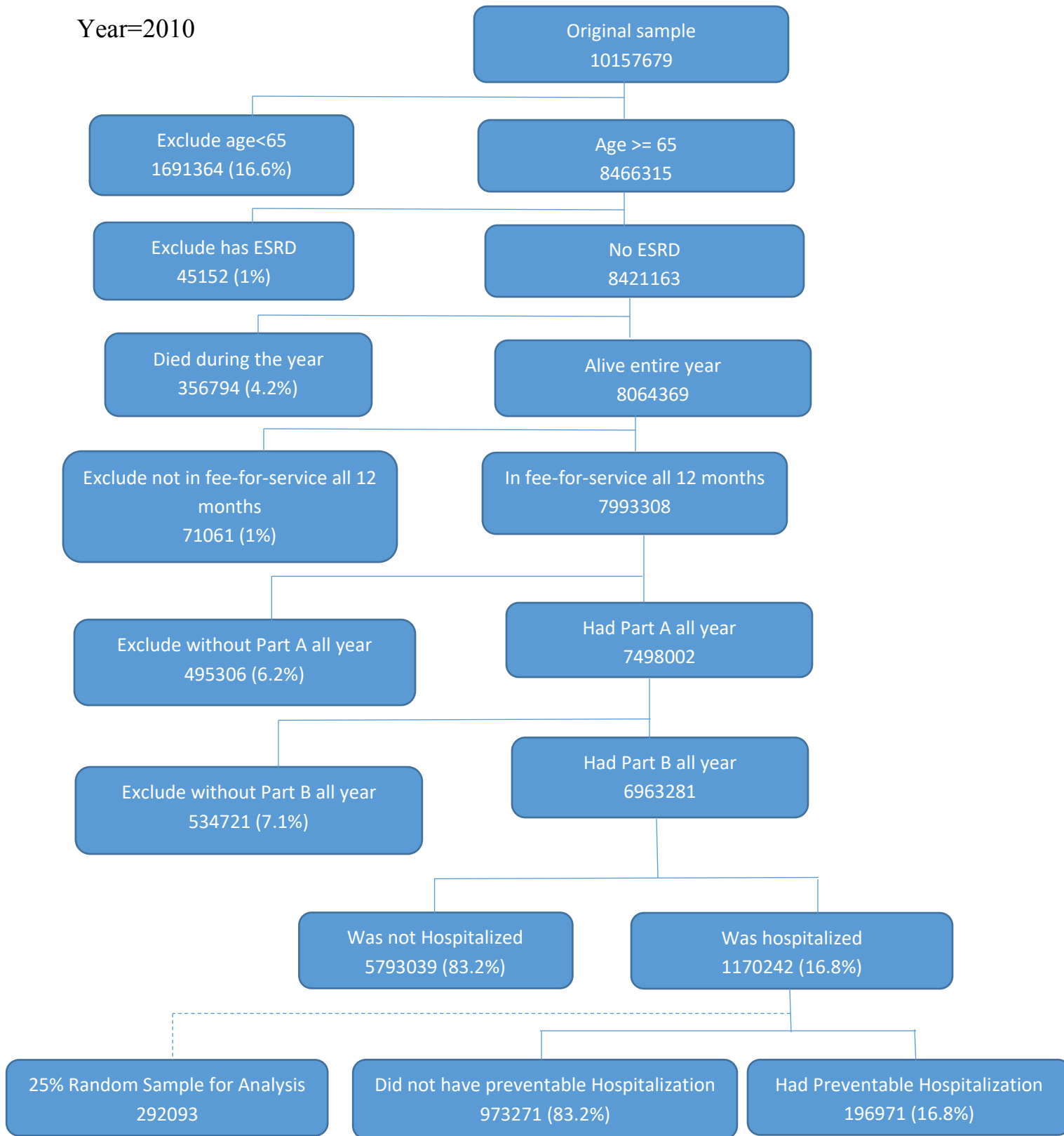


Supplemental materials for:

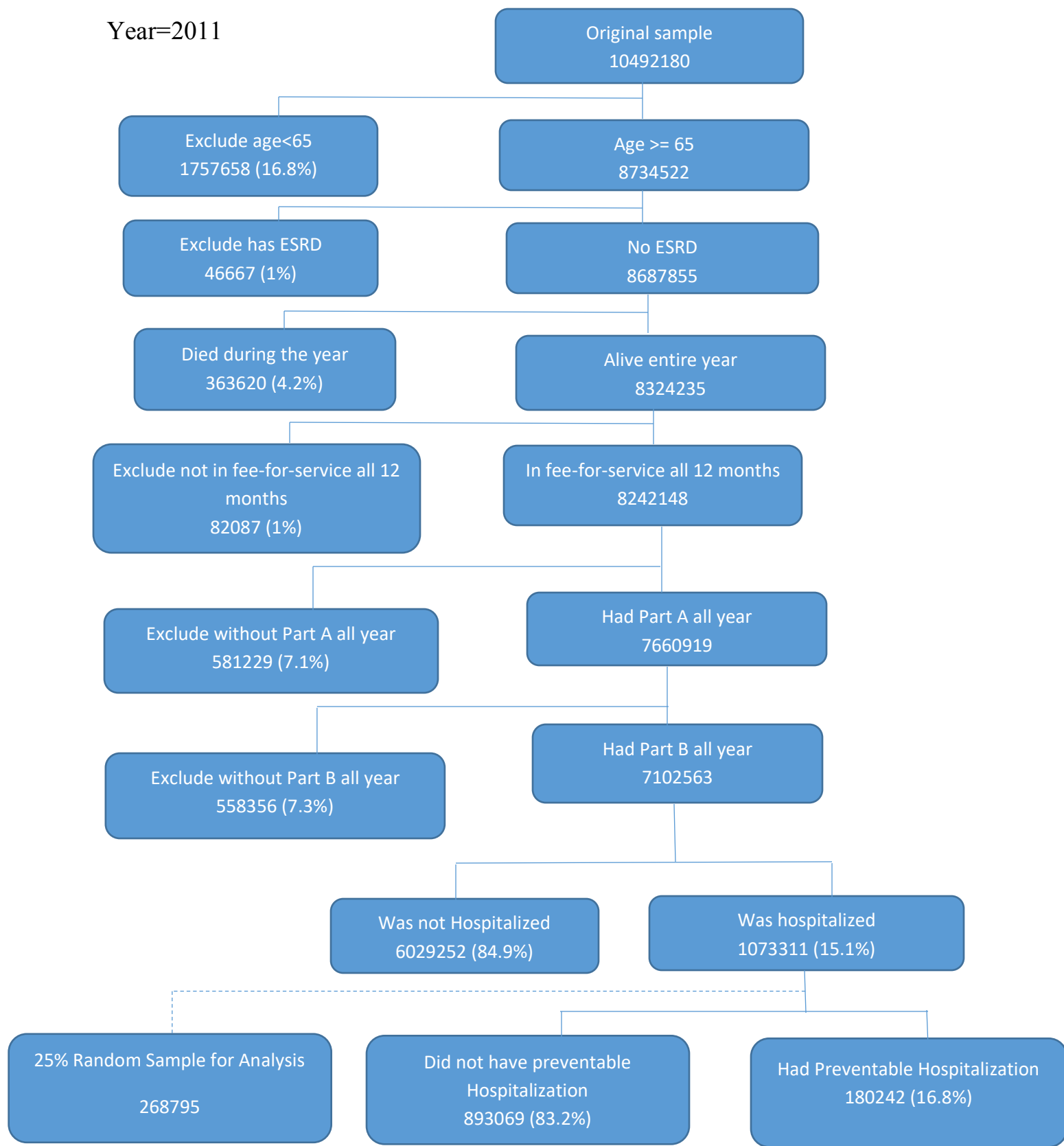
Mahmoudi E, Kamdar N, Furgal A, Sen A, Zazove P, Bynum J. Potentially preventable hospitalizations among older adults: 2010-2014. *Ann Fam Med*. 2020;18(6):511-519.

Supplemental Figure 1. Schematic Flow Diagram of Patient Population

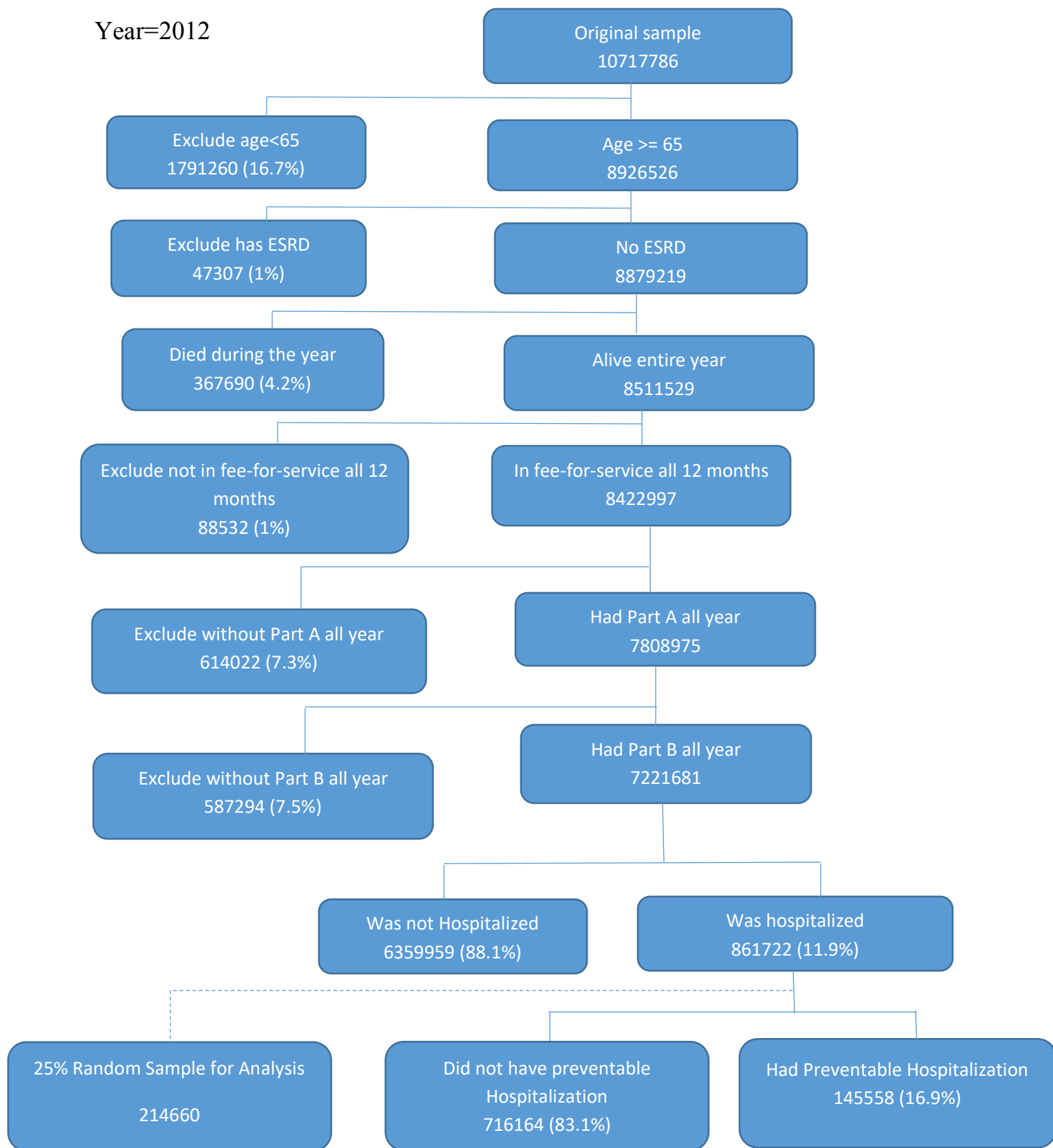
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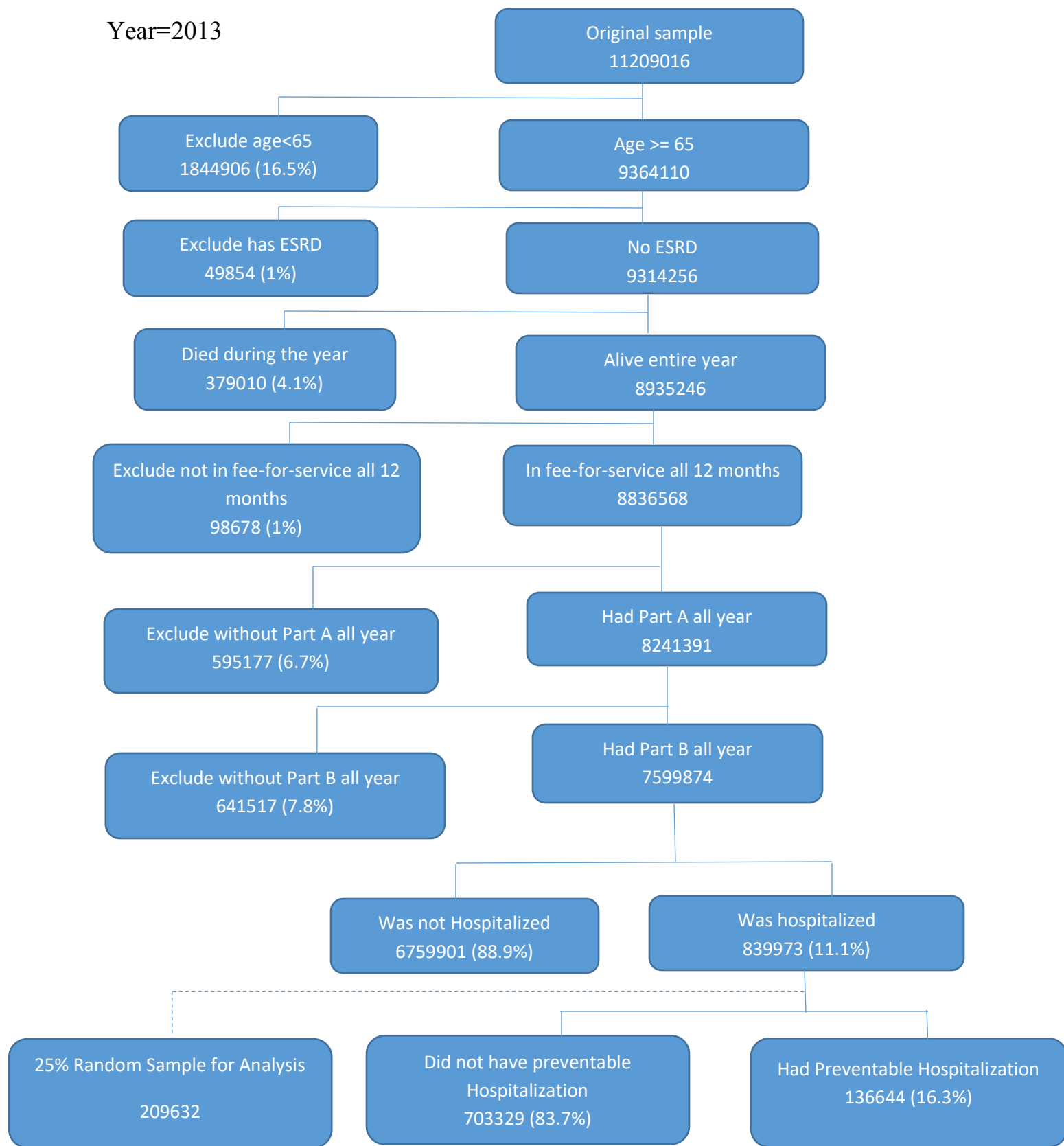
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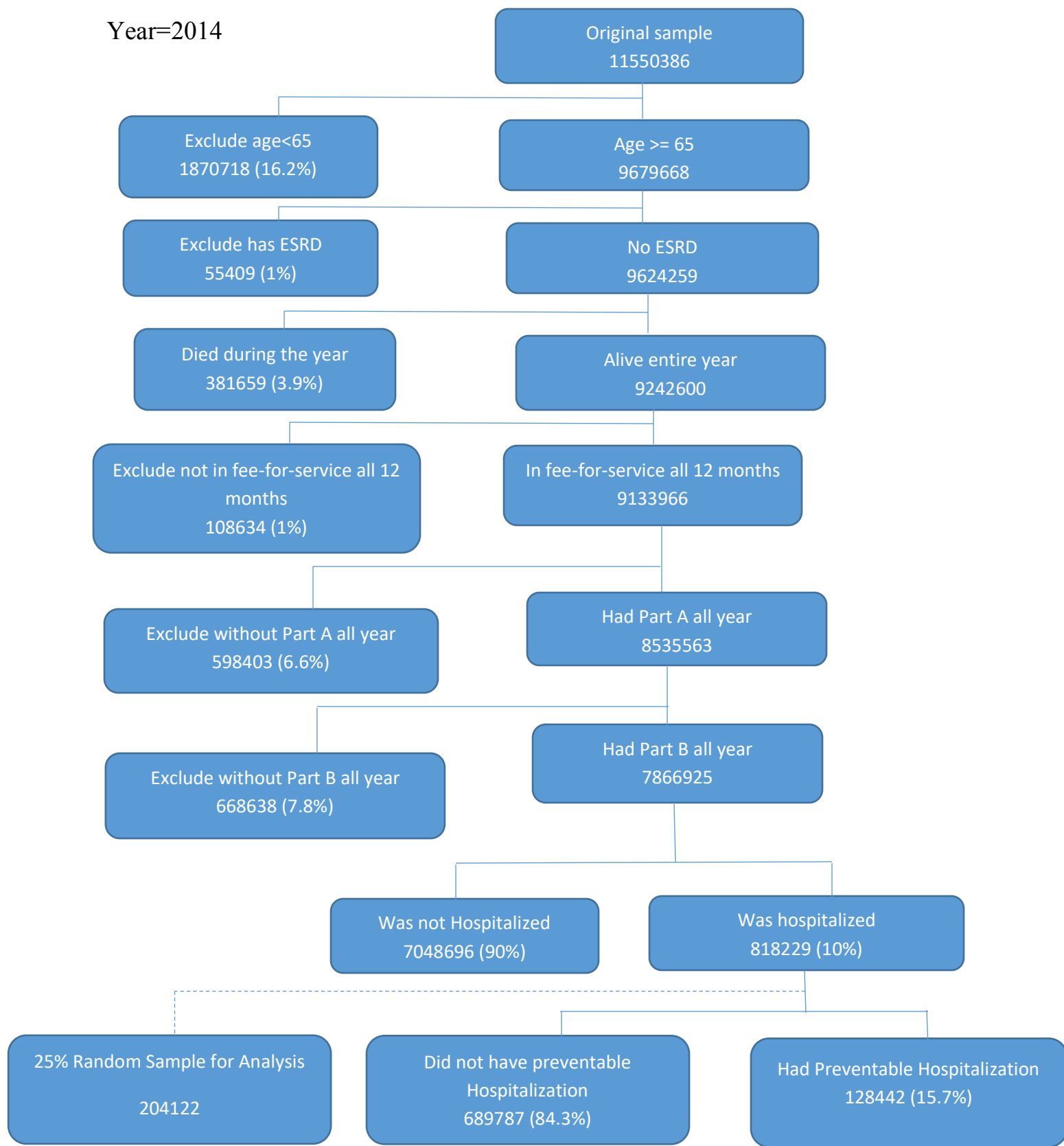
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Year=2014

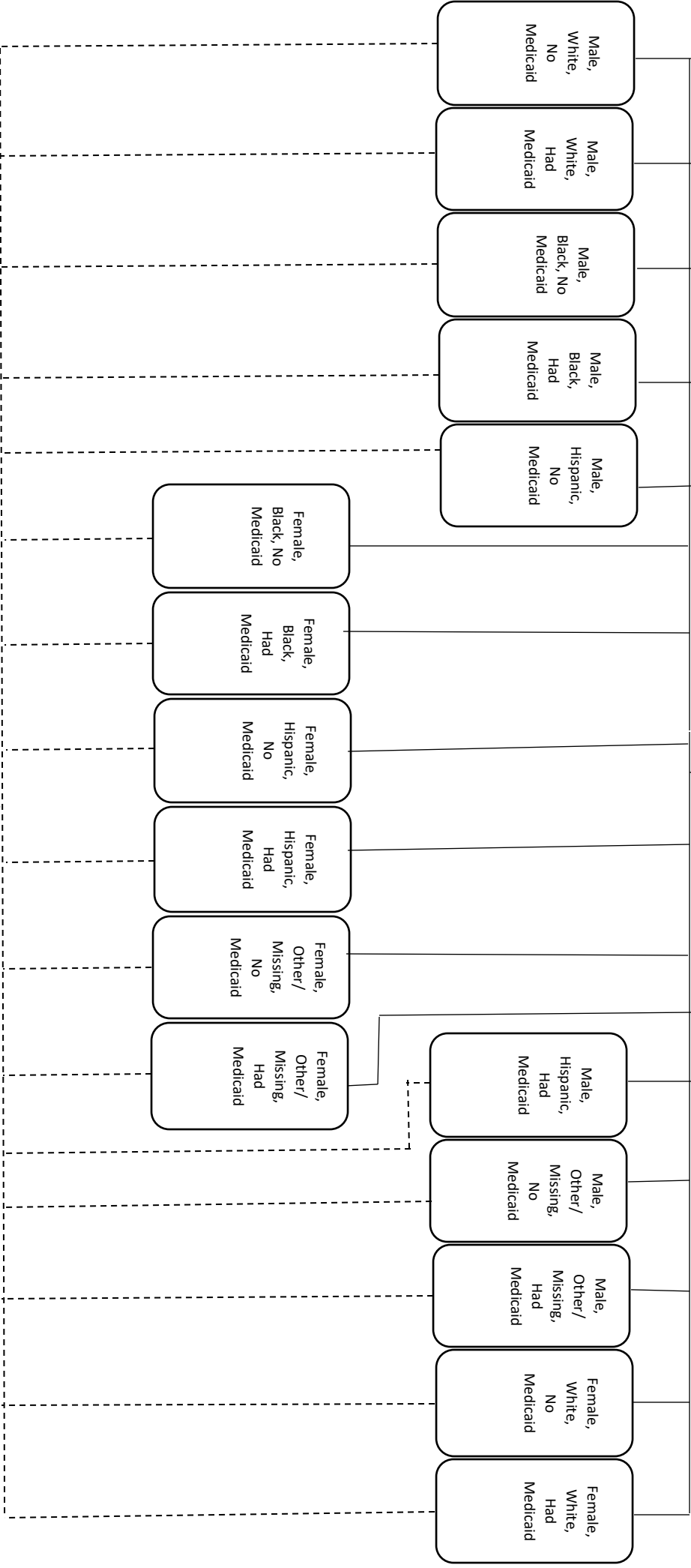


Schematic flow diagram of patient population

Supplemental Figure 2. Sampling Schematic of Patient Population

Sample from All patients

201x patients included

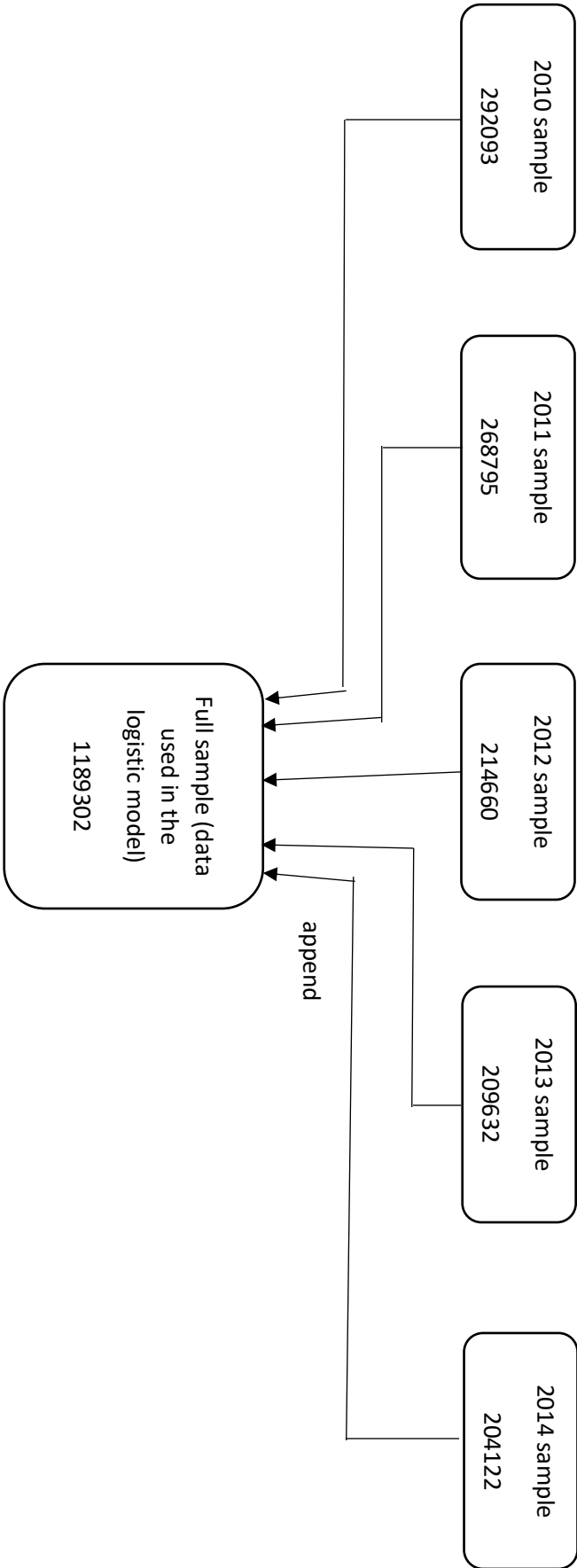


25% sample from each group

201x sample

Random sampling with stratification

Sample from All patients (continued)



Supplemental Table 1. Characteristics of 5% sample with potentially preventable and non-preventable hospitalizations in 2010 and 2014

	PPH Mean (SD) or N (%)	Not PPH Mean (SD) or N (%)	P-Value or CI of the Difference	PPH Mean (SD) or N (%)	Not PPH Mean (SD) or N (%)	P-Value or CI of the Difference
	2010 (N=292,448)			2014 (N=204,413)		
N	49,185 (16.8%)	243,263 (83.2%)	P < 0.0001	32,299 (15.8%)	172,114 (84.2%)	P < 0.0001
Age	80.0 (8.3)	77.6 (7.8)	2.4 (2.3-2.4)	80.2 (8.5)	77.8 (8.1)	2.5 (2.4-2.6)
Sex						
Male	18616(37.85)	102803(42.26)	P < 0.0001	11916 (36.89)	72083(41.88)	P < 0.0001
Female	30569(62.15)	140460(57.74)	P < 0.0001	20383 (63.11)	100031(58.12)	P < 0.0001
Race/Ethnicity						
Non-Hispanic White	38906(79.10)	203234(83.54)	P < 0.0001	25848(80.03)	144980(84.23)	P < 0.0001
Black	5410(11.00)	20016(8.23)	P < 0.0001	3419(10.59)	13171(7.65)	P < 0.0001
Hispanic	3522(7.16)	13750(5.65)	P < 0.0001	2006(6.21)	8332 (4.84)	P < 0.0001
Other	1290(2.62)	6042(2.48)	P < 0.0001	930(2.88)	4834(2.81)	P < 0.0001
Unknown/Missing	57(0.12)	221(0.09)	P < 0.0001	96(0.30)	797(0.46)	P < 0.0001
Medicaid						
No	199360(81.95)	34595(70.34)	P < 0.0001	22955(71.07)	141774(82.37)	P < 0.0001
Yes	43903(18.05)	14590(29.66)	P < 0.0001	9344(28.93)	30340(17.63)	P < 0.0001
Zip-code level median income+						
Low	13702(27.86)	58007(23.85)	P < 0.0001	9124(28.25)	40753(23.68)	P < 0.0001
Average	23436(47.65)	120354(49.47)	P < 0.0001	15501(47.99)	85044(49.41)	P < 0.0001
High	11061(22.49)	60376 (24.82)	P < 0.0001	6997(21.66)	43009(24.99)	P < 0.0001
Missing	986(2.00)	4526(1.86)	P < 0.0001	677(2.10)	3308(1.92)	P < 0.0001
Number of prescriptions	14.5 (13.8)	10.4 (11.0)	4.0 (3.9-4.1)	17.3 (14.9)	12.7 (12.2)	4.6 (4.4-4.7)
Elixhauser Index	9.1 (8.1)	5.3 (7.0)	3.8 (3.8-3.9)	10.7 (8.7)	6.8 (8.0)	3.9 (3.9-4.0)
County-level PCP per 1000 ++						
Low	3292(6.70)	14379(5.92)	P < 0.0001	2318(7.19)	11252(6.55)	P < 0.0001
Medium	27239(55.45)	132857(54.68)	P < 0.0001	18016(55.86)	93815(54.59)	P < 0.0001
High	18589(37.84)	95714(39.40)	P < 0.0001	11918(36.95)	66787(38.86)	P < 0.0001
County-level MMC penetration	23.6 (14.2)	24.3 (14.1)	-0.7 (-0.7- -0.6)	26.9 (13.7)	27.9 (13.5)	-0.3 (-0.4- -0.1)
County-level hospitals per 100,000 +++						
Low	49602(20.42)	9678(19.70)	P < 0.0001	6142(19.04)	34788(20.24)	P < 0.0001
Medium	181854(74.85)	36572(74.45)	P < 0.0001	23854(73.96)	127828(74.38)	P < 0.0001
Low	11493(4.73)	2870(5.84)	P < 0.0001	2256(6.99)	9234(5.37)	P < 0.0001

Note: Based on 5% random sample of Medicare fee-for-service claims data of included cohort of older adults with at least one hospitalization during 2010 or 2014.

+ Low: <25th percentile; Medium: 25-75th percentile; High: >75th percentile.

++ Low: <25th percentile ($\leq$ 0.49 per 1,000); Medium: 25-75th percentile (between 0.49 and 1.04 per 1,000); High: >75th percentile ($>$ 1.04 per 1,000).

+++ Low: <25th percentile ($\leq$ 0.996 per 100,000); Medium: 25-75th percentile (between 0.996 and 6.17 per 100,000); High: >75th percentile ($>$ 6.17 per 100,000).

Abbreviations: PPH: potentially preventable hospitalization; SD: standard deviation; PCP: primary care physician; MMC: Medicare managed care.

Supplemental Table 2. ICD-9 Codes for Potentially Preventable Hospitalization – Ambulatory Care Sensitive Conditions

Diagnosis	ICD-9 Codes
Bacterial pneumonia	481, 482.2, 482.30, 483.21, 482.32, 482.39, 482.9, 483.0, 483.1, 483.8, 485, 486
Dehydration	276.5, 276.50
Urinary tract infection	599, 599.0, 599.00, 590.01, 590.10, 590.11, 590.2, 590.3, 590.80, 590.81, 590.9, 595.0, 595.9, 599.0
Angina	411.1, 411.10, 411.81, 413.0, 4130.0, 413.1, 413.9
Asthma	493.00, 493.01, 493.02, 493.10, 493.11, 493.12, 493.20, 493.21, 493.22, 493.90, 493.91, 493.92
Chronic obstructive pulmonary disease	493.00, 493.01, 493.02, 493.10, 493.11, 493.12, 493.20, 493.21, 493.22, 493.90, 493.91, 493.92
Congestive heart failure	398.91, 404.13, 402.01, 404.91, 402.11, 404.93, 402.91, 428.0, 404.01, 428.1, 404.03, 428.9, 404.11
Diabetes	250
Short term complications	250.10, 250.11, 250.12, 250.13, 250.20, 250.21, 250.22, 250.23, 250.30, 250.31, 250.32, 250.33
Long term complications	250.40, 250.41, 250.42, 250.43, 250.50, 250.51, 250.52, 250.53, 250.60, 250.61, 250.62, 250.63, 250.70, 250.71, 250.72, 250.73, 250.80, 250.81, 250.82, 250.83, 250.90, 250.91, 250.92, 250.93
Uncontrolled diabetes	250.02, 250.03
Diabetic amputation	V49.70, V49.71, V49.72, V49.73, V49.74, V49.75, V49.76, V49.77, 841.1, 841.2, 841.3, 841.4, 841.5, 841.6, 841.7, 841.8, 841.9
Hypertension	401.0, 401.9, 402, 402.0, 402.00, 402.10, 402.90, 403.00, 403.10, 403.90, 404.00, 404.10, 404.90
Perforated appendix	540.0, 540.1

ICD-9 codes for potentially preventable hospitalizations– ambulatory care sensitive conditions

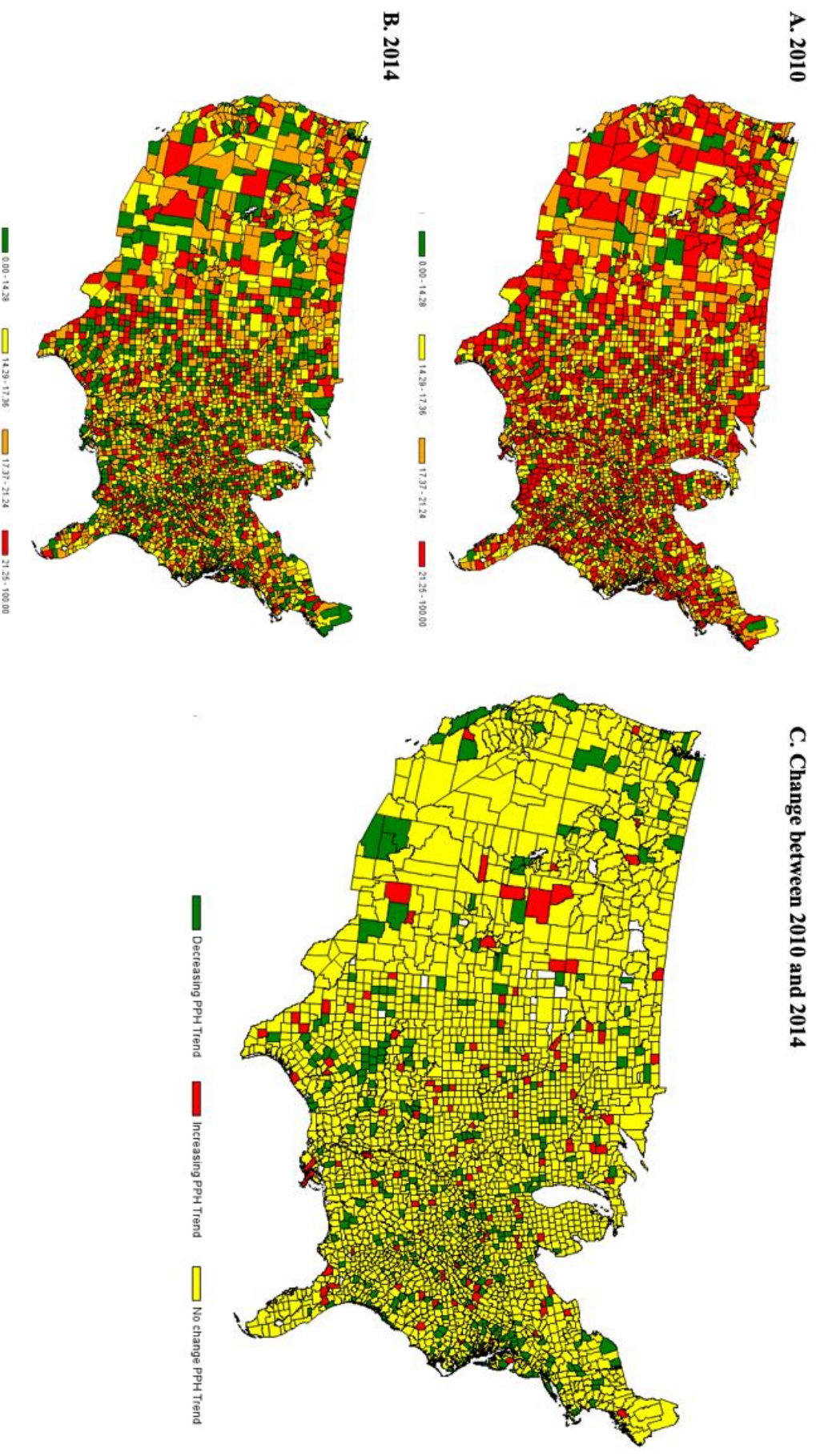
Supplemental Table 3. ICD-9 Codes for Elixhauser Comorbidity Conditions

Comorbidity	ICD-9 Codes
Congestive heart failure	398.91, 428.0-428.9
Valvular disease	093.20-093.24, 394.0-397.1, 397.9, 424.0-424.99, 746.3-746.6, V42.2, V43.3
Pulmonary circulation disease	415.11-415.19, 416.0-416.9, 417.9
Peripheral vascular disorder	440.0-440.9, 441.00-441.9, 442.0-442.9, 443.1-443.9, 444.21-444.22, 447.1, 449, 557.1, 557.9, V43.4
Hypertension, uncomplicated	401.1, 401.9, 642.00-642.04
Hypertension, complicated	401.0, 437.2
Pre-existing hypertension complicating pregnancy	642.20-642.24
Hypertensive heart disease, without heart failure	402.00, 402.10, 402.90, 405.09, 405.99
Hypertension heart disease with heart failure	402.01, 402.11, 402.91
Hypertensive renal disease, without renal failure	403.00, 403.10, 403.90, 405.01, 405.11, 405.91, 642.10-642.14
Hypertensive renal disease, with renal failure	403.01, 403.11, 403.91
Hypertensive heart and renal disease, without heart or renal failure	404.00, 404.10, 404.90
Hypertensive heart and renal disease, with heart failure	404.01, 404.11, 404.91
Hypertensive heart and renal disease, with renal failure	404.02, 404.12, 404.92
Hypertensive heart and renal disease, with heart and renal failure	404.03, 404.13, 404.93
Other hypertension in pregnancy	642.70-642.74, 642.90-642.94
Paralysis	342.0-344.9, 438.20-438.53, 780.72
Other neurological	330.0-331.9, 332.0, 333.4, 333.5, 333.7, 333.71, 333.72, 333.79, 333.85, 333.94, 334.0-335.9, 338.0, 340, 341.1-341.9, 345.00-345.11, 345.2-345.3, 345.40-345.91, 347.00-347.01, 649.40-649.44, 768.7, 768.70-768.73, 780.3, 780.31, 780.32, 780.33, 780.39, 780.97, 784.3
Chronic pulmonary disease	490-492.8, 493.00-493.92, 494-494.1, 495.0-505, 506.4
Diabetes, without chronic complications	250.00-250.33, 648.00-648.04, 249.00-249.31
Diabetes, with chronic complications	2504.0-250.93, 775.1, 249.40-249.91
Hypothyroidism	243-244.2, 244.8, 244.9
Renal failure	585.3, 585.4, 585.5, 585.6, 585.9, 586, V42.0, V45.1, V56.0-V56.32, V56.8, V45.11-V45.12
Liver disease	070.22, 070.23, 070.32, 070.33, 070.44, 070.54, 456.0, 456.1, 456.20, 456.21, 571.0, 571.2, 571.3, 581.40-571.49, 571.5, 571.6, 571.8, 571.9, 572.3, 572.8, V42.7
Chronic peptic ulcer disease	531.41, 531.51, 531.61, 531.70, 531.71, 531.91, 532.41, 532.51, 532.61, 532.70, 532.71, 532.91, 533.41, 533.51, 533.61, 533.70, 533.71, 533.91, 534.41, 534.51, 534.61, 534.70, 354.71, 534.91

HIV and AIDS	042-044.9
Lymphoma	200.00-202.38, 202.50-203.01, 238.6, 273.3, 203.02-203.82
Metastatic cancer	196.0-199.1, 209.70-209.75, 209.79, 789.51
Solid tumor, without metastasis	140.0-172.9, 174.0-175.9, 17.9-195.8, 209.00-209.24, 209.25-209.3, 209.31-209.36, 258.01-258.03
Rheumatoid arthritis/ collagen vascular disease	701.0, 710.0-710.9, 714.0-714.9, 720.0-720.9, 725
Coagulation deficiency	286.0-286.9, 287.1, 287.3-287.5, 649.30-649.34, 289.84
Obesity	278.0, 278.00, 278.01, 278.03, 649.10-649.14, V85.30-V85.39, V85.41-V85.45, V85.54, 793.91
Weight loss	260-263.9, 783.21-783.22
Fluid and electrolyte disorders	276.0-276.9
Blood loss anemia	280.0, 648.20-648.24
Deficiency anemia	280.1-281.9, 285.21-285.29, 285.9
Alcohol abuse	291.0-291.3, 291.5, 291.8, 291.81, 291.82, 291.89, 291.9, 303.00-303.93, 305.00-305.03
Drug abuse	292.0, 292.82-292.89, 292.9, 304.00-304.93, 305.20-305.93, 648.30-648.34
Psychoses	2950.0-298.9, 299.10, 299.11
Depression	300.4, 301.12, 309.0, 309.1, 311

ICD-9 codes for Elixhauser comorbidity conditions

Supplemental Figure 3. Heat maps of unadjusted county-level rates of potentially preventable hospitalizations in 2010(A) and 2014(B) and changes over time (C)



Source: Medicare claims data (2010-2014)

Heat maps of unadjusted county-level rates of potentially preventable hospitalizations in 2010(A) and 2014(B) and changes over time (C)

Supplemental Appendix. Study Design and Results of Developing County-level Heat Maps for Potentially Preventable Hospitalization (PPH)

For the baseline year of the study period, the quantile distribution of the county-specific PPH rates were examined, and appropriate cutoffs were made at critical terciles. To ensure 2010 and 2014 maps were comparable, the same endpoint cutoffs for different PPH rate categories on a per county basis were applied to the 2014 map. Since observed changes in PPH rates at a county-year might be purely due to chance, an examination of trends in PPH over time for each county were quantified using generalized linear models (GLMs). This generates an average change in PPH over the entire study period for each county. When the county-specific PPH rate is regressed with time in years, the p-value of the trend or slope and the sign of the parameter estimate provides insights whether the county increased (positive slope and significant p-value at 0.10 significance level), decreased (negative slope and significant p-value at 0.10 significance level), or stayed the same (positive or negative slope and non-significant p-value). We chose 0.10 significance level since some of the slope differences at tighter significance levels may have excluded some counties that had meaningful county-specific trends in PPH.

Results

Supplemental Figure 3 shows PPH rates in 2010 (A), 2014 (B), and how it changed over time (C) across 3200 counties in the U.S. Supplemental Figure 3-A and Supplemental Figure 3-B demonstrate wide county-level variation in PPH rates, ranging from below 14% (in green) in some counties to above 21% (in red) in others. Proportion of counties with low PPH rates (< 14.28%) increased between 2010 and 2014. Supplemental Figure 3-C shows how PPH changed over time. In 327 counties (in green) PPH rates significantly declined ($p < 0.1$). On the other hand, 123 counties (in red) experienced rising PPH trends over time ($p < 0.1$) (100 of these 123 counties were small rural counties). Finally, in

majority of counties (in yellow) PPH rates did not change over time. List of counties with increasing and decreasing PPH trends are provided in Supplemental Tables 4 and 5.

Supplemental Table 4. List of counties with increasing trend in potentially preventable hospitalization between 2010-2014.

Type	FIPS	State	Name
Large fringe metro	27163	MN	Washington County
Large fringe metro	27139	MN	Scott County
Large fringe metro	45091	SC	York County
Large fringe metro	21015	KY	Boone County
Large fringe metro	37159	NC	Rowan County
Large fringe metro	8093	CO	Park County
Large fringe metro	48325	TX	Medina County
Large fringe metro	47043	TN	Dickson County
Large fringe metro	13067	GA	Cobb County
Large fringe metro	21191	KY	Pendleton County
Large fringe metro	22075	LA	Plaquemines Parish
Large fringe metro	17005	IL	Bond County
Medium metro	39099	OH	Mahoning County
Medium metro	41053	OR	Polk County
Medium metro	47153	TN	Sequatchie County
Medium metro	51023	VA	Botetourt County
Medium metro	12001	FL	Alachua County
Medium metro	40131	OK	Rogers County
Medium metro	29119	MO	McDonald County
Medium metro	19085	IA	Harrison County
Medium metro	42049	PA	Erie County
Medium metro	35061	NM	Valencia County
Medium metro	45037	SC	Edgefield County
Micropolitan	18169	IN	Wabash County
Micropolitan	37155	NC	Robeson County
Micropolitan	26043	MI	Dickinson County
Micropolitan	23011	ME	Kennebec County
Micropolitan	39011	OH	Auglaize County
Micropolitan	12023	FL	Columbia County
Micropolitan	27015	MN	Brown County
Micropolitan	12107	FL	Putnam County
Micropolitan	56037	WY	Sweetwater County
Micropolitan	26091	MI	Lenawee County
Micropolitan	17081	IL	Jefferson County
Micropolitan	48321	TX	Matagorda County

Micropolitan	17177	IL	Stephenson County
Micropolitan	31141	NE	Platte County
Micropolitan	28071	MS	Lafayette County
Micropolitan	49047	UT	Uintah County
Micropolitan	28113	MS	Pike County
Micropolitan	42109	PA	Snyder County
Micropolitan	18037	IN	Dubois County
Micropolitan	18017	IN	Cass County
Micropolitan	47099	TN	Lawrence County
Micropolitan	40123	OK	Pontotoc County
Missing			
Missing			
Missing			
Missing			
Missing			
Noncore	42047	PA	Elk County
Noncore	48017	TX	Bailey County
Noncore	48081	TX	Coke County
Noncore	21133	KY	Letcher County
Noncore	51141	VA	Patrick County
Noncore	38067	ND	Pembina County
Noncore	30091	MT	Sheridan County
Noncore	20133	KS	Neosho County
Noncore	19117	IA	Lucas County
Noncore	54087	WV	Roane County
Noncore	20053	KS	Ellsworth County
Noncore	30039	MT	Granite County
Noncore	48331	TX	Milam County
Noncore	56035	WY	Sublette County
Noncore	46089	SD	McPherson County
Noncore	29093	MO	Iron County
Noncore	46107	SD	Potter County
Noncore	5057	AR	Hempstead County
Noncore	48507	TX	Zavala County
Noncore	51099	VA	King George County
Noncore	51097	VA	King and Queen County
Noncore	8115	CO	Sedgwick County
Noncore	55099	WI	Price County
Noncore	17165	IL	Saline County

Noncore	51081	VA	Greensville County
Noncore	29057	MO	Dade County
Noncore	28125	MS	Sharkey County
Noncore	21041	KY	Carroll County
Noncore	2290	AK	Yukon-Koyukuk Census Area
Noncore	49055	UT	Wayne County
Noncore	39065	OH	Hardin County
Noncore	40035	OK	Craig County
Noncore	40141	OK	Tillman County
Noncore	13037	GA	Calhoun County
Noncore	19093	IA	Ida County
Noncore	46023	SD	Charles Mix County
Noncore	28055	MS	Issaquena County
Noncore	48033	TX	Borden County
Noncore	48247	TX	Jim Hogg County
Noncore	19173	IA	Taylor County
Noncore	12123	FL	Taylor County
Noncore	18181	IN	White County
Noncore	35003	NM	Catron County
Noncore	55119	WI	Taylor County
Noncore	46067	SD	Hutchinson County
Noncore	31065	NE	Furnas County
Noncore	16061	ID	Lewis County
Noncore	31133	NE	Pawnee County
Noncore	56045	WY	Weston County
Noncore	36121	NY	Wyoming County
Noncore	28159	MS	Winston County
Noncore	48435	TX	Sutton County
Noncore	56027	WY	Niobrara County
Noncore	29073	MO	Gasconade County
Noncore	42053	PA	Forest County
Noncore	5071	AR	Johnson County
Noncore	27115	MN	Pine County
Noncore	54109	WV	Wyoming County
Noncore	55081	WI	Monroe County
Noncore	54025	WV	Greenbrier County
Noncore	31057	NE	Dundy County
Small metro	47179	TN	Washington County

Small metro	16041	ID	Franklin County
Small metro	10001	DE	Kent County
Small metro	29135	MO	Moniteau County
Small metro	6031	CA	Kings County
Small metro	47019	TN	Carter County
Small metro	20161	KS	Riley County
Small metro	54019	WV	Fayette County
Small metro	22057	LA	Lafourche Parish
Small metro	18005	IN	Bartholomew County
Small metro	46099	SD	Minnehaha County
Small metro	55063	WI	La Crosse County
Small metro	48041	TX	Brazos County

List of counties with increasing trend in potentially preventable hospitalization between 2010-2014.

Supplemental Table 5. List of counties with declining trend in potentially preventable hospitalization between 2010-2014.

County category	FIPS code	State	County name
Large central metro	48085	TX	Collin County
Large central metro	36085	NY	Richmond County
Large central metro	37119	NC	Mecklenburg County
Large central metro	53033	WA	King County
Large central metro	4013	AZ	Maricopa County
Large central metro	49035	UT	Salt Lake County
Large central metro	48029	TX	Bexar County
Large central metro	8031	CO	Denver County
Large central metro	25025	MA	Suffolk County
Large central metro	36047	NY	Kings County
Large central metro	51013	VA	Arlington County
Large central metro	48113	TX	Dallas County
Large central metro	36005	NY	Bronx County
Large central metro	24510	MD	Baltimore city
Large central metro	51510	VA	Alexandria city
Large central metro	34039	NJ	Union County
Large central metro	17031	IL	Cook County
Large central metro	37183	NC	Wake County
Large central metro	48439	TX	Tarrant County
Large central metro	36061	NY	New York County
Large fringe metro	34037	NJ	Sussex County
Large fringe metro	28093	MS	Marshall County
Large fringe metro	24021	MD	Frederick County
Large fringe metro	51101	VA	King William County
Large fringe metro	25023	MA	Plymouth County
Large fringe metro	8001	CO	Adams County
Large fringe metro	48497	TX	Wise County
Large fringe metro	48367	TX	Parker County
Large fringe metro	12109	FL	St. Johns County
Large fringe metro	48187	TX	Guadalupe County
Large fringe metro	27141	MN	Sherburne County
Large fringe metro	48021	TX	Bastrop County
Large fringe metro	20209	KS	Wyandotte County
Large fringe metro	48257	TX	Kaufman County
Large fringe metro	48491	TX	Williamson County
Large fringe metro	24005	MD	Baltimore County

Large fringe metro	24003	MD	Anne Arundel County
Large fringe metro	51059	VA	Fairfax County
Large fringe metro	18109	IN	Morgan County
Large fringe metro	6013	CA	Contra Costa County
Large fringe metro	33015	NH	Rockingham County
Large fringe metro	47119	TN	Maury County
Large fringe metro	4021	AZ	Pinal County
Large fringe metro	26099	MI	Macomb County
Large fringe metro	40051	OK	Grady County
Large fringe metro	51183	VA	Sussex County
Large fringe metro	51157	VA	Rappahannock County
Large fringe metro	17197	IL	Will County
Large fringe metro	48071	TX	Chambers County
Large fringe metro	18175	IN	Washington County
Large fringe metro	8014	CO	Broomfield County
Large fringe metro	51550	VA	Chesapeake city
Large fringe metro	12117	FL	Seminole County
Large fringe metro	8005	CO	Arapahoe County
Large fringe metro	34025	NJ	Monmouth County
Large fringe metro	40027	OK	Cleveland County
Large fringe metro	13223	GA	Paulding County
Large fringe metro	51630	VA	Fredericksburg city
Large fringe metro	24013	MD	Carroll County
Large fringe metro	24031	MD	Montgomery County
Large fringe metro	18161	IN	Union County
Large fringe metro	37101	NC	Johnston County
Large fringe metro	51199	VA	York County
Large fringe metro	42045	PA	Delaware County
Large fringe metro	48121	TX	Denton County
Large fringe metro	42029	PA	Chester County
Large fringe metro	17089	IL	Kane County
Large fringe metro	18029	IN	Dearborn County
Large fringe metro	51047	VA	Culpeper County
Large fringe metro	51600	VA	Fairfax city
Large fringe metro	36103	NY	Suffolk County
Large fringe metro	34029	NJ	Ocean County
Large fringe metro	6081	CA	San Mateo County
Large fringe metro	51061	VA	Fauquier County
Large fringe metro	17111	IL	McHenry County

Large fringe metro	42103	PA	Pike County
Large fringe metro	39045	OH	Fairfield County
Large fringe metro	34003	NJ	Bergen County
Medium metro	49049	UT	Utah County
Medium metro	15003	HI	Honolulu County
Medium metro	17161	IL	Rock Island County
Medium metro	13051	GA	Chatham County
Medium metro	48303	TX	Lubbock County
Medium metro	51775	VA	Salem city
Medium metro	5125	AR	Saline County
Medium metro	45019	SC	Charleston County
Medium metro	53063	WA	Spokane County
Medium metro	6053	CA	Monterey County
Medium metro	39113	OH	Montgomery County
Medium metro	6107	CA	Tulare County
Medium metro	13083	GA	Dade County
Medium metro	18163	IN	Vanderburgh County
Medium metro	45063	SC	Lexington County
Medium metro	19113	IA	Linn County
Medium metro	6111	CA	Ventura County
Medium metro	6079	CA	San Luis Obispo County
Medium metro	36053	NY	Madison County
Medium metro	10005	DE	Sussex County
Medium metro	36001	NY	Albany County
Medium metro	48305	TX	Lynn County
Medium metro	42133	PA	York County
Medium metro	8013	CO	Boulder County
Medium metro	47013	TN	Campbell County
Medium metro	37115	NC	Madison County
Medium metro	48245	TX	Jefferson County
Medium metro	4019	AZ	Pima County
Medium metro	22017	LA	Caddo Parish
Medium metro	48065	TX	Carson County
Medium metro	39095	OH	Lucas County
Medium metro	47105	TN	Loudon County
Medium metro	6087	CA	Santa Cruz County
Medium metro	5033	AR	Crawford County
Medium metro	22047	LA	Iberville Parish
Medium metro	36083	NY	Rensselaer County

Medium metro	45039	SC	Fairfield County
Medium metro	36075	NY	Oswego County
Medium metro	54099	WV	Wayne County
Medium metro	51045	VA	Craig County
Medium metro	9009	CT	New Haven County
Medium metro	31109	NE	Lancaster County
Medium metro	37057	NC	Davidson County
Medium metro	48027	TX	Bell County
Micropolitan	18071	IN	Jackson County
Micropolitan	48265	TX	Kerr County
Micropolitan	13275	GA	Thomas County
Micropolitan	16083	ID	Twin Falls County
Micropolitan	8081	CO	Moffat County
Micropolitan	29161	MO	Phelps County
Micropolitan	48097	TX	Cooke County
Micropolitan	39027	OH	Clinton County
Micropolitan	48349	TX	Navarro County
Micropolitan	49051	UT	Wasatch County
Micropolitan	1017	AL	Chambers County
Micropolitan	13009	GA	Baldwin County
Micropolitan	36019	NY	Clinton County
Micropolitan	47079	TN	Henry County
Micropolitan	20099	KS	Labette County
Micropolitan	28087	MS	Lowndes County
Micropolitan	33019	NH	Sullivan County
Micropolitan	41013	OR	Crook County
Micropolitan	37055	NC	Dare County
Micropolitan	39145	OH	Scioto County
Micropolitan	20093	KS	Kearny County
Micropolitan	27099	MN	Mower County
Micropolitan	5055	AR	Greene County
Micropolitan	8043	CO	Fremont County
Micropolitan	13129	GA	Gordon County
Micropolitan	48471	TX	Walker County
Micropolitan	39037	OH	Darke County
Micropolitan	29159	MO	Pettis County
Micropolitan	28105	MS	Oktibbeha County
Micropolitan	5009	AR	Boone County
Micropolitan	41059	OR	Umatilla County

Micropolitan	18093	IN	Lawrence County
Micropolitan	40119	OK	Payne County
Micropolitan	40125	OK	Pottawatomie County
Micropolitan	20155	KS	Reno County
Micropolitan	5101	AR	Newton County
Micropolitan	45075	SC	Orangeburg County
Micropolitan	46081	SD	Lawrence County
Micropolitan	13069	GA	Coffee County
Micropolitan	29195	MO	Saline County
Micropolitan	48223	TX	Hopkins County
Micropolitan	21179	KY	Nelson County
Micropolitan	13279	GA	Toombs County
Micropolitan	50027	VT	Windsor County
Micropolitan	42123	PA	Warren County
Micropolitan	19033	IA	Cerro Gordo County
Micropolitan	21021	KY	Boyle County
Micropolitan	36089	NY	St. Lawrence County
Micropolitan	18023	IN	Clinton County
Micropolitan	6023	CA	Humboldt County
Micropolitan	48189	TX	Hale County
Micropolitan	19101	IA	Jefferson County
Micropolitan	13285	GA	Troup County
Micropolitan	28003	MS	Alcorn County
Micropolitan	13031	GA	Bulloch County
Micropolitan	39039	OH	Defiance County
Micropolitan	39167	OH	Washington County
Micropolitan	39077	OH	Huron County
Micropolitan	46065	SD	Hughes County
Micropolitan	2130	AK	Ketchikan Gateway Borough
Micropolitan	18069	IN	Huntington County
Micropolitan	35035	NM	Otero County
Micropolitan	5139	AR	Union County
Missing			
Missing			
Noncore	31087	NE	Hitchcock County
Noncore	18075	IN	Jay County
Noncore	48407	TX	San Jacinto County
Noncore	51133	VA	Northumberland County

Noncore	1091	AL	Marengo County
Noncore	48337	TX	Montague County
Noncore	53031	WA	Jefferson County
Noncore	28007	MS	Attala County
Noncore	51077	VA	Grayson County
Noncore	20203	KS	Wichita County
Noncore	51181	VA	Surry County
Noncore	5137	AR	Stone County
Noncore	18051	IN	Gibson County
Noncore	13241	GA	Rabun County
Noncore	53069	WA	Wahkiakum County
Noncore	37117	NC	Martin County
Noncore	40015	OK	Caddo County
Noncore	27089	MN	Marshall County
Noncore	21157	KY	Marshall County
Noncore	39135	OH	Preble County
Noncore	20137	KS	Norton County
Noncore	55001	WI	Adams County
Noncore	30053	MT	Lincoln County
Noncore	51001	VA	Accomack County
Noncore	17181	IL	Union County
Noncore	42057	PA	Fulton County
Noncore	28101	MS	Newton County
Noncore	21181	KY	Nicholas County
Noncore	13265	GA	Taliaferro County
Noncore	48067	TX	Cass County
Noncore	48293	TX	Limestone County
Noncore	8125	CO	Yuma County
Noncore	8007	CO	Archuleta County
Noncore	37079	NC	Greene County
Noncore	8003	CO	Alamosa County
Noncore	16085	ID	Valley County
Noncore	31083	NE	Harlan County
Noncore	5047	AR	Franklin County
Noncore	17055	IL	Franklin County
Noncore	48315	TX	Marion County
Noncore	5083	AR	Logan County
Noncore	41037	OR	Lake County
Noncore	19167	IA	Sioux County

Noncore	1013	AL	Butler County
Noncore	54047	WV	McDowell County
Noncore	53049	WA	Pacific County
Noncore	55107	WI	Rusk County
Noncore	21027	KY	Breckinridge County
Noncore	19067	IA	Floyd County
Noncore	46021	SD	Campbell County
Noncore	48149	TX	Fayette County
Noncore	28097	MS	Montgomery County
Noncore	26071	MI	Iron County
Noncore	1035	AL	Conecuh County
Noncore	12133	FL	Washington County
Noncore	17075	IL	Iroquois County
Noncore	1029	AL	Cleburne County
Noncore	1075	AL	Lamar County
Noncore	38063	ND	Nelson County
Noncore	38043	ND	Kidder County
Noncore	46047	SD	Fall River County
Noncore	16047	ID	Gooding County
Noncore	18047	IN	Franklin County
Noncore	8113	CO	San Miguel County
Noncore	47069	TN	Hardeman County
Noncore	46077	SD	Kingsbury County
Noncore	31035	NE	Clay County
Noncore	21187	KY	Owen County
Noncore	5127	AR	Scott County
Noncore	51109	VA	Louisa County
Noncore	17085	IL	Jo Daviess County
Noncore	1039	AL	Covington County
Noncore	31127	NE	Nemaha County
Noncore	13291	GA	Union County
Noncore	21119	KY	Knott County
Noncore	17185	IL	Wabash County
Noncore	54067	WV	Nicholas County
Noncore	48101	TX	Cottle County
Noncore	51595	VA	Emporia city
Noncore	19047	IA	Crawford County
Noncore	21201	KY	Robertson County
Noncore	48125	TX	Dickens County

Noncore	21207	KY	Russell County
Noncore	48267	TX	Kimble County
Noncore	48131	TX	Duval County
Noncore	19137	IA	Montgomery County
Noncore	36039	NY	Greene County
Noncore	40025	OK	Cimarron County
Noncore	48467	TX	Van Zandt County
Noncore	29125	MO	Maries County
Noncore	19023	IA	Butler County
Noncore	51620	VA	Franklin city
Noncore	38033	ND	Golden Valley County
Noncore	22127	LA	Winn Parish
Noncore	35053	NM	Socorro County
Noncore	19055	IA	Delaware County
Small metro	37103	NC	Jones County
Small metro	51003	VA	Albemarle County
Small metro	29151	MO	Osage County
Small metro	6007	CA	Butte County
Small metro	21091	KY	Hancock County
Small metro	51079	VA	Greene County
Small metro	28111	MS	Perry County
Small metro	38017	ND	Cass County
Small metro	54039	WV	Kanawha County
Small metro	17129	IL	Menard County
Small metro	18165	IN	Vermillion County
Small metro	53017	WA	Douglas County
Small metro	21227	KY	Warren County
Small metro	19075	IA	Grundy County
Small metro	30063	MT	Missoula County
Small metro	37001	NC	Alamance County
Small metro	47023	TN	Chester County
Small metro	22105	LA	Tangipahoa Parish
Small metro	53073	WA	Whatcom County
Small metro	2090	AK	Fairbanks North Star Borough
Small metro	21163	KY	Meade County
Small metro	51029	VA	Buckingham County
Small metro	42037	PA	Columbia County
Small metro	29027	MO	Callaway County

Small metro	38065	ND	Oliver County
Small metro	51540	VA	Charlottesville city
Small metro	13115	GA	Floyd County
Small metro	1103	AL	Morgan County
Small metro	48077	TX	Clay County
Small metro	55087	WI	Outagamie County
Small metro	17077	IL	Jackson County
Small metro	48183	TX	Gregg County
Small metro	21031	KY	Butler County
Small metro	48485	TX	Wichita County
Small metro	34009	NJ	Cape May County
Small metro	19061	IA	Dubuque County
Small metro	13213	GA	Murray County
Small metro	48135	TX	Ector County
Small metro	53003	WA	Asotin County
Small metro	48059	TX	Callahan County
Small metro	13139	GA	Hall County
Small metro	54107	WV	Wood County
Small metro	20149	KS	Pottawatomie County
Small metro	13127	GA	Glynn County

List of counties with declining trend in potentially preventable hospitalization between 2010-2014.

Supplemental Table 6. Generalized Estimating Equation Regression Results for Probability of Potentially Preventable Hospitalization

Parameter			Estimate	95% Confidence Limits		OR	95% Confidence Limits		P
Intercept			-5.00	-5.08	-4.92	0.01	0.01	0.01	<.0001
year 2011			-0.07	-0.08	-0.05	0.94	0.92	0.95	<.0001
year 2012			-0.08	-0.09	-0.06	0.93	0.91	0.94	<.0001
year 2013			-0.16	-0.18	-0.14	0.85	0.83	0.87	<.0001
year 2014			-0.22	-0.24	-0.20	0.80	0.79	0.82	<.0001
year 2010			0.00	0.00	0.00	1.00	1.00	1.00	.
Age			0.03	0.03	0.03	1.03	1.03	1.04	<.0001
Female			0.09	0.08	0.10	1.09	1.08	1.11	<.0001
Male			0.00	0.00	0.00	1.00	1.00	1.00	.
Black			0.19	0.15	0.23	1.20	1.16	1.25	<.0001
Hispanic			0.16	0.10	0.23	1.18	1.11	1.25	<.0001
Other			0.03	-0.05	0.12	1.03	0.95	1.12	0.43
Unknown/Missing			0.12	-0.19	0.43	1.13	0.83	1.53	0.44
White			0.00	0.00	0.00	1.00	1.00	1.00	.
Medicaid			0.27	0.24	0.30	1.31	1.28	1.35	<.0001
No Medicaid			0.00	0.00	0.00	1.00	1.00	1.00	.
Number of Prescription			0.02	0.02	0.02	1.02	1.02	1.02	<.0001
Elixhauser Index			0.05	0.05	0.05	1.05	1.05	1.05	<.0001
Median Income Missing			0.06	0.03	0.10	1.06	1.03	1.10	0.00
Median Income Low			0.06	0.04	0.07	1.06	1.04	1.08	<.0001
Median Income High			-0.03	-0.05	-0.01	0.97	0.95	0.99	0.00
Median Income Average			0.00	0.00	0.00	1.00	1.00	1.00	.
PCP Average	Between 0.486288 and 1.043732/1000		0.08	0.06	0.10	1.08	1.06	1.10	<.0001
PCP Low	Less than 0.486288/1000		0.11	0.08	0.14	1.12	1.09	1.16	<.0001
PCP High	Greater than 1.043732/1000		0.00	0.00	0.00	1.00	1.00	1.00	.
% Medicare Penetration			0.00	0.00	0.00	1.00	1.00	1.00	<.0001
Hospital Average	Between 0.995773 and 6.168270/100000		0.03	0.01	0.06	1.03	1.01	1.06	0.02
Hospital High	Greater than 6.168270/100000		0.20	0.17	0.24	1.23	1.18	1.27	<.0001
Hospital Low	Less than 0.996/100000		0.00	0.00	0.00	1.00	1.00	1.00	.

Number of observations: 1,189,302; Number of observations used: 1,187,801; Number of events: 196,027.

Abbreviations: SE: standard error; CI: confidence intervals; OR: odds ratio; PCP: primary care physician; MMC: Medicare managed care

+References: Year: year 2010; race/ethnicity: White; zip-code level median income: average income; PCP high; Hospital low

Source: Medicare fee-for-service claims data: 2010-2014

Generalized Estimating Equation Regression Results for Probability of Potentially Preventable Hospitalization

Supplemental Figure 4. Correlation Between Change in Primary Care Physicians and Change in Potentially Preventable Hospitalization between 2010 and 2014.

