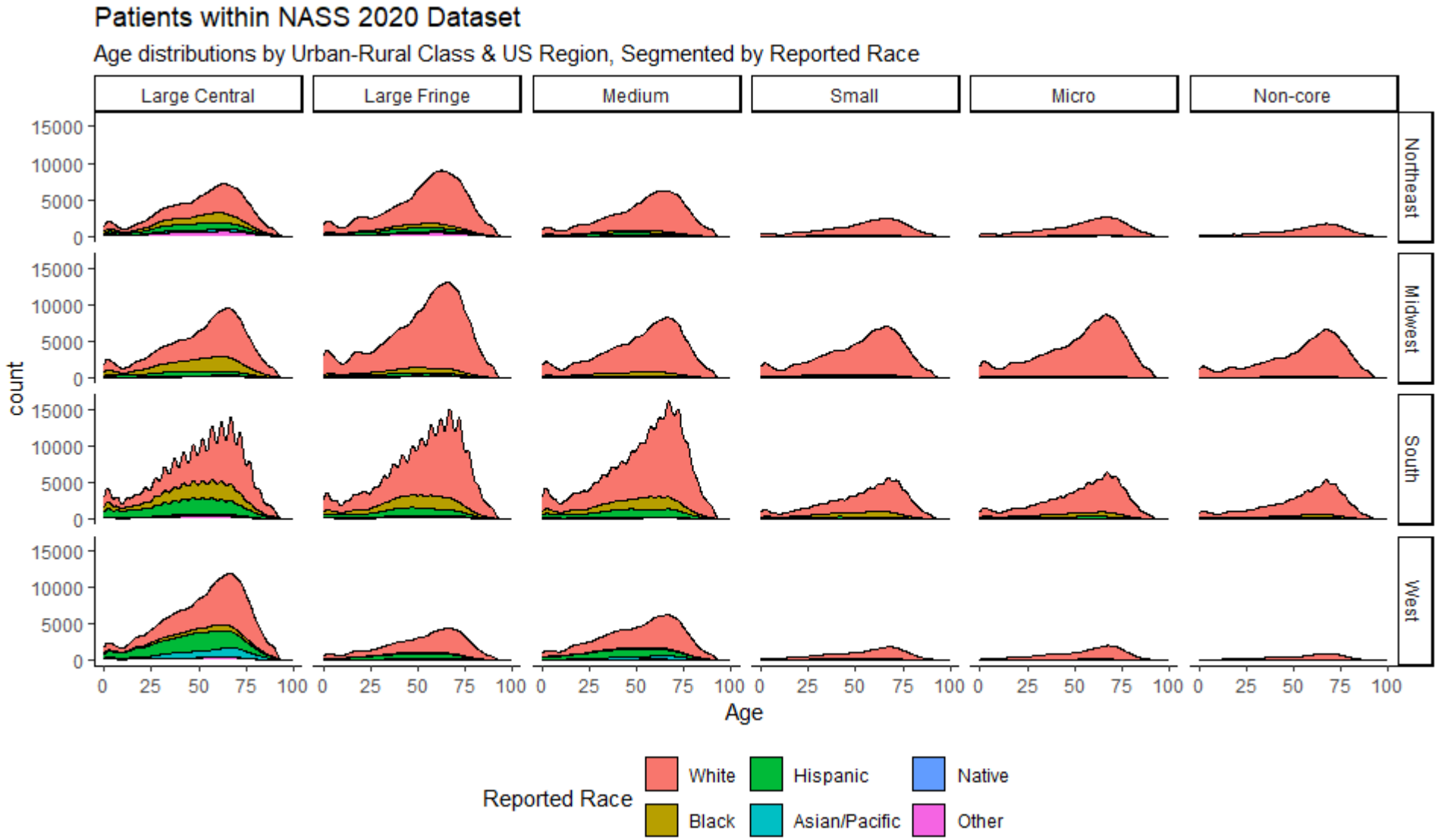
CCS Code	**Procedure**
15	Lens and cataract procedures
160	Other therapeutic procedures on muscles and tendons
84	Cholecystectomy and common duct exploration
152	Arthroplasty knee
85	Inguinal and femoral hernia repair
86	Other hernia repair
162	Other OR therapeutic procedures on joints
124	Hysterectomy, abdominal and vaginal
175	Other OR therapeutic procedures on skin and breast
6	Decompression peripheral nerve

The same 10 most common ambulatory surgery encounters seem to show much poorer distribution across race, with overall NASS 2020 dataset showing distribution that trends but does not match US 2020 census.

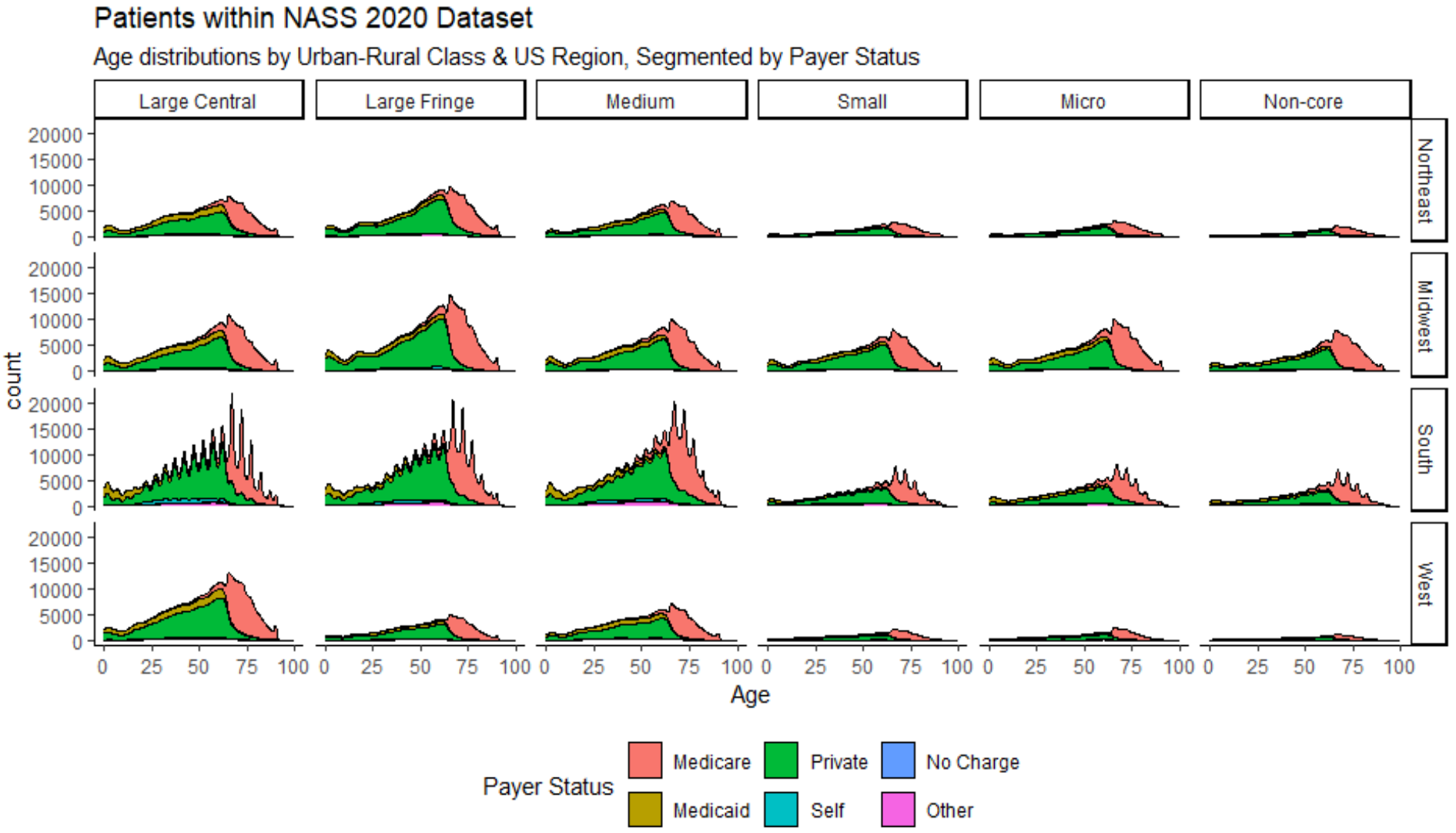


	NASS 2020	US Census 2020
White	5,644,868 (72%)	60.10%
Black	737,227 (9.4%)	12.20%
Hispanic	762,668 (9.7%)	18.50%
Asian	190,304 (2.4%)	5.60%
Native	36,108 (0.5%)	0.90%
Other	237,048 (3.0%)	2.80%

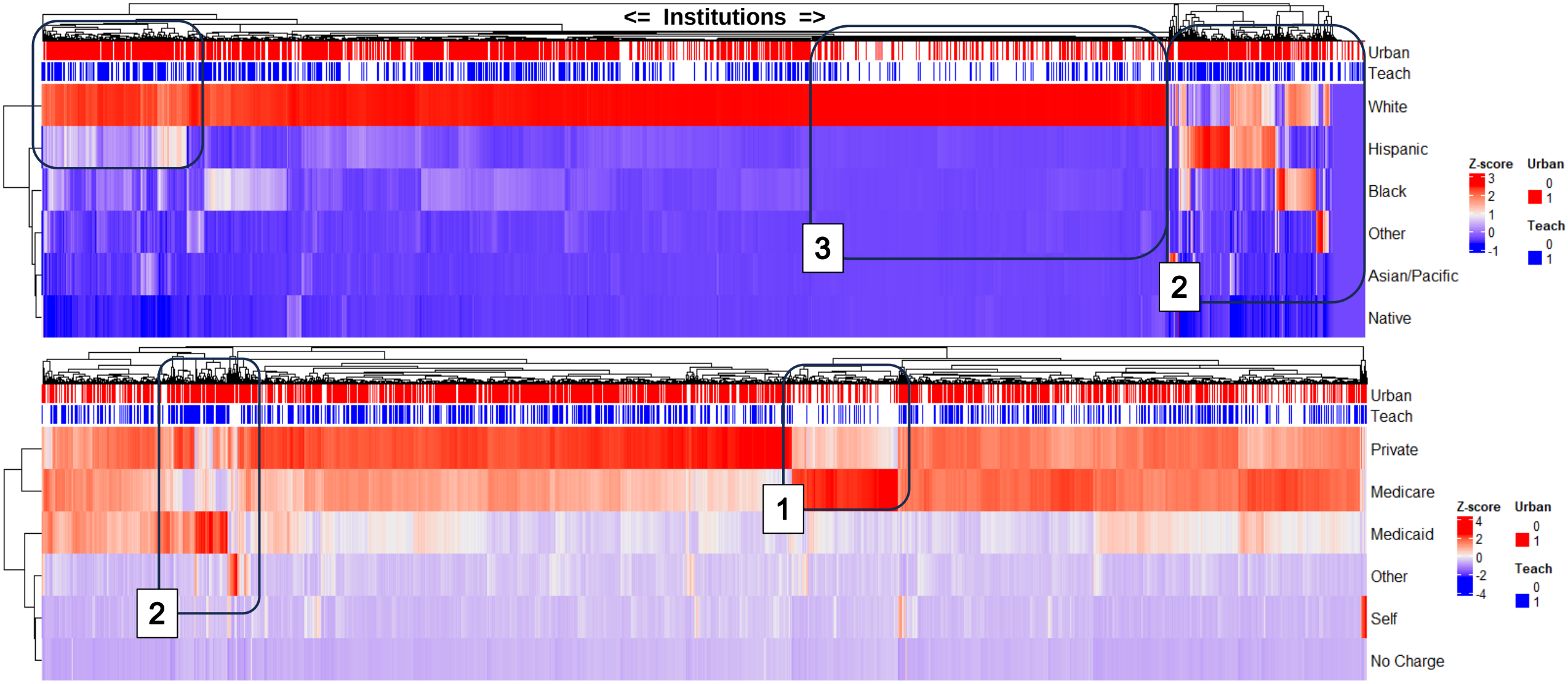
The high relative utilization of ambulatory surgery by white patients holds true across regions and urban classification, but higher urban/south/west representation of minorities also suggests local patient mix as rationale.



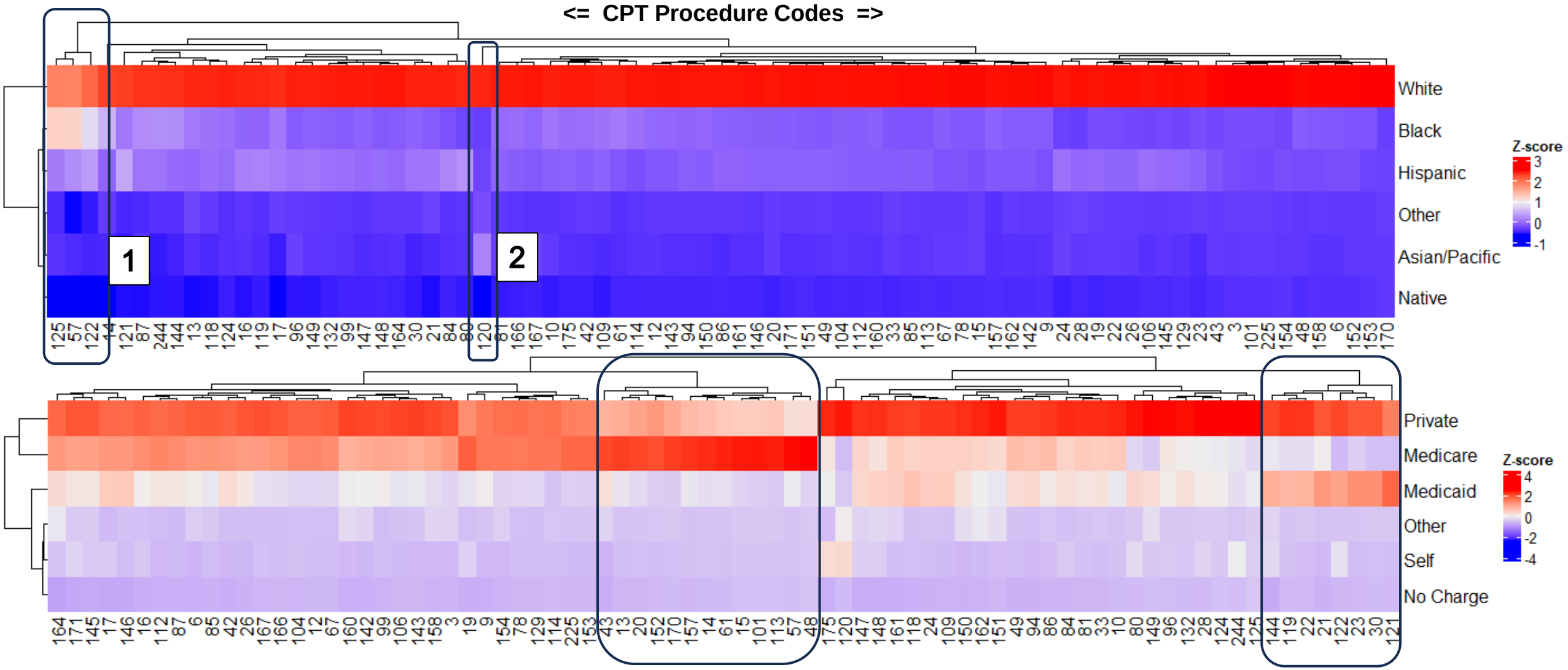
Payer status similarly shows consistent patterns across regions and urban densities. Private insurance is best represented for most ages, is almost the majority of ambulatory encounters (47%), but is completely supplanted by Medicare by age of 65.



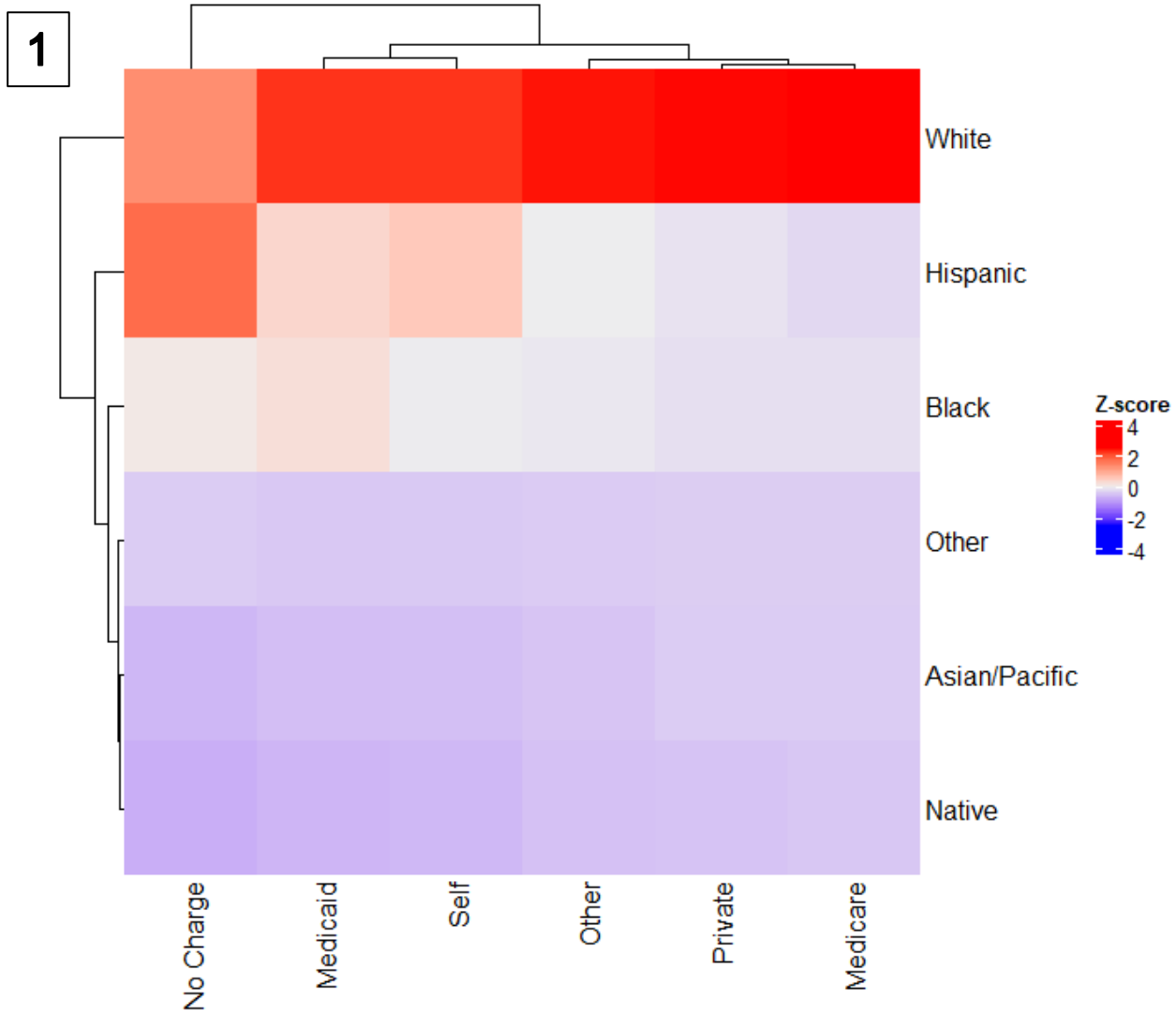
Simple (Euclidean) clustering analysis (z-normalized) of Institutions in dataset vs their racial and payer mixes indicates more balanced payer mixes relative to the more imbalanced racial mix. Clusters appear indicating (1) long term care affiliated centers, (2) urban academic/public centers, and (3) rural American.

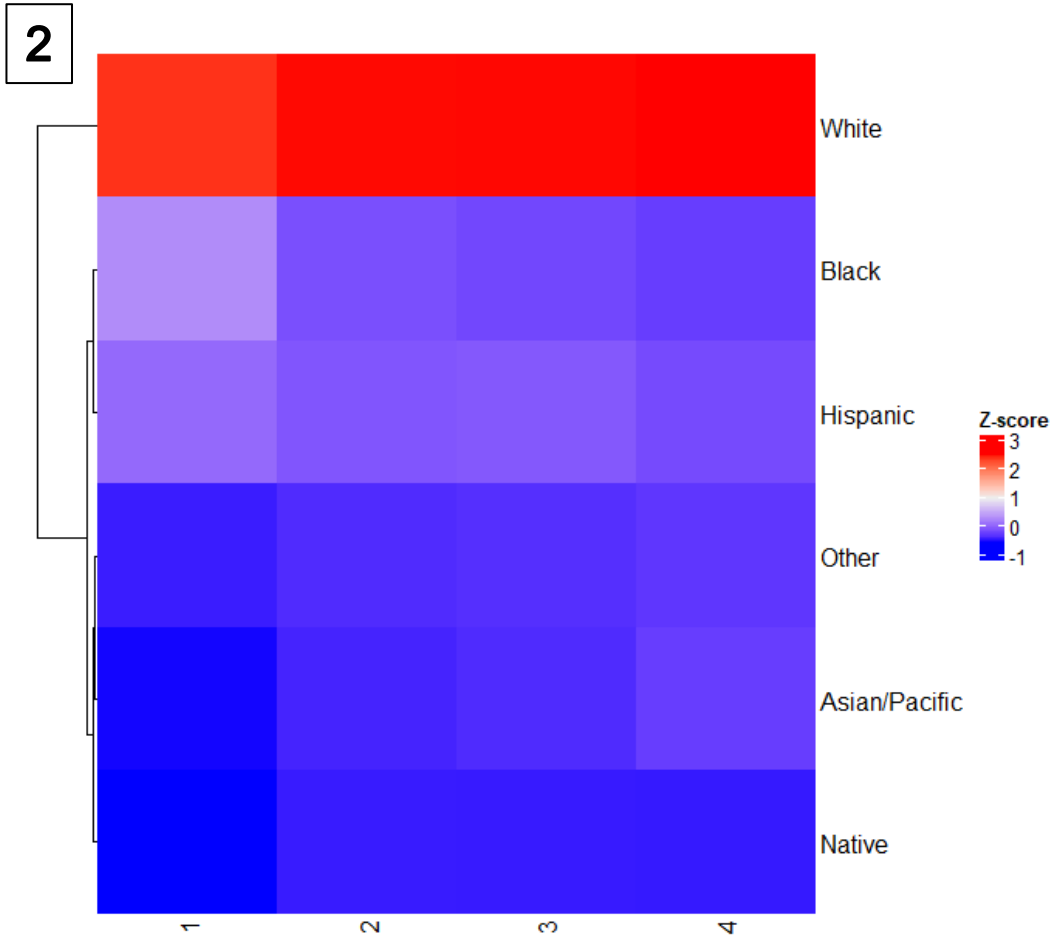


Clustering along CPT codes in dataset vs their racial and payer status shows clear profiles for payer status for procedures, but generally shows uniform racial bias informed by the underlying dataset distribution. The exception includes fistula creations, ectopic pregnancy and other excisions of the cervix, uterus (1) or ovaries (2).

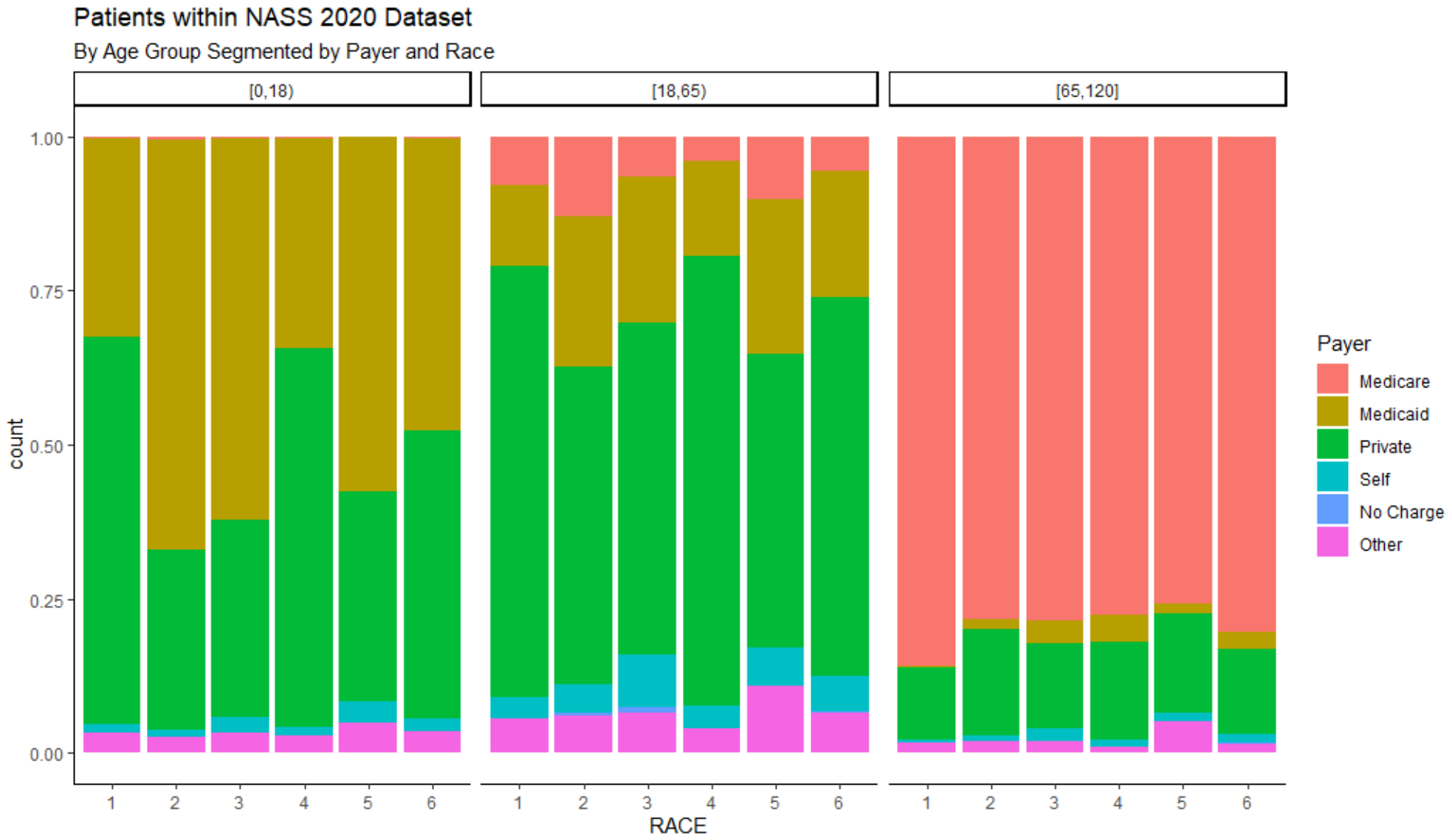


Comparison of Race vs (1) payer status or (2) income quartile shows mild relative overrepresentation of minorities along lower ends of spectrum, but is not overly unbalanced across economic status indicator.

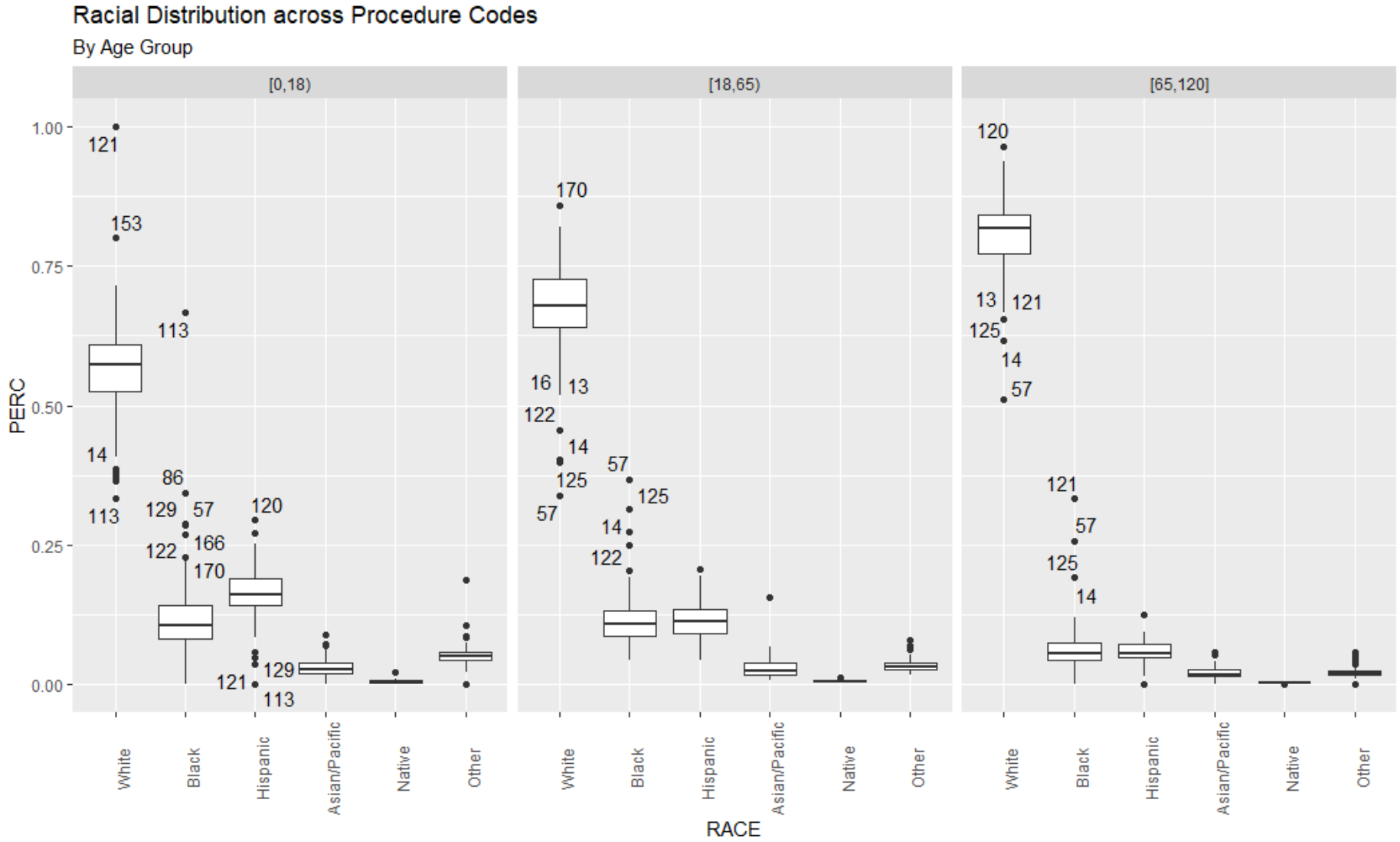




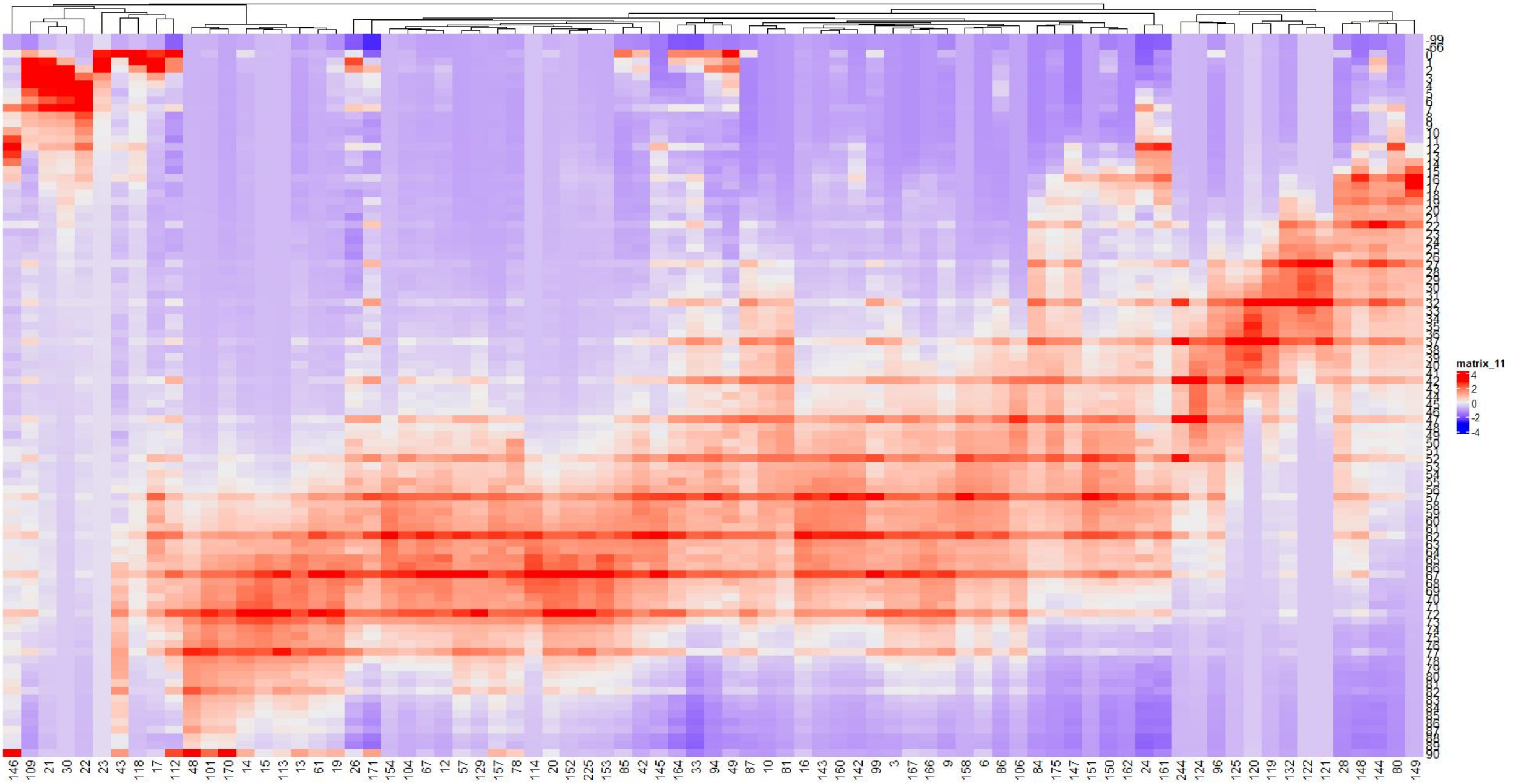
PENDING: When bracketed by Age group, payer mixes appear relatively uniform across races, with the exception of the under 18 bracket, which shows more Medicaid utilization in certain groups, as expected. TODO: Redo title, add marginal graph



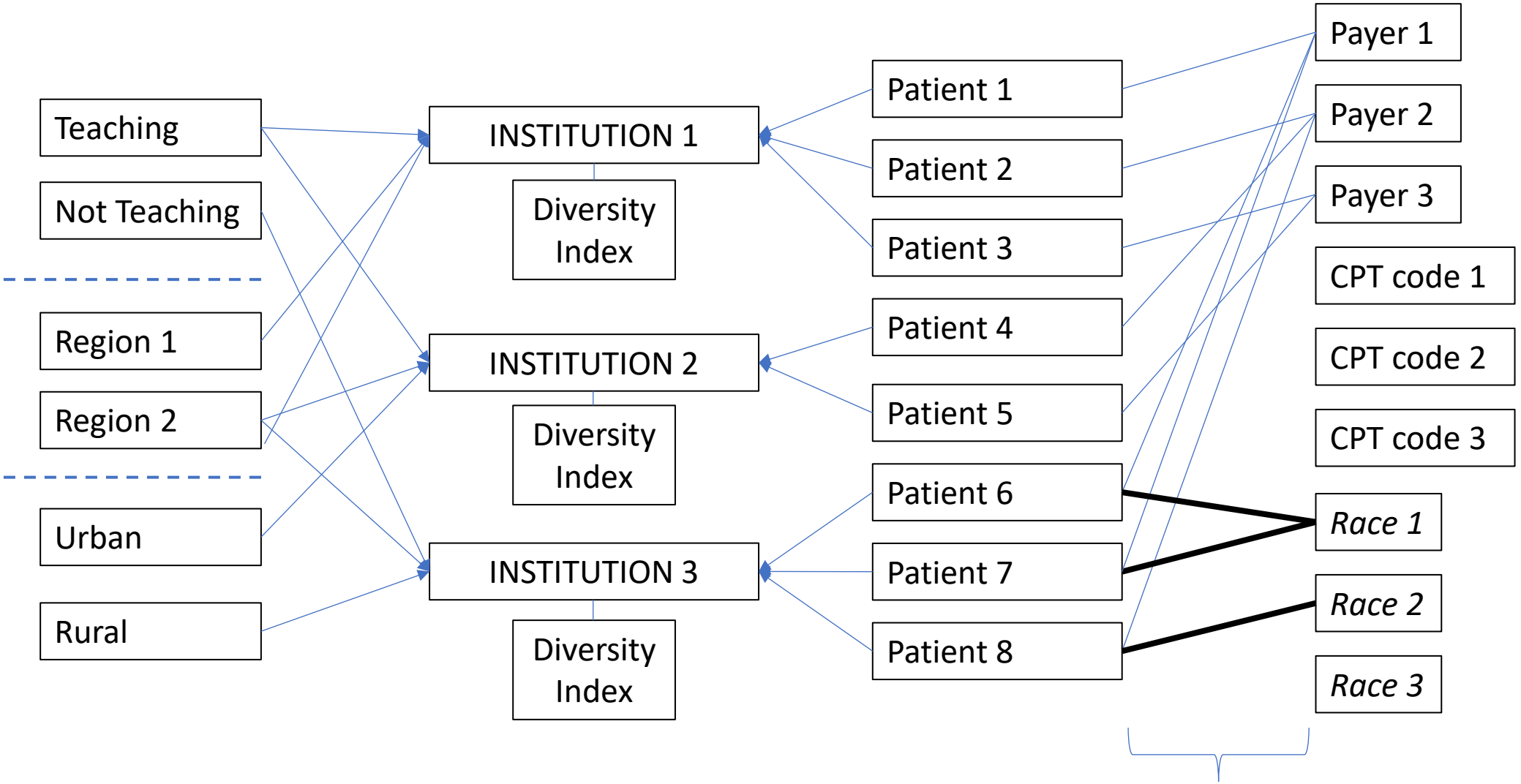
PENDING: When bracketed by patient age group, the racial distribution of CPT codes shows trend towards more imbalance, as expected per 2020 Census of racial make-up by age. TODO: redo title, filter noisy points, add Census 2020 references to chart, add CPT labels



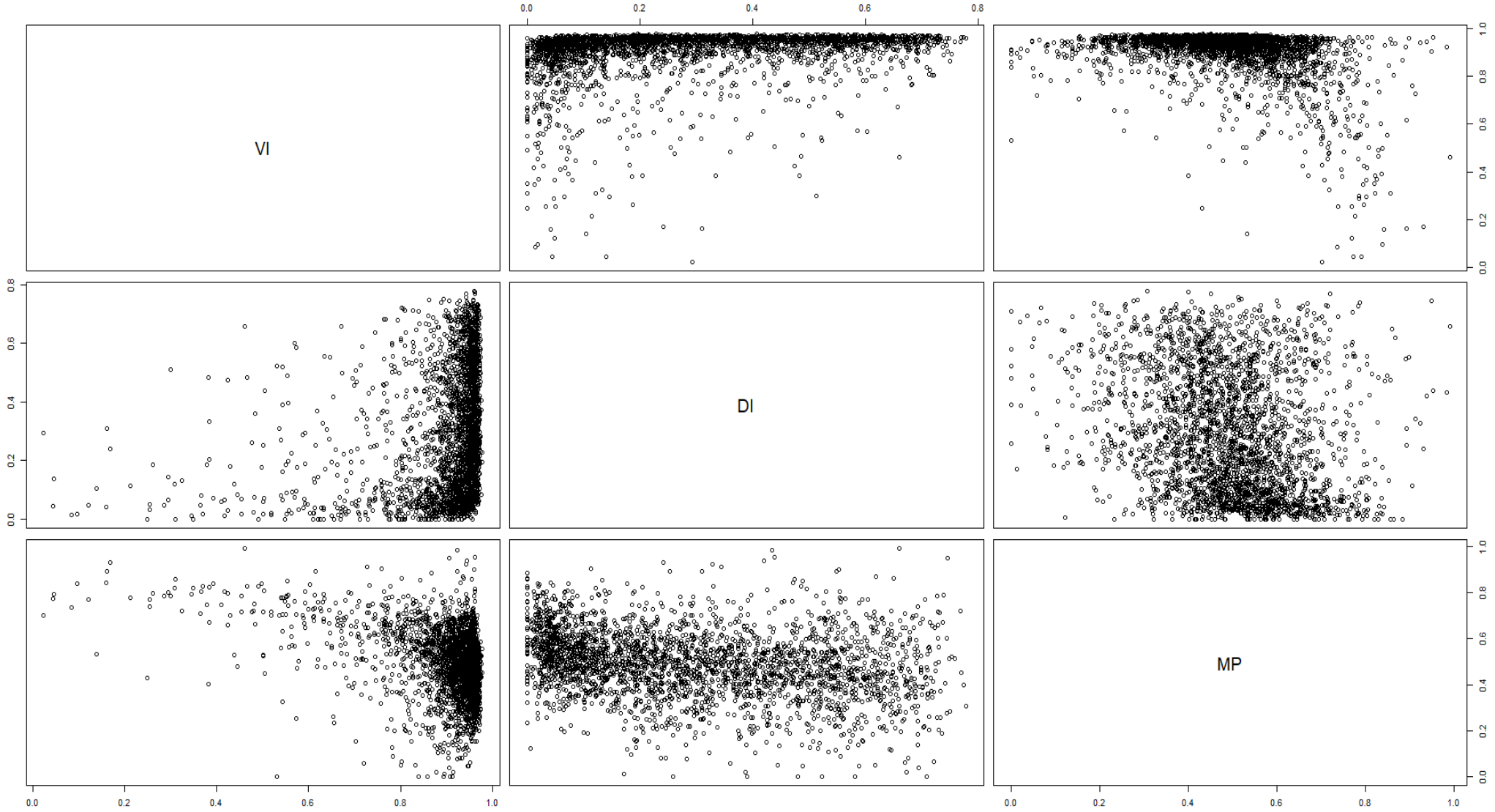
PENDING: CPT code vs age (McQuitty clustering of CPT only)



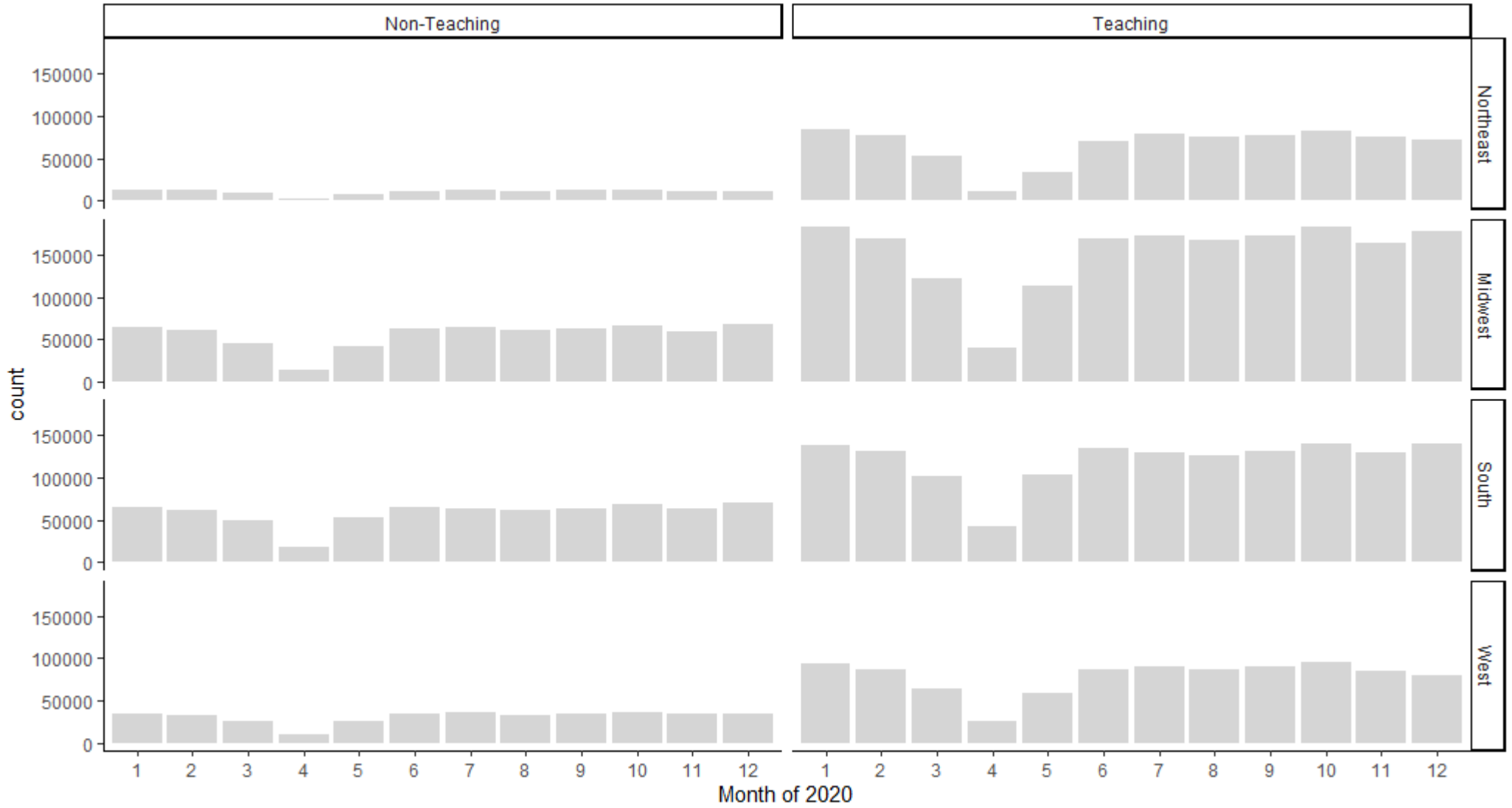
Pending: Some sort of MLM



Plotting institutions, % Medicare + Medicaid (MP) shows distinct relationships with Case mix index (VI) and Diversity Index (DI), indicating specialty centers with low diversity but high government payment. Such centers do not exist at high DI.



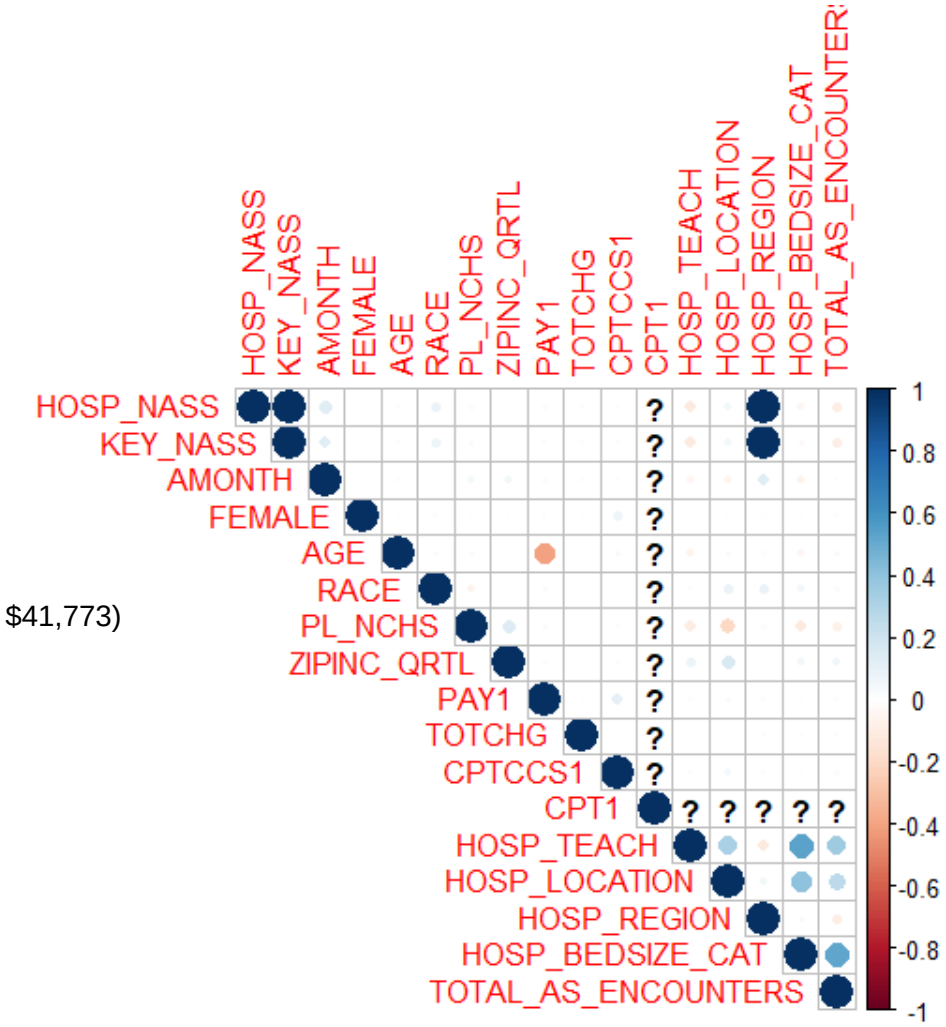
As an aside, it can be observed that across teaching status and region, all ambulatory surgeries saw major dips in volume Feb.-June of 2020, with trough in April, onset of the Pandemic. Some regions saw further, milder dips in December with the 2nd wave.



Overview of HCUP NASS 2020 Dataset Variables and Correlation Matrix of variables. Please see attached PDF for R script of figures.

1 Median (IQR); n (%)

Characteristic	N = 7,828,3101
HOSP_NASS	30,020 (20,253, 30,792)
KEY_NASS	30,057,867 (20,597,736, 32,014,944)
AMONTH	6 (2, 10)
FEMALE	
-9	701 (<0.1%)
-8	40 (<0.1%)
-6	136 (<0.1%)
0 (Male)	3,472,335 (44%)
1 (Female)	4,355,098 (56%)
AGE	57 (38, 68)
RACE	
-9	219,935 (2.8%)
-8	152 (<0.1%)
1 (White)	5,644,868 (72%)
2 (Black)	737,227 (9.4%)
3 (Hispanic)	762,668 (9.7%)
4 (Asian/PI)	190,304 (2.4%)
5 (Native)	36,108 (0.5%)
6 (Other)	237,048 (3.0%)
PL_NCHS	
-99	10,956 (0.1%)
1 (Large Metro Central)	2,001,905 (26%)
2 (Large Metrro Fringe)	1,874,453 (24%)
3 (Medium)	1,692,414 (22%)
4 (Small)	767,598 (9.8%)
5 (Micropolitan)	865,911 (11%)
6 (Non-core)	615,073 (7.9%)
ZIPINC_QRTL	
-9	83,969 (1.1%)
-8	104 (<0.1%)
1 (Lowest)	1,784,061 (23%)
2	2,204,802 (28%)
3	1,975,063 (25%)
4 (Highest)	1,780,311 (23%)
PAY1	
-9	9,788 (0.1%)
-8	99 (<0.1%)
1 (Medicare)	2,601,624 (33%)
2 (Medicaid)	1,019,170 (13%)
3 (Private Ins.)	3,640,228 (47%)
4 (Self Pay)	220,234 (2.8%)
5 (No Charge)	10,996 (0.1%)
6 (Other)	326,171 (4.2%)
TOTCHG	$23,353 ($12,821, $41,773)
CPTCCS1	79 unique
HOSP_TEACH	5,766,442 (74%)
HOSP_LOCATION	7,003,739 (89%)
HOSP_REGION	
1 (Northeast)	1,359,342 (17%)
2 (Midwest)	2,496,947 (32%)
3 (South)	2,654,907 (34%)
4 (West)	1,317,114 (17%)
HOSP_BEDSIZE_CAT	
1 (1-99)	1,188,114 (15%)
2 (100-299)	2,491,495 (32%)
3 (300+)	4,148,701 (53%)
TOTAL_AS_ENCOUNTERS	4,841 (2,595, 9,398)



Next Steps.

- HCUP NASS 2020 Dataset shows some indication of Racial bias in ambulatory surgery usage independent of economic class, or at least wider geographic availability of ambulatory surgery services for white Americans.
- However, I have not thought of a statistical approach to validate this hypothesis internal of the dataset, as the dataset is not a time series, and is not a sample of the larger population (US population) for which we have no knowledge of the distribution.
  - Solution 1: Cross-classified Multi-level Model at Institution level, predicting racial breakdown of an institution via input of facility parameters/Patient CPT codes. The result here will be predictable (urban/teaching -> diversity), and I am stuck in the math of working this still.
  - Solution 2: Utilize Census or other resource to provide baseline to compare NASS to. Issue here is whether the different data methodologies will create problems.
  - Solution 3: Utilize an alternative AHRQ dataset (ED (NED), Inpatient Sample (NIS)) from 2020 to extract racial distribution, and compare to NASS. This would be more similar methodologies of underlying data, but not the ideal comparison of ambulatory vs. inpatient surgery. At best we could say ambulatory is more imbalanced than some other service.
  - Solution 4: Since NASS 2021 was just released, we can analyze the dataset over time, looking for a trend in racial makeup, which can be tested for. Alternatively, the reaction of the ambulatory surgery market to COVID will be further highlighted in that timeframe.