

# 2011-2017 Potentially Preventable Hospitalizations



**Bureau of Assessment, Statistics & Epidemiology**

**Allegheny County Health Department**

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# **2011-2017 Potentially Preventable Hospitalizations**

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# **2011-2017 Potentially Preventable Hospitalizations**



**REPORT HIGHLIGHTS**

**&**

**ILLUSTRATIONS**

### Overview and Key Findings

This report identifies and describes the disease burden of potentially preventable hospitalizations in Allegheny County between 2011-2017. The total disease burden is divided by zip code, sex, and race to illustrate specific areas and populations disproportionately affected by higher rates of hospitalizations. Areas with high hospitalization rates may represent communities with access to quality outpatient care obstacles. Overall, potentially preventable hospitalizations in Allegheny County have remained consistent, with 172.7 per 10,000 residents 18 years and older in 2011 and 169.5 per 10,000 residents 18 years and older in 2017. During this time, hospitalizations for acute disease have decreased while chronic disease hospitalizations have increased. In 2017, 67% of these hospitalizations were due to chronic diseases and the remaining 33% attributable to acute diseases. Southeast Allegheny County contained the majority of the highest rate areas for potentially preventable hospitalizations between 2015-2017. In addition, observable racial disparities were present for every condition analyzed, confirming the need for intervention to eliminate these health inequities.

### Introduction

Ambulatory-care sensitive conditions (ACSCs), also known as potentially preventable hospitalizations, are inpatient admissions for select acute and chronic conditions which are generally avoidable given timely treatment in an outpatient setting <sup>1</sup>. The occurrence of these conditions is considered a reflection of the quality of and access to outpatient care in a community <sup>2</sup>. Some ACSCs include asthma, community-acquired pneumonia, hypertension, urinary tract infection, and diabetes. Hypertension and diabetes increase the risk for developing cardiovascular disease, a leading cause of death in the United States and in Allegheny County <sup>3</sup>. Surveillance of ACSCs can provide insight into specific areas or populations in Allegheny County that are disproportionately affected by barriers to quality outpatient care. Allegheny County Health Department's (ACHD) mission is to protect, promote, and serve the health and well-being of all Allegheny County residents, particularly the most vulnerable. Using these results, programs targeting the communities most at risk can be implemented to improve the health of Allegheny County residents. Additionally, racial disparities present in potentially preventable hospitalizations shows a difference in health care access in minority populations and will inform policy initiatives to reduce these contrasting health outcomes.

The goals of this report are to:

1. Describe trends of the burden of potentially preventable hospitalizations in Allegheny County between 2011-2017.
2. Illustrate the presence of local health disparities for ACSCs.
3. Determine zip code areas with the highest *age-adjusted*\* rates for potentially preventable hospitalizations in which to concentrate intervention efforts.
4. Inform development of interventions to increase access to care in order to improve the health of Allegheny County residents.

\*words in italicized font are explained further in the Technical Notes section of this report.

### Methods

ACHD received data from the Pennsylvania Health Care Cost Containment Council which included each hospitalization and the associated health conditions responsible for each hospitalization between 2011-2017 for Allegheny County residents. Conditions considered for analysis as potentially preventable hospitalizations included: asthma, chronic obstructive pulmonary disease, community-acquired pneumonia, congestive heart failure, dehydration, dental conditions, diabetes and diabetes-related complications, influenza, nutritional deficiencies, perforated appendix, and urinary tract infection. ACHD also considered vaccine-preventable diseases for this analysis, but there were too few occurrences in Allegheny County during the analysis period to calculate reliable rates. Hospitalizations which corresponded to any of the previously listed conditions were totaled by year and divided by age (child or adult), race (white, black, and all other races), and zip code of residence. Races other than black or white were aggregated due to the small population of these races in Allegheny County. If a population size is small, the rate, or number of potentially preventable hospitalizations divided by the population of interest, is sensitive to minor changes and is unreliable as an estimate for the true burden of a disease for that specific population. Additionally, some of these conditions were combined into disease categories for acute and chronic diseases; the acute disease category includes urinary tract infection (UTI), dehydration, and community-acquired pneumonia, and the chronic disease category includes diabetes (short-term and long-term complications, uncontrolled diabetes with no complications, and lower extremity amputations due to diabetes), chronic obstructive pulmonary disease (COPD), asthma, hypertension (HTN), and congestive heart failure (CHF).

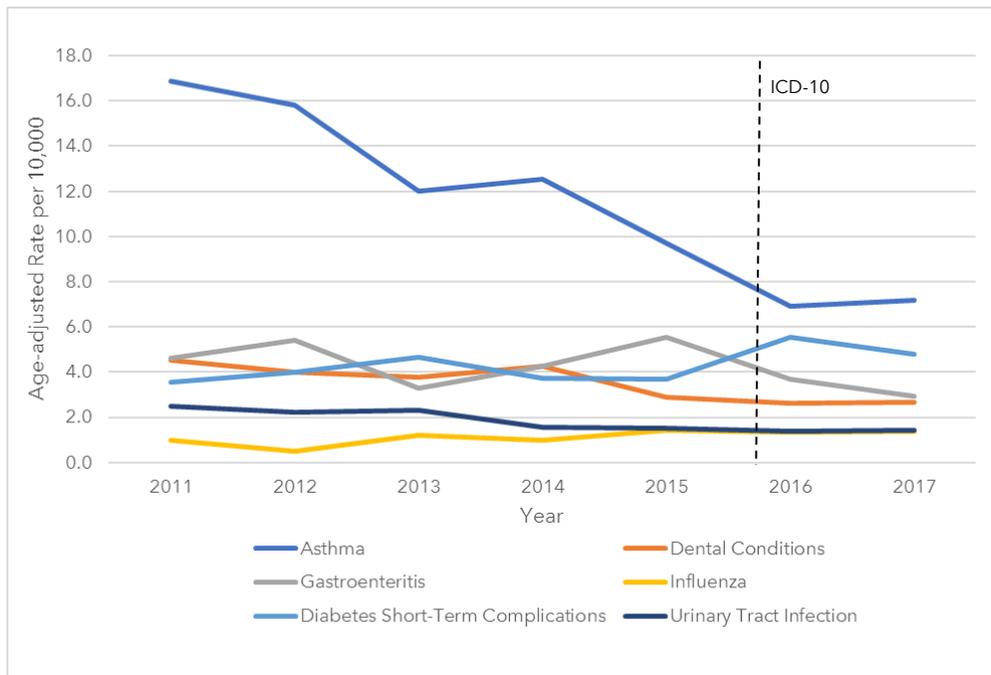
ACHD then calculated *age-adjusted* rates from the total counts for each disease and subgroup. *Racial disparity rate ratios* were also calculated to illustrate which ACSCs have the highest rate contrast between white adults and black adults in Allegheny County. *Racial disparity rate ratios* were not calculated for the all other races category because the results show lower ACSC hospitalization rates for this population compared to the white adult population. Rates are required for analysis because counts alone cannot be compared across racial groups or zip codes. Allegheny County has different total populations for each race and zip code; therefore only a total count of occurrences would result in misleading conclusions about the true burden of these ACSCs. Additionally, rates were *age-adjusted* to further prevent misleading conclusions. As a person ages, he or she has an increased risk for developing most diseases. Therefore, if there is a higher percentage of older adults in a specific area, the total count will be higher than surrounding areas; this higher total is most likely due to the age of the residents rather than a lack of accessibility to quality care.

Finally, each individual disease and disease category rate by zip code was illustrated through county maps to portray the zip codes with the highest and lowest rates for each condition. This report will illustrate the results for the acute, chronic, and overall disease (the acute and chronic disease categories combined) rates for 2015-2017 by zip code, however a map for each individual disease is included in Appendix C for reference. Further description of the methods and limitations are included in the Technical Notes section of this report.

## Results

### Children

Figure 1: Age-Adjusted Rates for ACSCs per 10,000 Children\*, Allegheny County, 2011-2017



\*urinary tract infection, gastroenteritis, and influenza - 3 months-17 years old  
 asthma and dental conditions- 2-17 years old  
 diabetes short-term complications- 6-17 years old

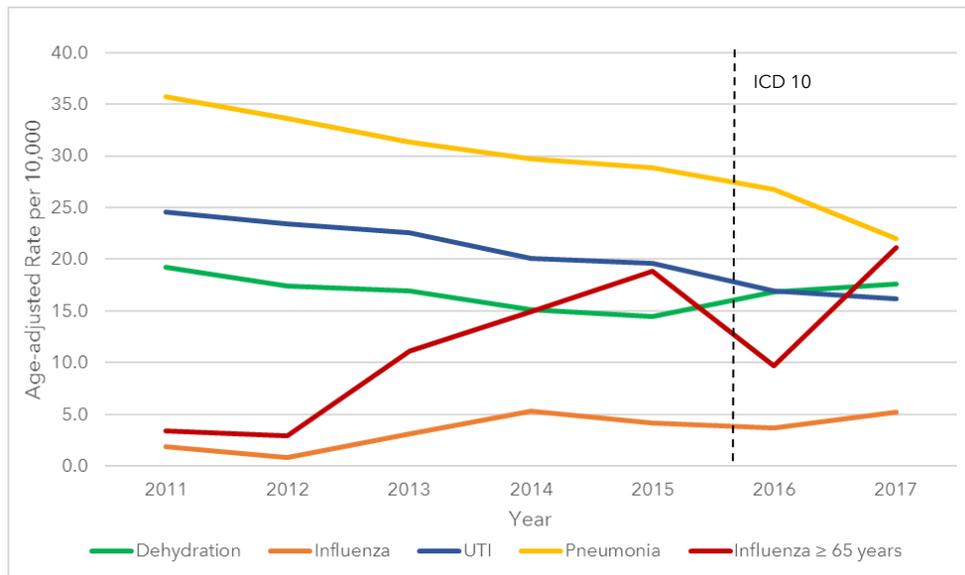
Overall, of the six ACSC conditions analyzed for children, asthma produced the highest rate of ACSCs in 2017. However, asthma-related hospitalizations have declined from 16.9 per 10,000 children ages 2-17 years old in 2011 to 7.2 per 10,000 children ages 2-17 years old in 2017, therefore reducing the gap between the first and second most frequent disease responsible for pediatric preventable hospitalizations in Allegheny County. Rates for all other pediatric ACSCs have remained relatively stable between 2011 and 2017. Following asthma, the 2017 rates for ACSCs from most common to least common were: diabetes short-term complications (4.8 per 10,000 children 6-17 years old), gastroenteritis (2.9 per 10,000 children 3 months-17 years old), dental conditions (2.7 per 10,000 children 2-17 years old), UTIs (1.4 per 10,000 children 3 months-17 years old), and influenza (1.4 per 10,000 children 3 months-17 years old).

**Adults**

Acute Diseases

In 2017, community-acquired pneumonia (all adults 18 years and older) and influenza in elderly adults (65 years and older) accounted for the most common acute ACSCs in Allegheny County (Fig. 2). The age-adjusted rate for community-acquired pneumonia was 22.0 per 10,000 adults, decreasing over time from 35.7 per 10,000 adults in 2011. Overall, influenza hospitalizations among adults 65 years and older have increased since 2011, apart from 2016, with a rate of 21.2 per 10,000 adults 65 years and older in 2017. Dehydration is the third most common cause of acute disease ACSCs (17.6 per 10,000 adults), and rates have remained relatively stable since 2011. The lowest acute disease rates for 2017 were UTIs (16.2 per 10,000 adults) and influenza (5.2 per 10,000 adults) (Fig. 2). The age-adjusted rate for perforated appendix is not illustrated in Figure 2 as the denominator is among those diagnosed with appendicitis rather than the entire population. Perforated appendix rates have increased from 369.4 per 1,000 residents 18 years and older diagnosed with appendicitis in 2011 to 537.3 per 1,000 residents in 2017. The 2017 rate suggests that over half of hospitalizations for appendicitis included a perforated appendix.

Figure 2: Age-Adjusted Rates for Acute Disease ACSCs per 10,000 Adults 18 Years and Older\*, Allegheny County, 2011-2017

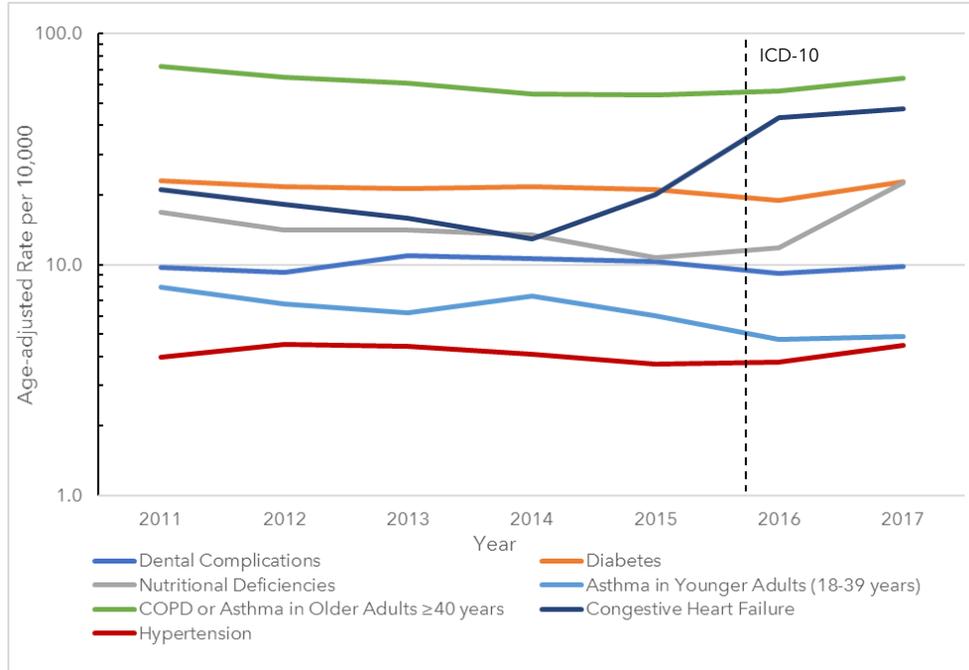


\*unless otherwise stated

\*\*The change in rates after 2016 should be interpreted with caution. This may be a reflection of the ICD code change in the fourth quarter of 2015 rather than an a change in ACSCs during this time.<sup>4f</sup>

Chronic Diseases

Figure 3: Age-Adjusted Rates for Chronic Disease ACSCs per 10,000 Adults 18 Years and Older\*, Allegheny County, 2011-2017



\*unless otherwise stated

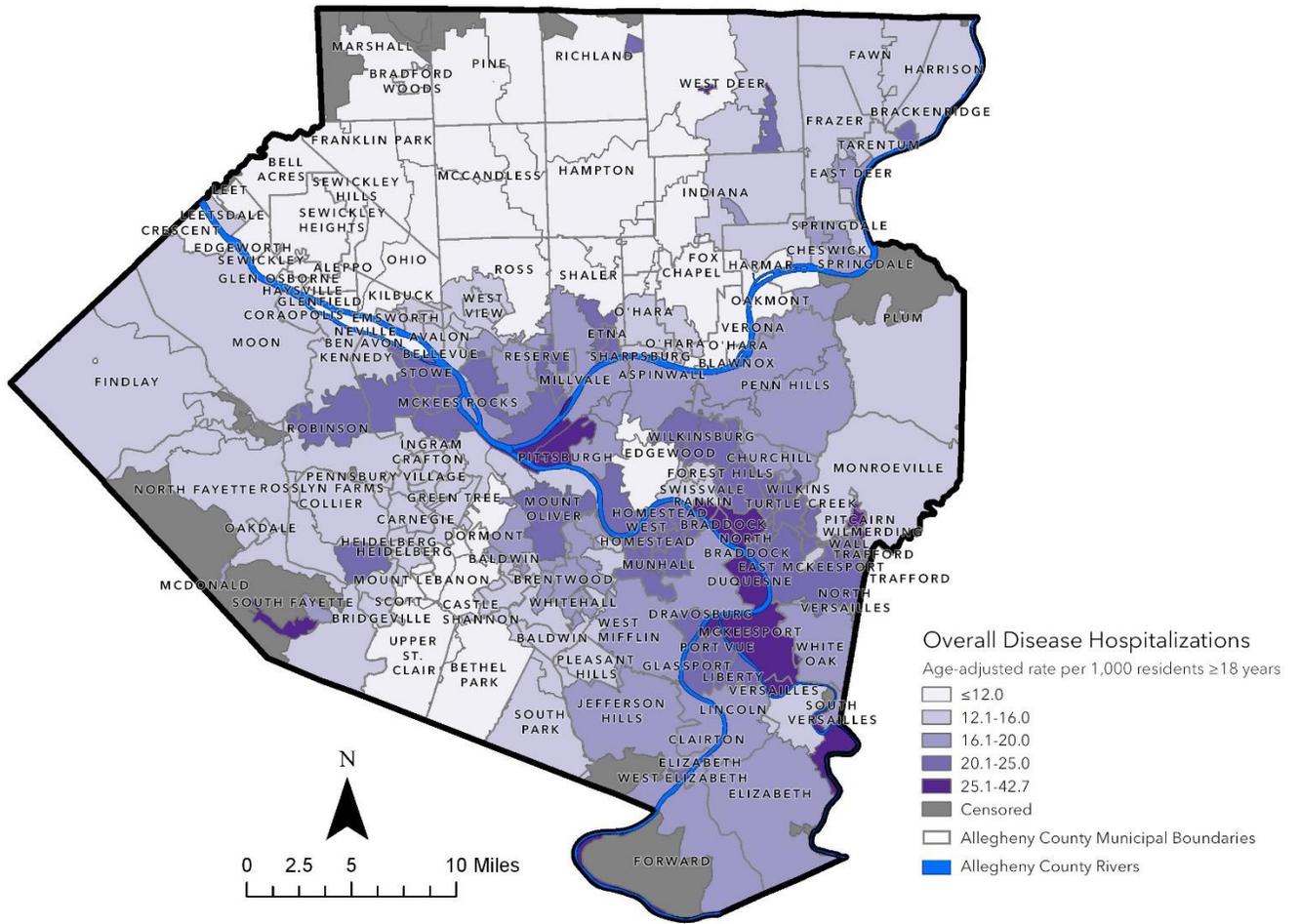
\*\*The increase in rates after 2016 should be interpreted with caution. This may be a reflection of the ICD code change in the fourth quarter of 2015 rather than an increase in ACSCs during this time.<sup>4</sup>

The hospitalization rate for COPD or asthma in older adults was the highest rate among all ACSC indicators, including both chronic and acute, and have decreased only slightly since 2011: from 71.9 per 10,000 in 2011 to 64.2 per 10,000 in 2017 (Fig. 3). CHF accounted for the second most prevalent chronic ACSC with a rate of 64.3 per 10,000 adults in 2017. Additionally, there was a notable rise in CHF hospitalizations between 2014-2017 with nearly a four-fold increase within this period. The third most common ACSC in 2017 was diabetes and nutritional deficiencies, both with rates of 22.7 per 10,000 adults, followed by dental complications (9.8 per 10,000 adults), asthma in younger adults (4.9 per 10,000 ages 18-39 years old), and hypertension (4.5 per 10,000 adults) (Fig. 3).

ACSCs by Zip code and Municipality

Overall Disease Hospitalizations

Figure 4: Age-Adjusted Rates for Overall (Acute and Chronic Diseases) ACSCs Category per 1,000 Residents 18 Years and Older by Zip Code, Allegheny County, 2015 -2017



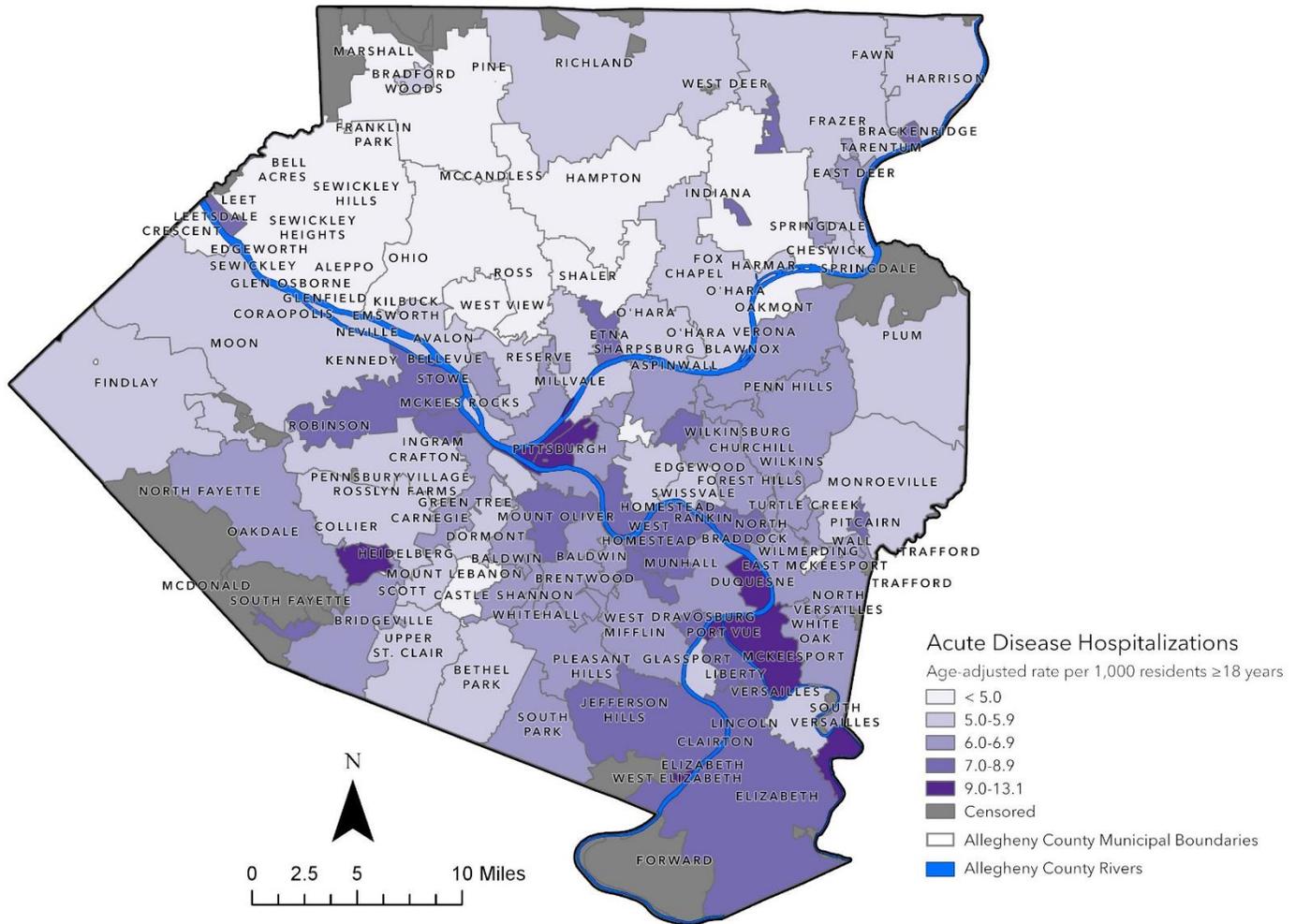
Areas with age-adjusted rates over 25 per 1,000 adult residents for overall disease hospitalizations include: Bairdford (15006)(n=18), Buena Vista (15018), Bunola (15020), Coulters (15028), Cuddy (15031), Rural Ridge\* (15075), Braddock (15104), Duquesne (15110), Mckeesport (15132), Pittcairn (15140), Hill District/Downtown Pittsburgh (15219), and Strip District Pittsburgh (15222) (Fig. 4).

\*Rural Ridge contained only 11 instances of overall disease ACSCs during this time with a 2010 census population of 128, therefore the high rate of ACSCs may be due to the small population rather than a high disease burden.

## 2011-2017 Potentially Preventable Hospitalizations

### Acute Disease ACSCs

Figure 5: Age-Adjusted Rates for Acute Disease ACSCs Category per 1,000 Residents 18 Years and Older by Zip Code, Allegheny County, 2015-2017



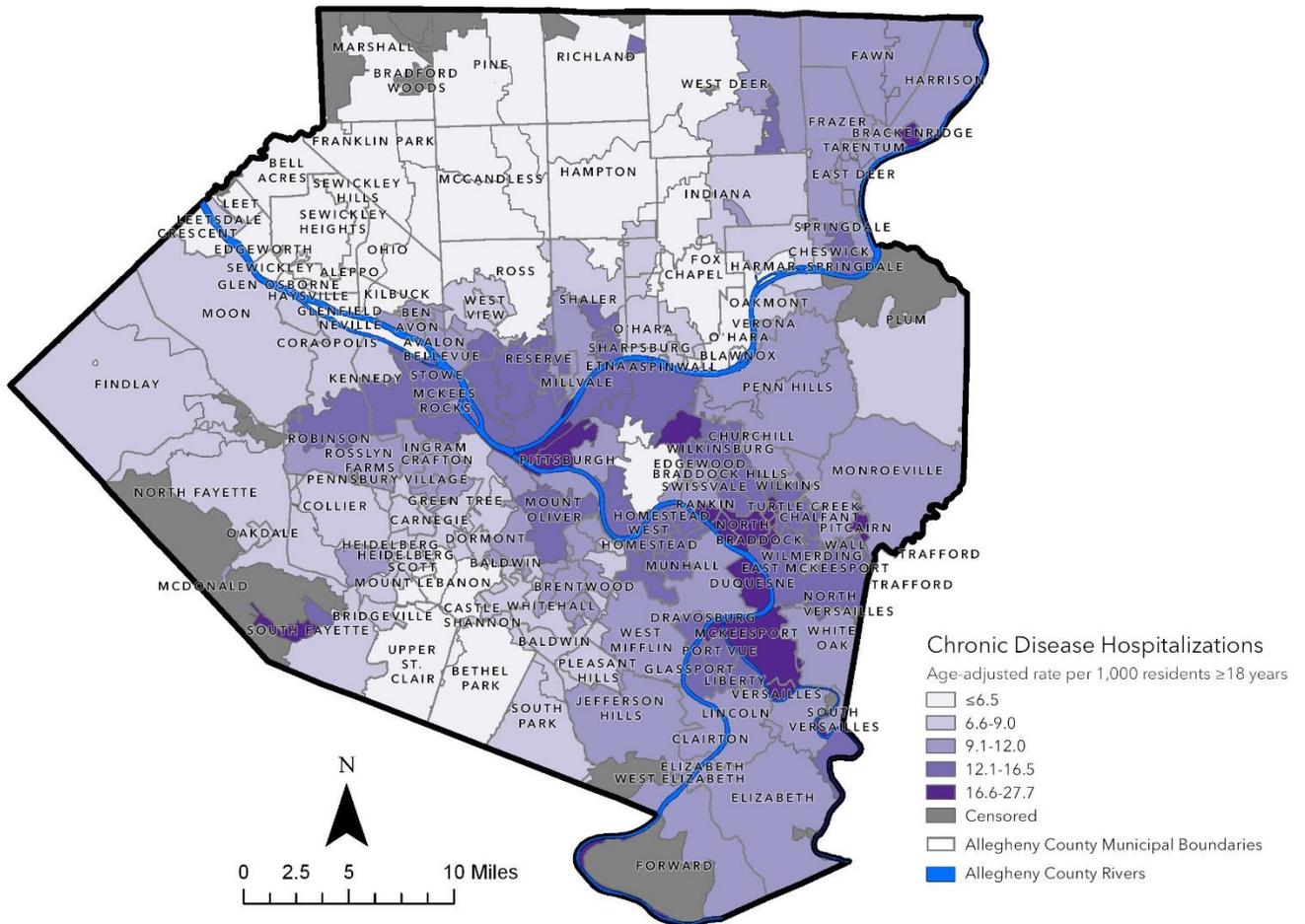
Areas in Allegheny County with age-adjusted rates of greater than or equal to 9 per 1,000 adult residents for acute disease ACSCs include Buena Vista (15018) West Elizabeth\* (15088), Duquesne (15110), Mckeesport (15132), Presto (15142), Hill District/Downtown Pittsburgh (15219), and Strip District Pittsburgh (15222)(Fig.5).

\*West Elizabeth contained only 15 instances of acute disease ACSCs during this time with a 2010 census population of 535, therefore the high rate of ACSCs may be due to the small population rather than a high disease burden.

## 2011-2017 Potentially Preventable Hospitalizations

### Chronic Disease ACSCs

Figure 6: Age-Adjusted Rates for Chronic Disease ACSCs Category per 1,000 Residents 18 Years and Older by Zip Code, Allegheny County, 2015-2017



Areas with age-adjusted rates of over 16.5 per 1,000 residents for chronic diseases ACSCs include Brackenridge (15014), Bunola (15020), Coulters (15028\*)(n=11), Cuddy (15031), Braddock (15104), Duquesne (15110), East Pittsburgh (15112), McKeesport (15132), Pitcairn (15140), Homewood Pittsburgh (15208), Hill District/Downtown Pittsburgh (15219), and Strip District Pittsburgh (15222)(Fig.6). Table 1 summarizes all ACSCs analyzed individually and as disease categories. These zip codes are considered areas of interest for potential intervention. Rates with counts between 1-9 hospitalizations have been excluded to prevent unreliable rates. Zip codes with high rates and hospitalization counts with smaller populations should be interpreted with caution.

\*Coulters only experienced 11 instances of chronic diseases ACSCs during this time with a 2010 Census population of 142, therefore the high rate of ACSCs may be due to the small population rather than high disease burden.

## 2011-2017 Potentially Preventable Hospitalizations

Table 1: Zip Codes of Interest with Highest Aggregate Age-Adjusted Rates per 1,000 Residents 18 Years and Older\* by ACSC, Allegheny County, 2015-2017

zip	acute rate (count)	chronic rate (count)	overall rate (count)	asthma 18-39 yrs rate (count)	CHF rate (count)	COPD or asthma ≥ 40 yrs rate (count)	dental rate (count)	diabetes rate (count)	HTN rate (count)	influenza ≥ 18 yrs rate (count)	influenza ≥ 65 yrs rate (count)	nutritional rate (count)	pneumonia rate (count)	UTI rate (count)
15006			27.4 (18)											
15014		16.7 (153)			7.2 (70)			4.5 (36)						
15017												2.6 (158)		
15018	9.9 (23)		26.2 (57)											4.6 (10)
15020		25.6 (19)	38.5 (27)											
15025										0.7 (34)				
15028		22.8 (11)	39.1 (19)											
15030												2.8 (11)		
15031		27.7 (38)	35.8 (49)			32.1 (26)								
15034						11.9 (44)								
15037										0.8 (29)	3.5 (24)			
15045		16.5 (209)						4.9 (53)						
15056														4.2 (13)
15075			42.7 (11)											
15076						15.3 (22)								4.1 (12)
15088	10.2 (15)					14.6 (12)							6.5 (10)	
15104		19.3 (439)	26.3 (596)		5.5 (134)	12.2 (166)		5.0 (108)	1.2 (25)					
15110	9.7 (131)	20.9 (288)	30.6 (419)		5.7 (82)		2.2 (23)	6.8 (89)	1.8 (22)					
15112		17.1 (147)			5.8 (52)	13.6 (67)						2.8 (23)		
15129										0.9 (20)	4.6 (18)			
15132	10.5 (650)	22.1 (1318)	32.7 (1968)		7.0 (448)	14.4 (539)	2.5 (112)	5.5 (273)		0.7 (44)				
15135										0.7 (11)	3.5 (10)			
15137					5.0 (166)									
15140		18.2 (163)	26.7 (243)		5.5 (53)	13.7 (73)	2.0 (14)							3.6 (33)
15142	13.1 (18)												11.6 (14)	
15145					5.5 (121)		2.0 (36)	4.2 (70)						
15148								4.7 (30)						
15204								4.6 (96)						
15207								4.3 (115)						
15208		17.1 (478)			7.6 (220)		2.1 (49)							
15210				24.8 (55)										
15212					5.2 (389)									
15219	10.2 (330)	20.6 (676)	30.8 (1006)		7.2 (232)	12.9 (238)		4.2 (148)	1.6 (48)	0.8 (26)		2.9 (94)		
15221					5.2 (484)									
15222	10.2 (68)	17.3 (120)	27.5 (188)		6.7 (43)		2.2 (14)	4.8 (34)						3.1 (21)
15223					5.0 (108)					0.7 (14)				
15233					6.4 (48)							3.2 (28)		
15238										0.7 (28)				

\*unless stated otherwise

-Rates derived from ACSC counts between 1-9 are excluded to prevent unreliable rates. Rates with lower counts should be interpreted with caution.

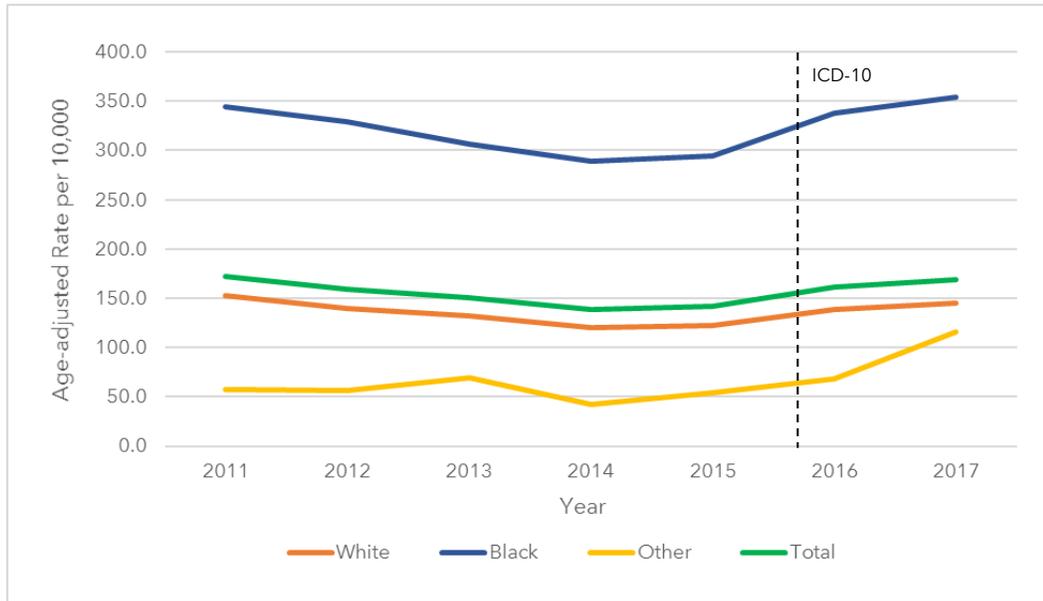
-count= number of hospitalizations for specific disease between 2015-2017.

**Disparities by Race and Sex**

Race Alone

*Overall Disease ACSCs*

Figure 7: Age-Adjusted Rates for Select Overall Disease ACSCs Category per 10,000 Residents 18 Years and Older by Race, Allegheny County, 2011-2017



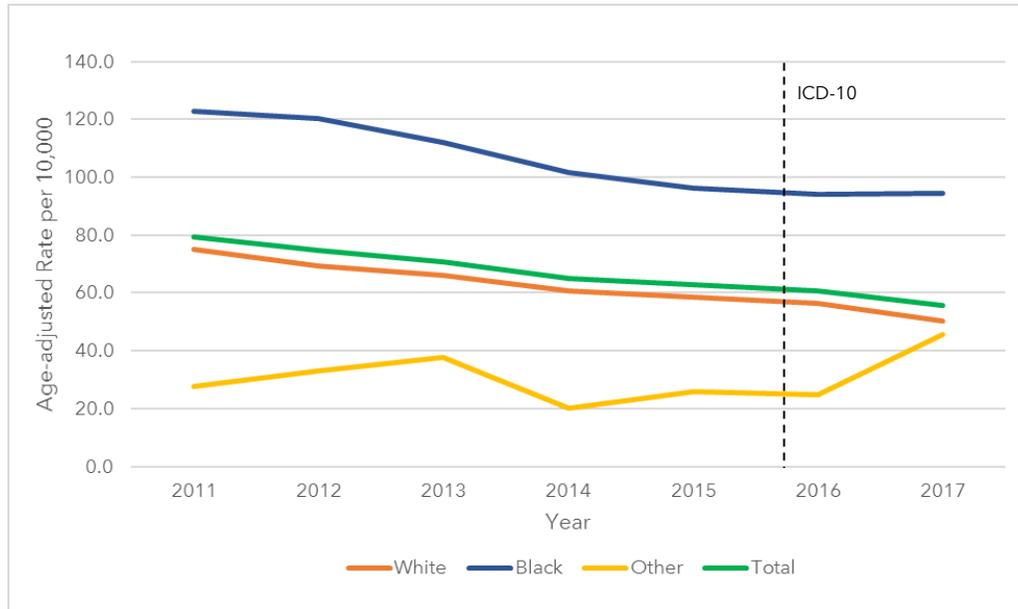
\*The increase in rates after 2016 should be interpreted with caution. This may be a reflection of the ICD code change in the fourth quarter of 2015 rather than an increase in ACSCs during this time.<sup>4</sup>

Overall, ACSCs among adults ≥ 18 years old have remained relatively constant from 172.7 per 10,000 residents in 2011 to 169.5 per 10,000 in 2017. Chronic conditions accounted for 67% of ACSC hospitalizations in 2017 with the remaining 33% due to acute conditions. Division of these rates by race reveals that black adults experience noticeably higher rates of ACSC hospitalizations overall. In 2017, the age-adjusted rate for all ACSCs was 354.2 per 10,000 among black adults, 2.4 times higher compared to 144.8 per 10,000 among white adults (Fig. 7). The disparity ratio between black and white adults has remained constant at 2.4 since 2014 (Table 2).

## 2011-2017 Potentially Preventable Hospitalizations

### Acute Disease ACSCs

Figure 8: Age-Adjusted Rates for Select Acute Disease ACSCs Category per 10,000 Residents 18 Years and Older by Race, Allegheny County, 2011-2017



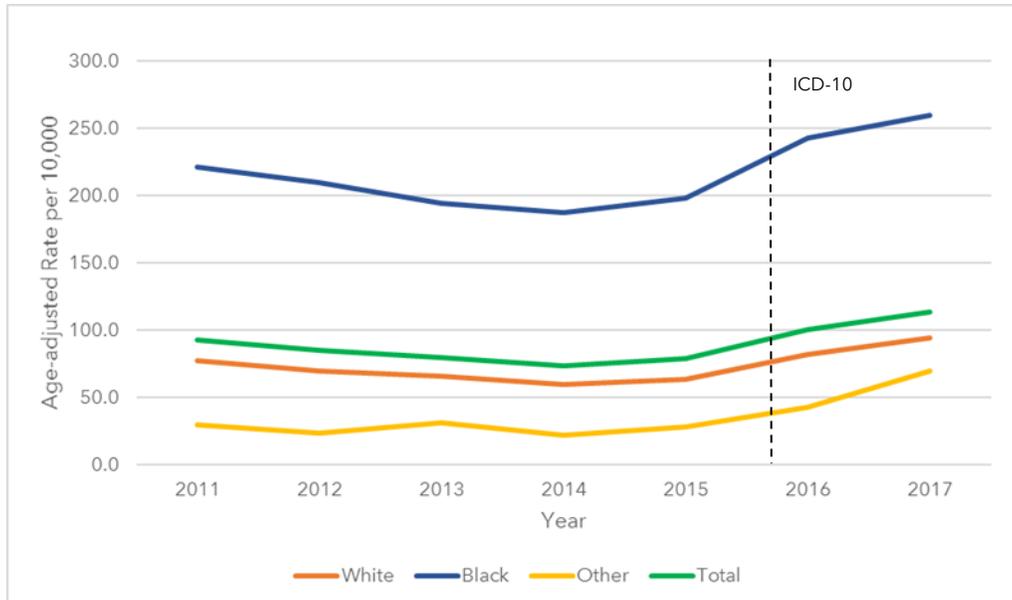
\*The change in rates after 2016 should be interpreted with caution. This may be a reflection of the *ICD code change* in the fourth quarter of 2015 rather than an a sudden change in ACSCs during this time.<sup>4</sup>

Total acute ACSCs declined from 79.5 per 10,000 residents in 2011 to 55.8 per 10,000 in 2017; total acute ACSCs decreased for both black and white adults, yet the black-white disparity has persisted and slightly increased over time, from 1.7 in 2013 to 1.9 in 2017 (Table 2). In 2017, the hospitalization rate for acute disease was 1.9 times higher when comparing black adults to white adults with age-adjusted rates of 94.5 and 50.2 per 10,000 adults for black and white adults respectively. In addition, the acute disease rate for all other races increased from 27.7 per 10,000 residents of other race 18 years and older in 2011 to 45.7 per 10,000 residents of other race 18 years and older in 2017 unlike the other demographics (Figure 8). However, this is based upon fewer than 50 incidents occurring in either year and represents unstable rates.

## 2011-2017 Potentially Preventable Hospitalizations

### Chronic Disease ACSCs

Figure 9: Age-Adjusted Rates for Select Chronic Disease ACSCs Category per 10,000 Residents 18 Years and Older by Race, Allegheny County, 2011-2017



\*The increase in rates after 2016 should be interpreted with caution. This may be a reflection of the *ICD code change* in the fourth quarter of 2015 rather than an increase in ACSCs during this time.<sup>4</sup>

Age-adjusted rates for chronic ACSCs were 2.7 times higher in black adults compared to white adults in 2017 with rates of 259.8 and 94.6 per 10,000 adults 18 years and older for black and white adults respectively (Fig. 9). This disparity ratio has declined from 3.1 in 2014 to 2.7 in 2017. As seen in the other rates, the chronic disease ACSC rate for all other races increased at a higher percentage than the other demographics between 2016-2017. This increase may be due to the *ICD code change*; as this population is not as prevalent in Allegheny County, a change in case definition will affect the rate to a greater extent compared to a larger population. Table 2 outlines racial disparities in age-adjusted rates with corresponding racial disparity rate ratios for each individual ACSC analyzed by year between 2013-2017.

## 2011-2019 Potentially Preventable Hospitalizations

Table 2: Age-Adjusted Rates for Individual ACSCs per 10,000 Adults 18 Years and Older\* by Race, Allegheny County, 2013-2017

Disease	2013					2014					2015					2016 <sup>a</sup>					2017				
	White	Black	All other <sup>b</sup>	Total	B/W ratio	White	Black	All other <sup>b</sup>	Total	B/W ratio	White	Black	All other <sup>b</sup>	Total	B/W ratio	White	Black	All other <sup>b</sup>	Total	B/W ratio	White	Black	All other <sup>b</sup>	Total	B/W ratio
Acute Disease Composite	66.1	112.1	37.8	70.8	1.7	60.6	101.5	20.0	64.9	1.7	58.6	96.3	26.0	63.0	1.6	56.2	94.2	24.9	60.6	1.7	50.2	94.5	45.7	55.8	1.9
Asthma in Younger Adults (18-39 years)	4.7	17.6	**	6.2	3.8	5.3	22.2	**	7.3	4.2	4.6	16.4	**	6.0	3.6	3.4	13.5	**	4.8	3.9	3.0	17.9	**	4.9	5.9
Bacterial Pneumonia	29.8	43.6	18.8	31.3	1.5	28.2	43.1	6.7	29.7	1.5	27.3	40.0	14.1	28.9	1.5	25.3	36.5	12.0	26.8	1.4	20.4	30.6	21.7	22.0	1.5
Chronic Disease Composite	65.9	194.8	31.4	79.7	3.0	59.9	187.7	22.2	73.8	3.1	64.1	198.1	28.3	78.9	3.1	82.6	243.1	43.2	100.7	2.9	94.6	259.8	69.8	113.7	2.7
COPD or Asthma in Older Adults (≥40 years)	53.4	128.9	24.5	61.1	2.4	47.2	122.6	16.5	55.0	2.6	45.8	124.0	24.1	54.1	2.7	48.1	124.4	21.4	56.2	2.6	57.8	117.2	34.8	64.3	2.0
Congestive Heart Failure	13.6	35.5	8.7	15.9	2.6	11.1	27.9	6.2	12.9	2.5	17.1	44.3	**	20.2	2.6	36.8	94.3	24.7	43.4	2.6	39.9	102.6	34.5	47.2	2.6
Dental Complications	9.4	22.6	**	11.0	2.4	9.0	22.8	5.0	10.6	2.5	8.5	23.4	4.2	10.3	2.8	7.4	20.6	4.2	9.2	2.8	7.9	23.5	5.0	9.8	3.0
Diabetes Composite	16.9	57.8	6.9	21.3	3.4	16.8	63.2	7.6	21.8	3.8	16.3	59.3	5.0	21.1	3.6	14.4	53.6	**	19.0	3.7	17.5	61.0	14.9	22.7	3.5
Hypertension	2.6	19.4	**	4.4	7.6	2.5	16.2	**	4.1	6.4	2.2	15.7	**	3.7	7.2	2.0	17.5	**	3.8	8.7	2.4	20.7	**	4.5	8.5
Influenza	2.9	5.2	**	3.2	1.8	4.6	11.1	**	5.4	2.4	4.1	4.9	**	4.2	1.2	2.9	9.5	**	3.7	3.3	4.6	10.6	**	5.2	2.3
Influenza in Elderly Adults (≥65 years)	11.2	10.1	**	11.2	0.9	13.8	24.1	**	15.0	1.7	18.9	17.5	**	18.9	0.9	8.6	17.9	**	9.7	2.1	19.2	39.4	**	21.2	2.0
Long-Term Diabetes Complications	9.7	30.0	4.6	11.9	3.1	9.8	32.4	6.1	12.2	3.3	8.9	30.0	**	11.2	3.4	6.8	21.0	**	8.5	3.1	10.1	27.0	12.0	12.2	2.7
Nutritional deficiencies	12.4	27.8	11.2	14.1	2.2	11.9	26.6	8.4	13.4	2.2	9.9	17.5	5.4	10.8	1.8	10.5	21.0	5.5	11.8	2.0	20.3	41.4	10.3	22.7	2.0
Overall Disease Composite	132.0	306.9	69.2	150.5	2.3	120.6	289.2	42.2	138.7	2.4	122.8	294.5	54.4	141.9	2.4	138.8	337.3	68.1	161.3	2.4	144.8	354.2	115.5	169.5	2.4
Perforated Appendix (per 1,000 people w/ appendicitis)	399.8	407.3	**	403.3	1.0	428.7	325.6	**	422.6	0.8	481.3	396.3	**	463.5	0.8	519.4	351.8	**	497.4	0.7	544.2	491.0	**	537.3	0.9
Short-term Diabetes Complications	5.6	22.3	**	7.5	4.0	5.6	25.8	**	7.8	4.6	6.0	23.0	**	7.9	3.8	4.6	17.8	**	6.2	3.9	5.3	21.9	**	7.2	4.2
Uncontrolled Diabetes w/o complications	1.0	4.1	**	1.4	3.9	0.9	3.5	**	1.2	3.9	1.1	5.4	**	1.5	4.9	2.5	13.0	**	3.7	5.3	2.0	11.8	**	3.2	5.7
Urinary Tract Infection	21.4	32.4	11.2	22.6	1.5	18.9	28.9	8.9	20.1	1.5	18.6	25.7	8.9	19.6	1.4	16.1	23.2	7.3	17.0	1.4	15.0	22.3	13.8	16.2	1.5

\*unless stated otherwise

\*\*count too low to calculate reliable rates

<sup>a</sup> ICD code change may contribute to sudden change in rates<sup>4</sup>

<sup>b</sup> Races could not be divided any further due to low number of ACSC incidents for each individual race

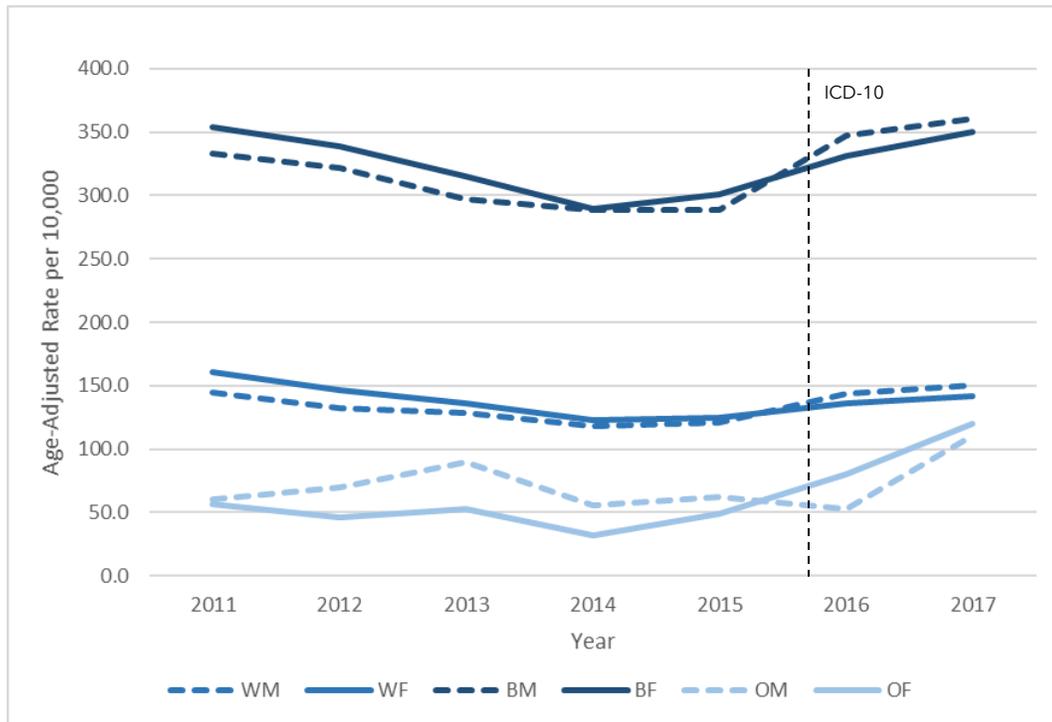
Individual ACSCs with the highest black adult to white adult disparity ratios in 2017 include hypertension (8.5), asthma in younger adults (5.9), and uncontrolled diabetes without complications (5.7). All three of these disparity ratios have noticeably increased since 2013: from 7.6 in 2013 to 8.5 in 2017 for hypertension, from 3.8 in 2013 to 5.9 in 2017 for asthma in younger adults, and from 3.9 in 2013 to 5.7 in 2017 for uncontrolled diabetes without complications.

## 2011-2017 Potentially Preventable Hospitalizations

### Race and Sex

#### Overall Disease ACSCs

Figure 10: Age-Adjusted Rates for Overall Disease ACSCs Category by Race and Sex\*, Allegheny County, 2011-2017



\*WM= white males, WF=white females, BM= black males, BF= black females, OM= all other races males, OF= all other races females

\*The increase in rates after 2016 should be interpreted with caution. This may be a reflection of the *ICD code change* in the fourth quarter of 2015 rather than an increase in ACSCs during this time. <sup>4</sup>

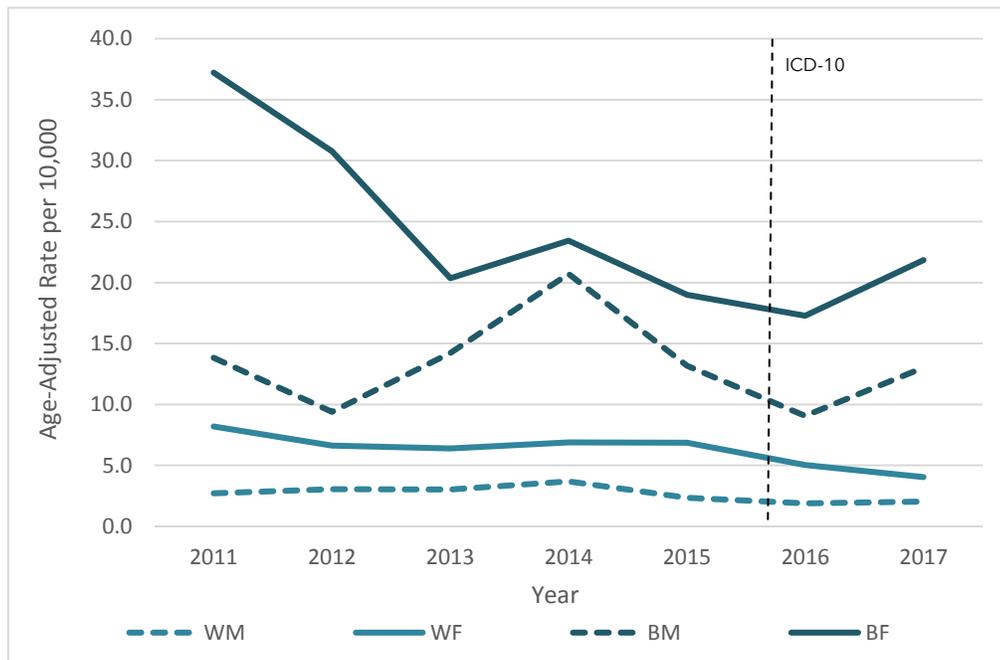
When ACSC rates were further divided by race and sex, black and white females experienced higher rates of hospitalization between 2011-2015, but since 2016 have had lower rates than their male counterparts. In 2017, ACSC hospitalization rates were 1.5% higher overall for black males and 3% higher for white males (Fig. 10). Similar disparity magnitudes between race by sex were present as seen in the previous graphs, divided only by race. All other races experienced the opposite trend of the other demographics; a higher rate for males between 2011-2015 and females between 2016-2017. In 2017, females of all other races had a 4% higher rate of overall disease hospitalizations than males of the same demographic. Acute and chronic ACSCs divided by race and sex (not pictured) followed similar trends as previously illustrated when divided by race alone.

*Individual ACSCs by Race and Sex*

While the overall, acute, and chronic disease categories for ACSCs divided by race and sex displayed relatively similar trends previously described when divided by race alone, the following individual ACSCs show notable differences when divided by both sex and race:

**Asthma in Younger Adults**

Figure 11: Age-Adjusted Rates for Asthma in Younger Adults (Ages 18-39) by Race and Sex, Allegheny County, 2011-2017

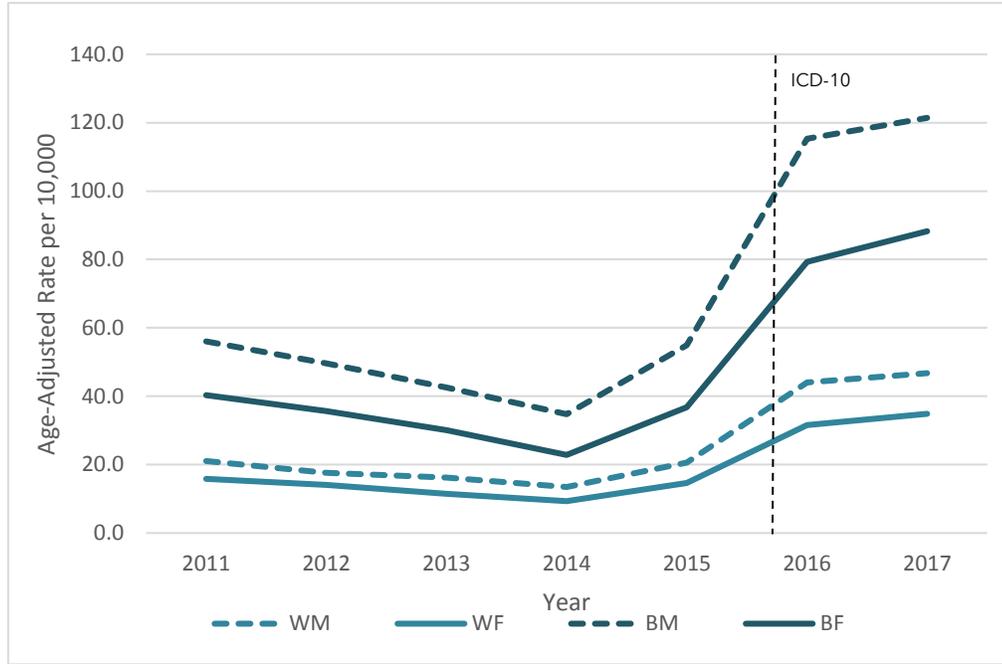


\*all other races population did not contain enough ACSC instances for asthma in younger adults to calculate reliable rates. The increase in rates after 2016 should be interpreted with caution. This may be a reflection of the ICD code change in the fourth quarter of 2015 rather than an increase in ACSCs during this time.<sup>4</sup>

The Centers for Disease Control and Prevention reports that asthma is more common among adult females than among adult males<sup>5</sup> for unknown reasons. The ACSC trends observed in Allegheny County are similar to the national trends. In 2017, asthma ACSC rates in young adult black females (ages 18-39) were 1.7 times greater compared to young adult black males with 21.8 and 13.0 per 10,000 young adults respectively, and 2 times greater for young adult white females compared to young adult white males with rates of 4.0 and 2.0 per 10,000 young adults respectively. However, young adult black females experienced 10.7 times greater asthma-related ACSC rates when compared to white males of this same age group (Fig.11).

**Congestive Heart Failure**

Figure 12: Age-Adjusted Rates for Congestive Heart Failure per 10,000 Adults 18 Years and Older by Race and Sex, Allegheny County, 2011-2017



\*The increase in rates after 2016 should be interpreted with caution. This may be a reflection of the ICD code change in the fourth quarter of 2015 rather than an increase in ACSCs during this time.<sup>4</sup>

Congestive heart failure (CHF) is a serious medical condition where the heart is unable to pump the appropriate amount of blood to the rest of the body, often due to a weakened heart muscle. Risk factors for congestive heart failure include diabetes, high blood pressure (hypertension), obesity, and coronary artery disease.<sup>6</sup> Males consistently retained higher rates of CHF-related hospitalizations compared to females of the same race between 2011-2017. Studies suggest this is because males possess higher health risk factors which contribute to CHF and utilize health care services less than females resulting in the progression of CHF and CHF-related hospitalizations<sup>7</sup>. Males and females of all other races were excluded due to the low number of instances of CHF ACSCs during this period. In 2017, ACSC rates for black males were 1.4 times higher than black females, with rates of 121.4 and 88.3 per 10,000 respectively, and 1.3 times higher for white males compared to white females, 46.8 and 34.9 per 10,000 respectively (Fig. 12).

### Urinary Tract Infection

Urinary tract infections are known to be more common in females than men due to the anatomical nature of each sex, which is reflected in these data. Overall, hospitalizations due to UTIs has steadily decreased since 2012, with the exception of females of all other races. Between 2016-2017, UTI-related hospitalizations increased 56% from 10.8 to 16.8 per 10,000 for females of all other races. In 2017, ACSC rates for adult white females were twice as high as adult white males, 19.2 and 9.6 per 10,000 respectively, and 1.5 times as high when comparing black adult females to black adult males, 26.4 and 17.2 per 10,000 respectively. The magnitude of difference between males and females of all other races could not be calculated due to the low instances of UTI-related ACSCs for males. However, black adult females had 1.4 times greater rates of hospitalizations due to UTIs when compared with white adult females. White adult females and adult females of all other races had comparable rates for UTIs in 2017.

### Conclusions

While some individual ACSCs have declined over the past seven years, high overall rates of preventable hospitalizations remain in Allegheny County, and racial disparities are prominent for chronic conditions. Furthermore, the burden of overall, acute, and chronic disease hospitalizations occur within certain zip codes, particularly in the Southeastern region of Allegheny County. Surveillance of preventable hospitalizations can help identify populations and communities with unmet primary care needs, where interventions can be target to increase access and availability to primary care.

# **Appendices**

**2011-2017 Potentially Preventable Hospitalizations**

**Appendix A: ACSC ICD-Codes for Case Identification**

ACSC	ICD-9 Codes	ICD-10 Codes	population of interest	ICD-9 codes	ICD-10 codes
asthma	49300, 49301, 49302, 49310, 49311, 49312, 49320, 49321, 49322, 49390, 49391, 49392	J4521, J4522, J4531, J4532, J4541, J4542, J4551, J4552, J45901, J45902, J45990, J45991, J45998	2 years and older	n/a	n/a
chronic obstructive pulmonary disease	490, 4910, 4911, 49120, 49121, 4918, 4919, 4920, 4928, 494, 4940, 4941, 496	J410, J411, J418, J42, J430, J431, J432, J438, J439, J440, J441, J449, J470, J471, J479	adults 40 years and older	n/a	n/a
community-acquired pneumonia	481, 4822, 4829, 4830, 4831, 4838, 48230, 48231, 48232, 48239, 485, 486	J13, J14, J15211, J15212, J153, J154, J157, J159, J160, J168, J180, J181, J188, J189	adults 18 years and older	n/a	n/a
congestive heart failure	39891, 40201, 40211, 40291, 40401, 40403, 40411, 40413, 40491, 40493, 4280, 4281, 4289	I0981, I110, I130, I132, I501, I5020, I5021, I5022, I5023, I5030, I5031, I5032, I5033, I5040, I5041, I5042, I5043, I509, I50810, I50811, I50812, I50813, I50814, I5082, I5083, I5084, I5089	adults 18 years and older	n/a	n/a
dehydration	2765	E860, E861, E869	adults 18 years and older	n/a	n/a
diabetes long-term complications	25040, 25041, 25042, 25043, 25050, 25051, 25052, 25053, 25060, 25061, 25062, 25063, 25070, 25071, 25072, 25073, 25080, 25081, 25082, 25083, 25090, 25091, 25092, 25093	E1021, E1022, E1029, E10311, E10319, E10321, E103211, E103212, E103213, E103219, E10329, E103291, E103292, E103293, E103299, E10331, E103311, E103312, E103313, E103319, E10339, E103391, E103392, E103393, E103399, E10341, E103411, E103412, E103413, E103419, E10349, E103491, E103492, E103493, E103499, E10351, E103511, E103512, E103513, E103519, E103521, E103522, E103523, E103529, E103531, E103532, E103533, E103539, E103541, E103542, E103543, E103549, E103551, E103552, E103553, E103559, E10359, E103591, E103592, E103593, E103599, E1036, E1037X1, E1037X2, E1037X3, E1037X9, E1039, E1040, E1041, E1042, E1043, E1044, E1049, E1051, E1052, E1059, E10610, E10618, E10620, E10621, E10622, E10628, E10630, E10638, E1069, E108, E1121, E1122, E1129, E11311, E11319, E11321, E113211, E113212, E113213, E113219, E11329, E113291, E113292, E113293, E113299, E11331, E113311, E113312, E113313, E113319, E11339, E113391, E113392, E113393, E113399, E11341, E113411, E113412, E113413, E113419, E11349, E113491, E113492, E113493, E113499, E11351, E113511, E113512, E113513, E113519, E113521, E113522, E113523, E113529, E113531, E113532, E113533, E113539, E113541, E113542, E113543, E113549, E113551, E113552, E113553, E113559, E11359, E113591, E113592, E113593, E113599, E1136, E1137X1, E1137X2, E1137X3, E1137X9, E1139, E1140, E1141, E1142, E1143, E1144, E1149, E1151, E1152, E1159, E11610, E11618, E11620, E11621, E11622, E11628, E11630, E11638, E1169, E118	adults 18 years and older	n/a	n/a
diabetes related lower extremity amputations (excluding toes)	8410, 8411, 8412, 8413, 8414, 8415, 8416, 8417, 8418, 8419	OY620ZZ, OY630ZZ, OY640ZZ, OY670ZZ, OY680ZZ, OY6C0Z1, OY6C0Z2, OY6C0Z3, OY6D0Z1, OY6D0Z2, OY6D0Z3, OY6F0ZZ, OY6G0ZZ, OY6H0Z1, OY6H0Z2, OY6H0Z3, OY6J0Z1, OY6J0Z2, OY6J0Z3, OY6M0Z0, OY6M0Z4, OY6M0Z5, OY6M0Z6, OY6M0Z7, OY6M0Z8, OY6M0Z9, OY6M0ZB, OY6M0ZC, OY6M0ZD, OY6M0ZF, OY6N0Z0, OY6N0Z4, OY6N0Z5, OY6N0Z6, OY6N0Z7, OY6N0Z8, OY6N0Z9, OY6N0ZB, OY6N0ZC, OY6N0ZD, OY6N0ZF	adults 18 years and older	n/a	n/a
diabetes short-term complications	25010, 25011, 25012, 25013, 25020, 25021, 25022, 25023, 25030, 25031, 25032, 25033	E1010, E1011, E10641 E1100, E1101, E11641, E1110, E1111	ages 6 years and older	n/a	n/a
diabetes uncontrolled with no complications	25002, 25003	E1165, E1065	adults 18 years and older	n/a	n/a
hypertension	4010, 4019, 40200, 40210, 40290, 40300, 40310, 40390, 40400, 40410, 40490	I10, I119, I129, I1310, I160, I161, I169	adults 18 years and older	n/a	n/a
pediatric gastroenteritis	00861, 00862, 00863, 00864, 00865, 00866, 00867, 00869, 0088, 0090, 0091, 0092, 0093, 5589	A080, A0811, A0819, A082, A0831, A0832, A0839, A084, A088, A09, K5289, K529	ages 3 months to 17 years	n/a	n/a
perforated appendix	5400, 5401	K352, K353	adults 18 years and older with appendicitis	5400, 5401, 5409, 541	K352, K353, K3580, K3589, K37
urinary tract infection	59000, 59001, 59010, 59011, 5902, 5903, 59080, 59081, 5909, 5950, 5959, 5990	N10, N119, N12, N151, N159, N16, N2884, N2885, N2886, N3000, N3001, N3090, N3091, N390	ages 3 months and older	n/a	n/a

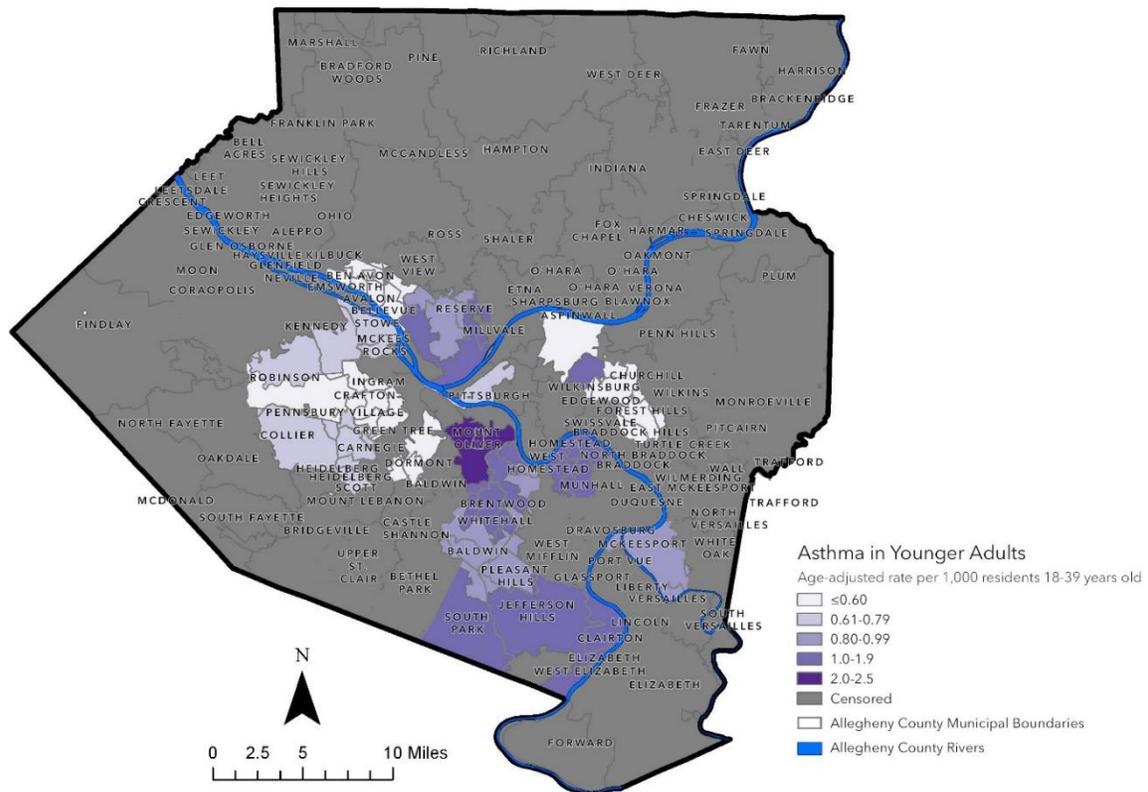
## Appendix B: Additional ACSC ICD Codes for Case Identification

ACSC	ICD-9 Codes	ICD-10 Codes	Population of Interest
dental conditions	521, 522, 523, 525, 528	K02, K03, K04, K05, K06, K08, K098, K099, K12, K13	ages 2 and older
influenza	4870, 4871, 4878, 4880, 4881, 4888	J09, J10, J11	ages 3 months and older
nutritional deficiencies	260, 261, 262, 2680, 2681	E40, E41, E42, E43, E550, E643	adults 18 years and older

9-11

## Appendix C: Age-Adjusted Rates for Individual ACSCs By Zip Code

Figure 1: Age-Adjusted Rates for Asthma per 1,000 Younger Adults (Ages 18-39) by Zip Code, 2015-2017



## 2011-2017 Potentially Preventable Hospitalizations

Figure 2: Age-Adjusted Rates for COPD or Asthma Hospitalizations per 1,000 Older Adults (Ages 40 and older) by Zip Code, 2015-2017

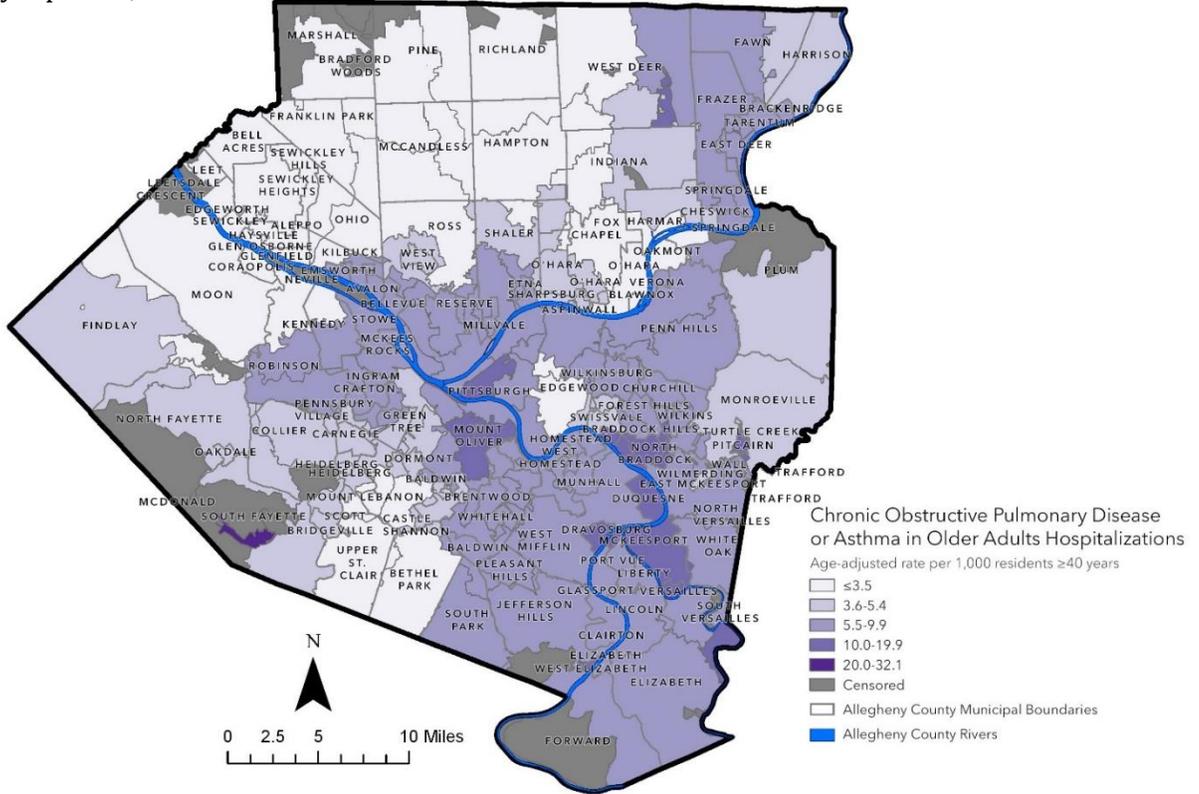
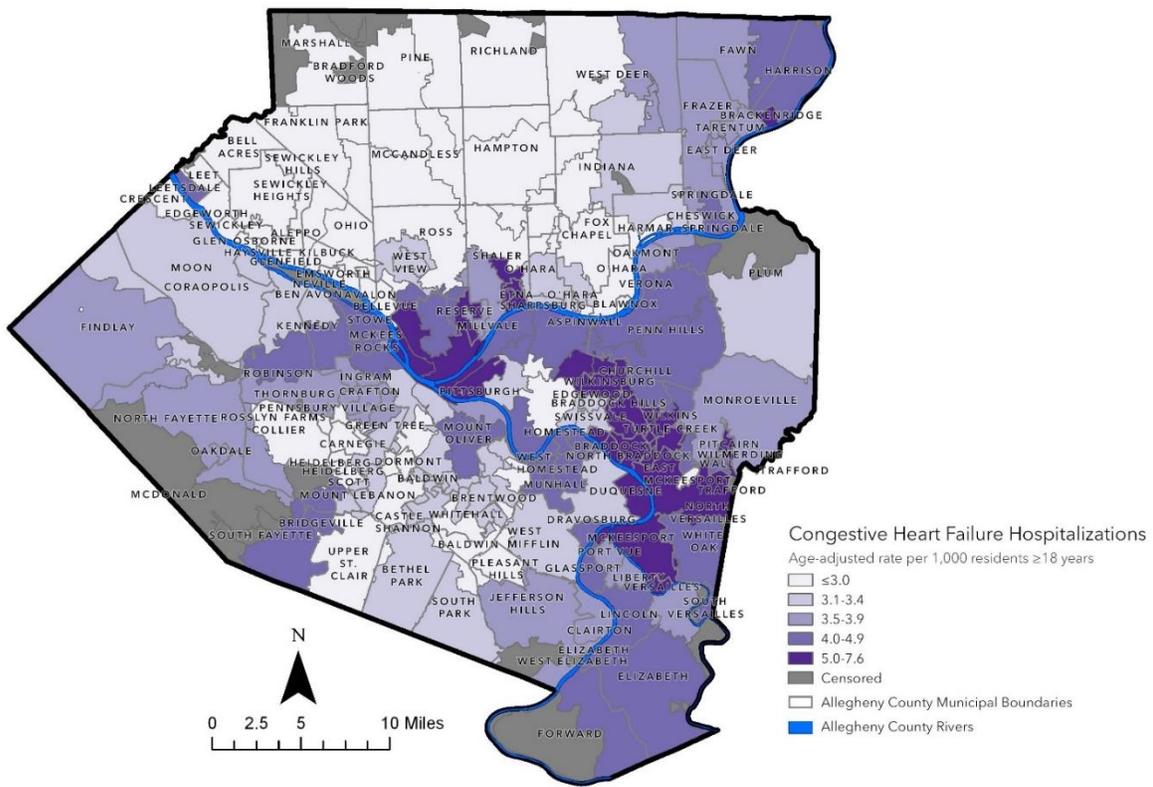


Figure 3: Age-Adjusted Rates for Congestive Heart Failure Hospitalizations per 1,000 Adults by Zip Code, 2015-2017



## 2011-2017 Potentially Preventable Hospitalizations

Figure 4: Age-Adjusted Rates for Dental Complications Hospitalizations per 1,000 Adults by Zip Code, 2015-2017

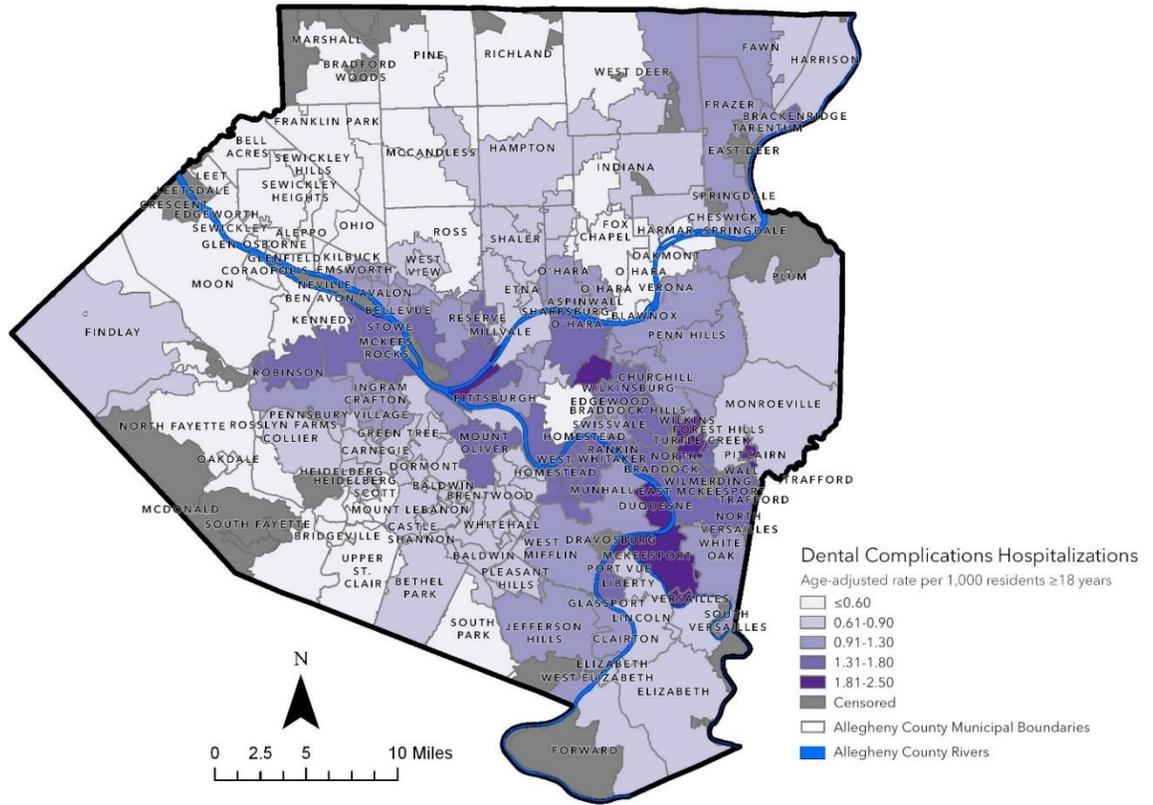
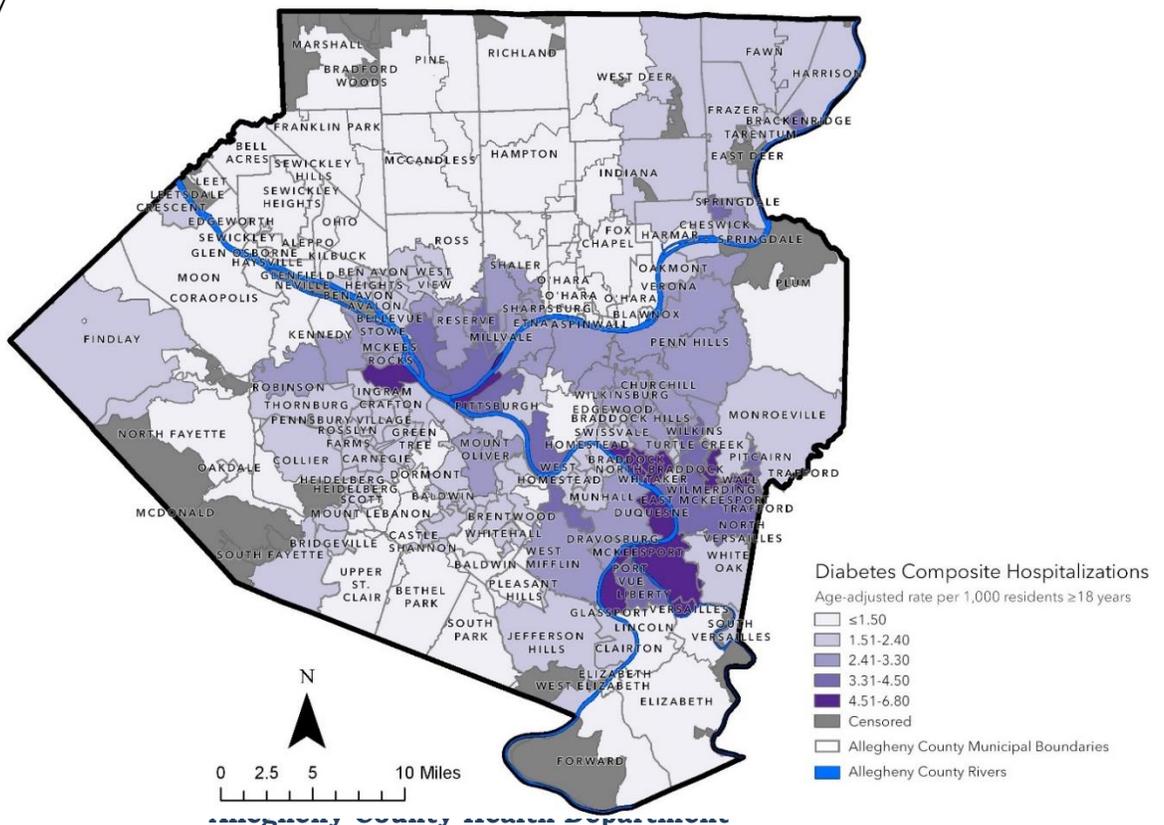


Figure 5: Age-Adjusted Rates for Diabetes Composite Hospitalizations per 1,000 Adults by Zip Code, 2015-2017



## 2011-2017 Potentially Preventable Hospitalizations

Figure 6: Age-Adjusted Rates for Diabetes Long-Term Complications Hospitalizations per 1,000 Adults by Zip Code, 2015-2017

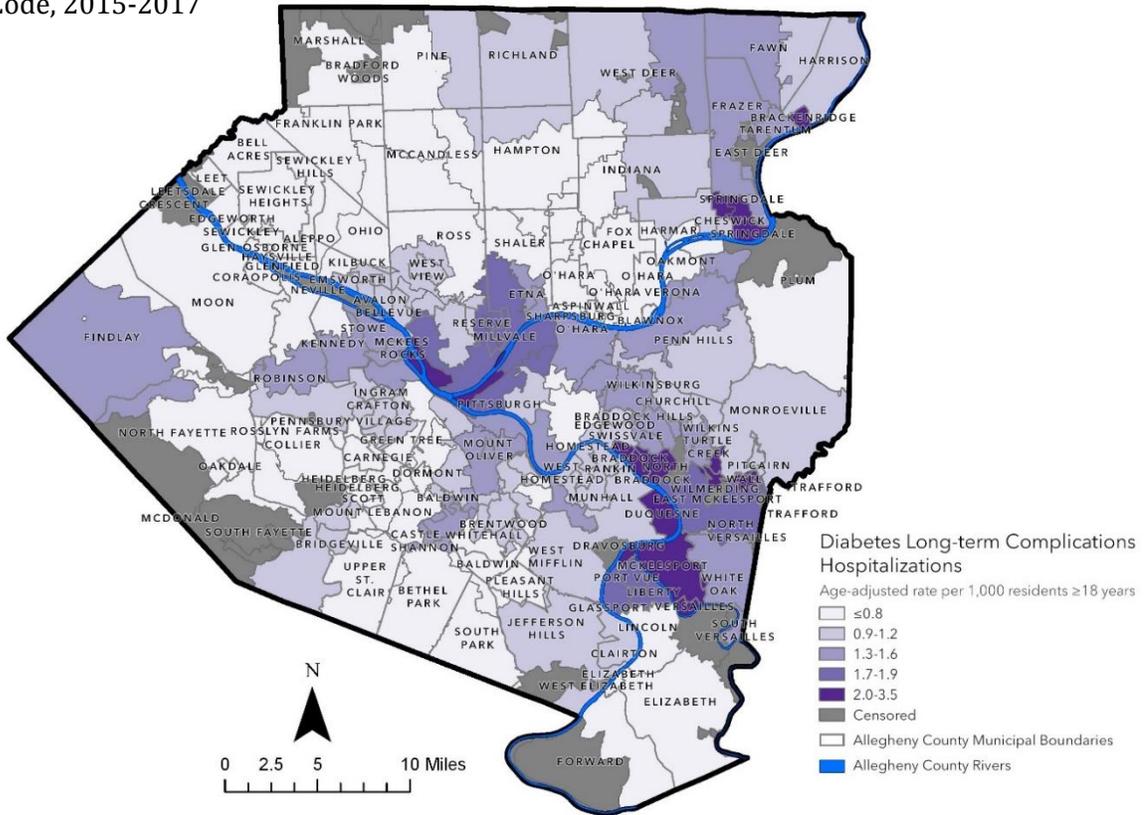
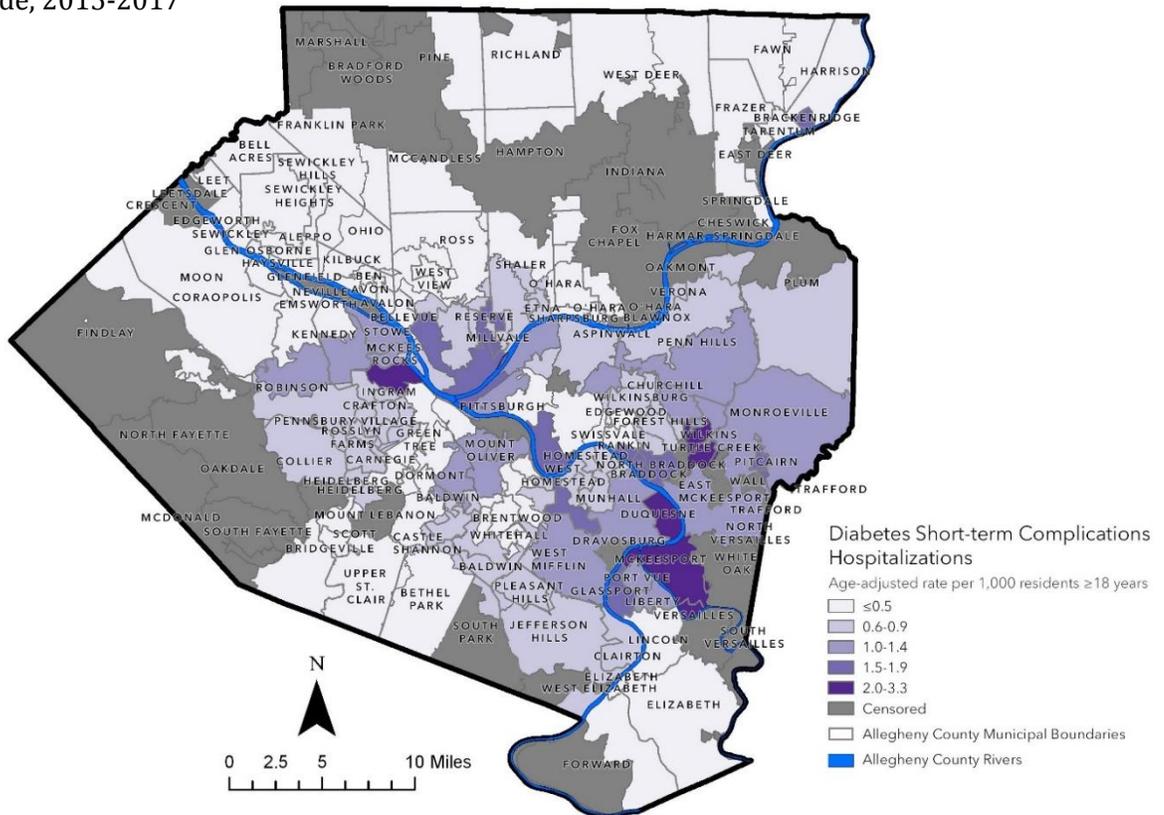


Figure 7: Age-Adjusted Rates for Diabetes Short-Term Complications Hospitalizations per 1,000 Adults by Zip Code, 2015-2017



## 2011-2017 Potentially Preventable Hospitalizations

Figure 8: Age-Adjusted Rates for Hypertension Hospitalizations per 1,000 Adults by Zip Code, 2015-2017

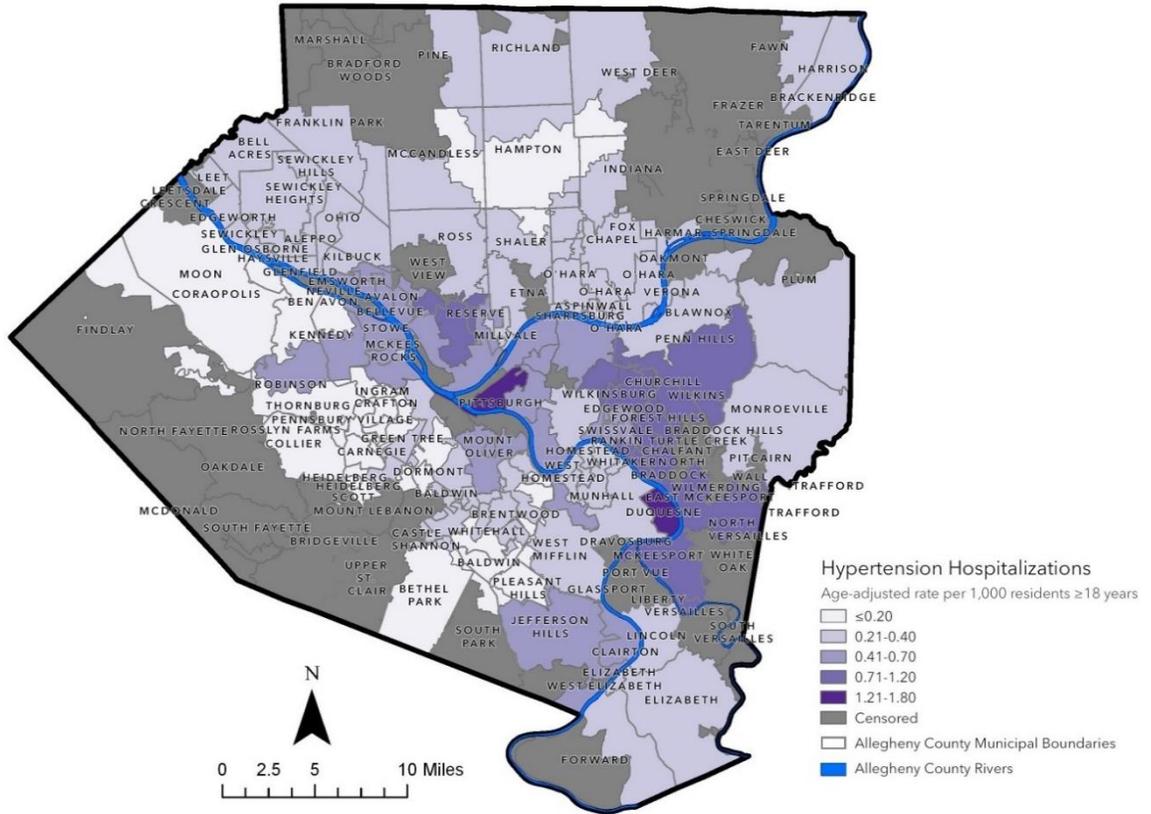
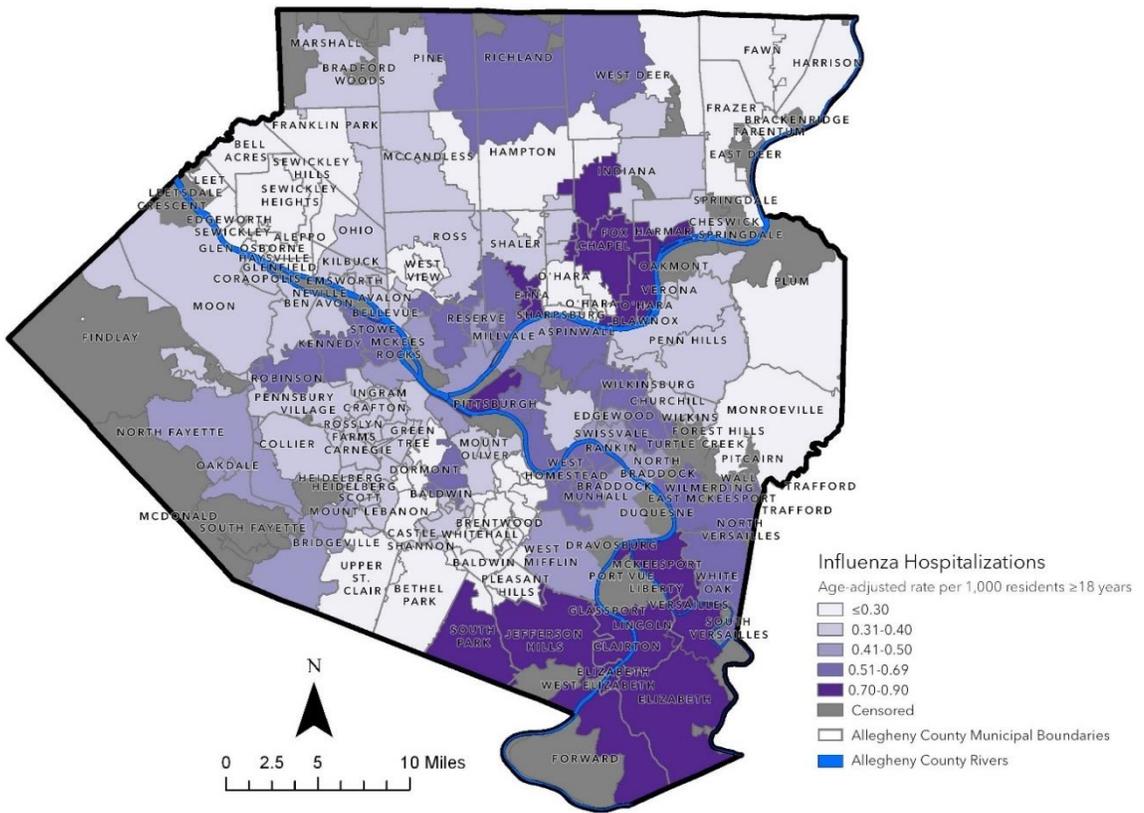


Figure 9: Age-Adjusted Rates for Influenza Hospitalizations per 1,000 Adults by Zip Code, 2015-2017



## 2011-2017 Potentially Preventable Hospitalizations

Figure 10: Age-Adjusted Rates for Influenza Hospitalizations per 1,000 Elderly Adults (65 Years and Older) by Zip Code, 2015-2017

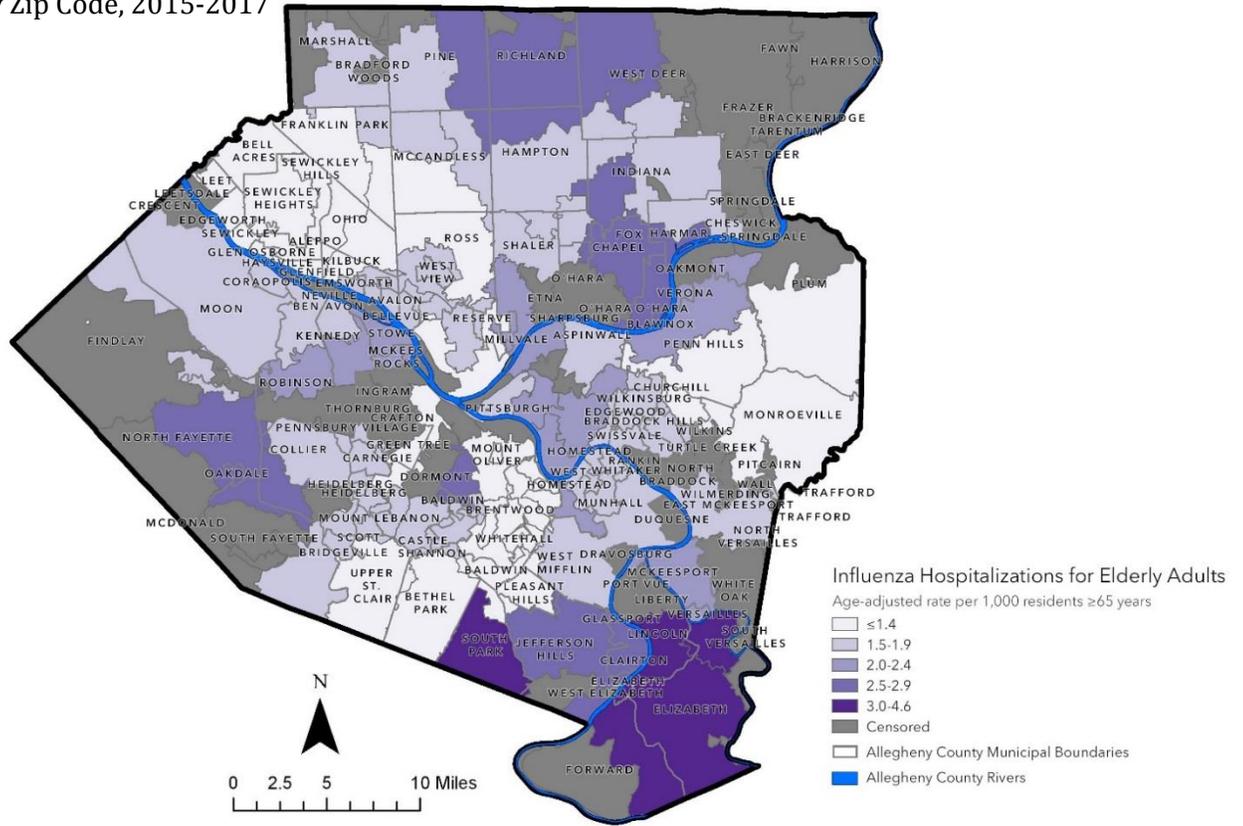
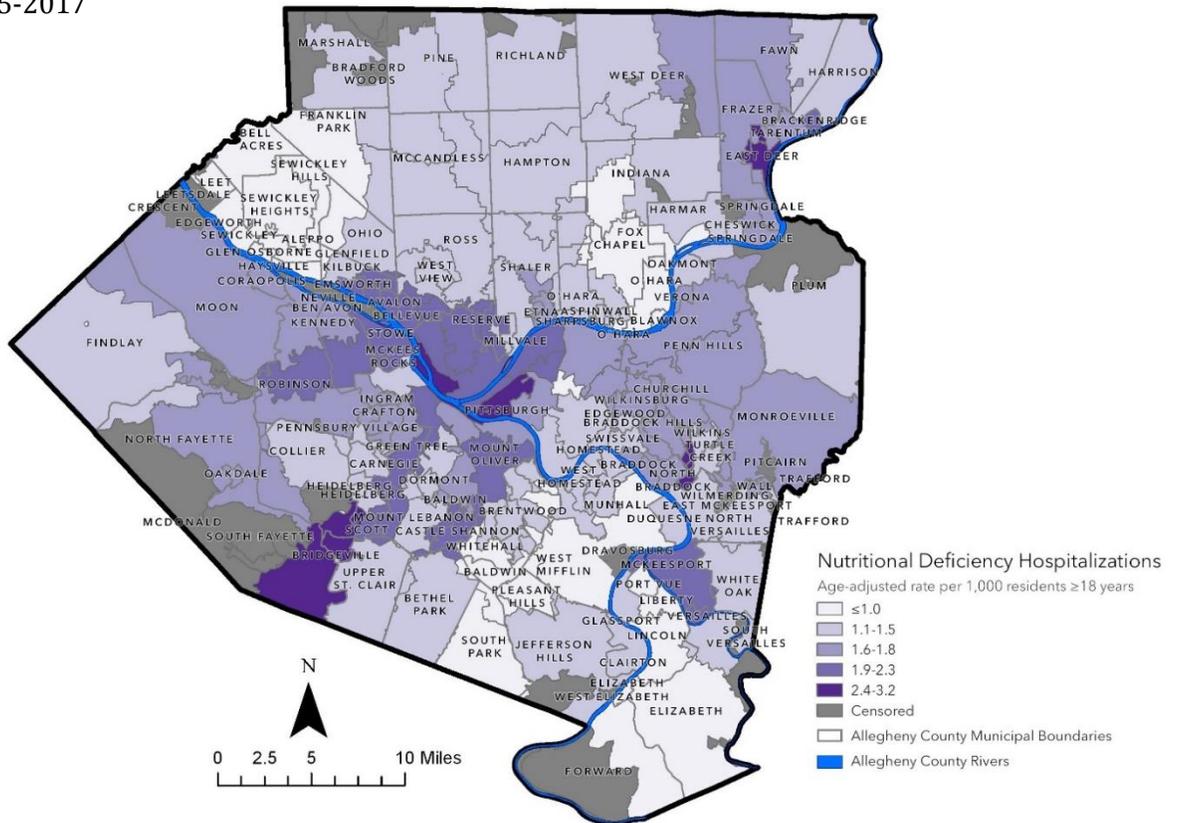


Figure 11: Age-Adjusted Rates for Nutritional Deficiencies Hospitalizations per 1,000 Adults by Zip Code, 2015-2017



## 2011-2017 Potentially Preventable Hospitalizations

Figure 12: Age-Adjusted Rates for Community-Acquired Pneumonia Hospitalizations per 1,000 Adults by Zip Code, 2015-2017

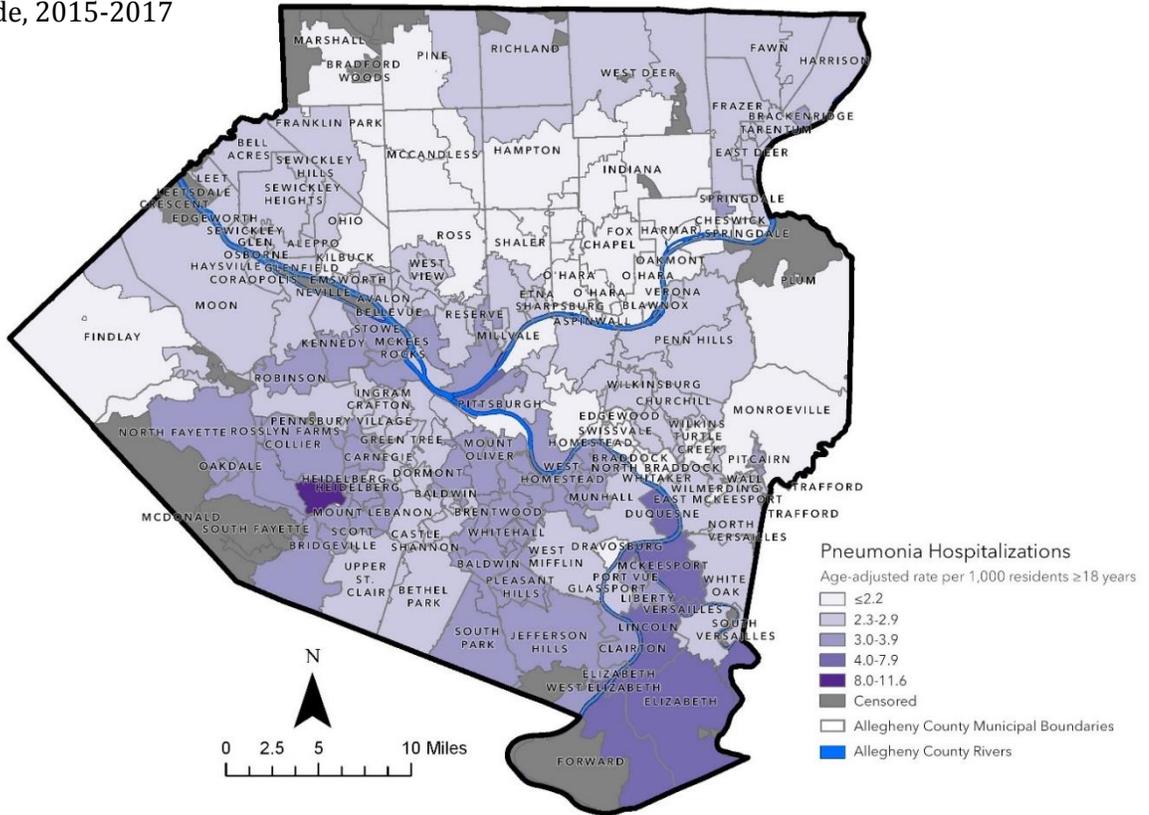
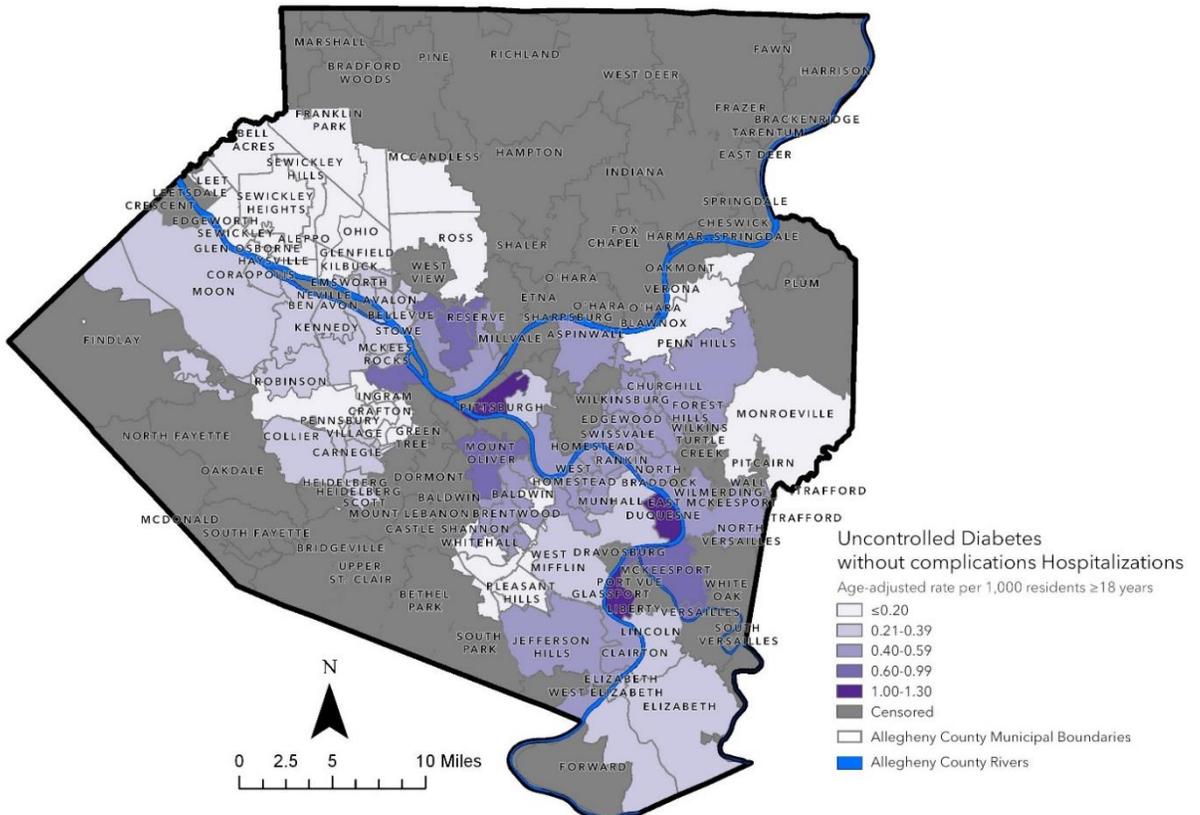
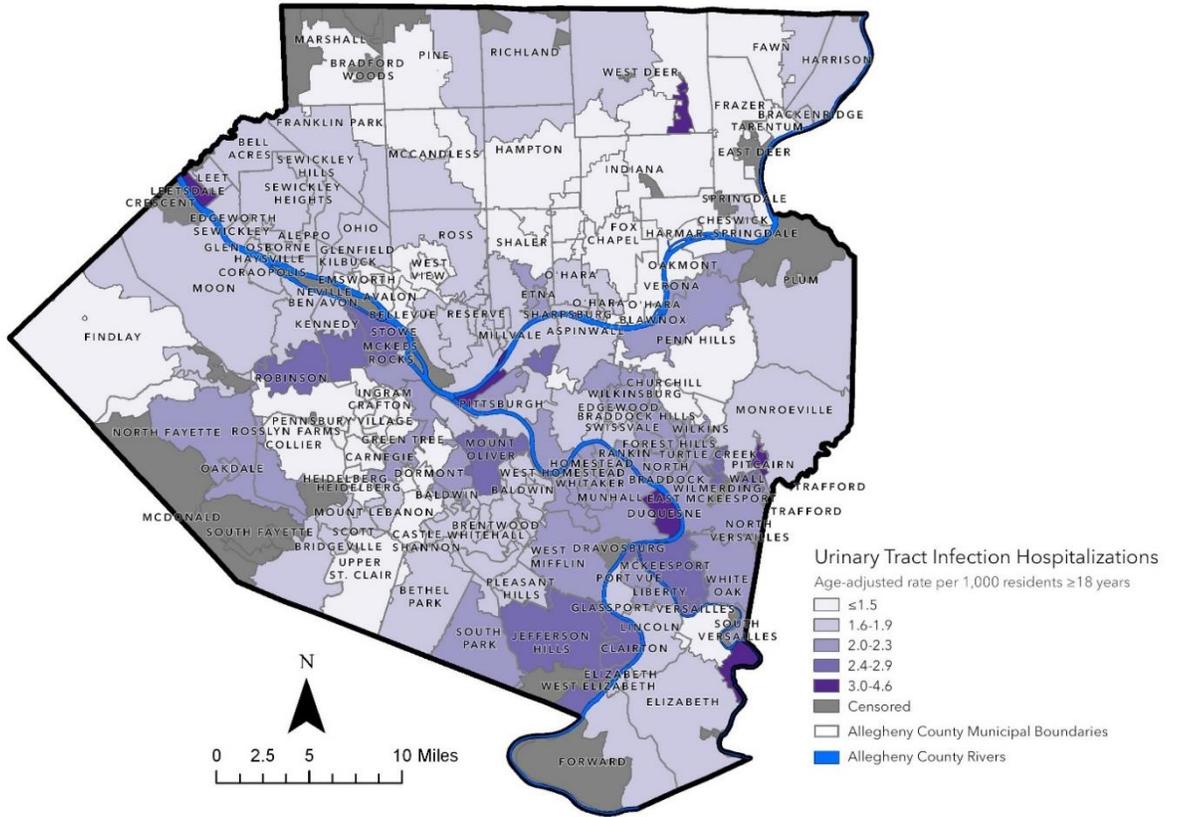


Figure 13: Age-Adjusted Rates for Uncontrolled Diabetes without Complications Hospitalizations per 1,000 Adults by Zip Code, 2015-2017



## 2011-2017 Potentially Preventable Hospitalizations

Figure 14: Age-Adjusted Rates for Urinary Tract Infection Hospitalizations per 1,000 Adults by Zip Code, 2015-2017



## Technical Notes

### *Case Identification*

The Agency for Healthcare Research and Quality (AHRQ) composed a list of prevention quality indicators (PQI) for illnesses considered ambulatory care sensitive conditions. These infirmities include diabetes (short-term and long-term complications, uncontrolled diabetes with no complications, and lower extremity amputations due to diabetes), chronic obstructive pulmonary disease (COPD), asthma, hypertension, congestive heart failure, dehydration, community-acquired pneumonia, perforated appendix, and urinary tract infection (UTI). ICD-9-CM and ICD-10-CM codes (Appendix A) provided within these indicators were used to determine cases in this analysis. These conditions were further grouped into composites of acute and chronic disease.<sup>8</sup> Through a literature review, additional conditions including influenza, dental conditions, and nutritional deficiencies (Appendix B) were identified and included in this analysis.<sup>8-10</sup> Vaccine-preventable diseases other than influenza were considered for analysis, but there were insufficient instances to calculate reliable rates for Allegheny County.

### *Data Analysis*

Utilizing hospital discharge data obtained from the Pennsylvania Health Care Cost Containment Council and SAS Version 9.4, ACHD calculated age-adjusted rates (or age-specific where applicable) by county, zip code, and race for all the previously listed conditions for Allegheny County from 2011-2017. Additional resources used to complete age-adjustment include the 2010 census for Allegheny County<sup>12</sup> and the National Cancer Institute Surveillance, Epidemiology, and End Results Program (SEER) single ages standard population.<sup>13</sup> Conditions with between 1-9 hospitalizations in the specific population of interest (i.e. race, zip code) were censored to prevent unreliable rates.

### *Adult Rates*

Most adult rates composed of Allegheny County adults ages 18 years and older, with a few exceptions: AHRQ recommends that asthma and COPD be split further into two groups: asthma in younger adults (18-39 years) and COPD or asthma in older adults  $\geq 40$  years old. To determine the perforated appendix rate, the target population was adults  $\geq 18$  years old with a diagnosis code of appendicitis, also outlined in the PQIs. Additionally, ACHD calculated two rates for influenza: Allegheny County population  $\geq 18$  years old and  $\geq 65$  years old to determine the difference in rate when focusing specifically on the elderly population.

### *Pediatric Rates*

For pediatric rates, ACHD used different age populations for each condition in accordance with AHRQ PQIs. UTI and gastroenteritis rates consisted of children 3 months to 17 years. Asthma and dental conditions rates included children 2-17 years old. Diabetes short-term complications rate contained children 6-17 years old. No composite rates were calculated due to the difference in age populations for each condition.

### *Mapping*

To determine zip codes with high rates of ACSCs, ACHD used ArcGIS Pro to illustrate aggregate rates from 2015-2017 for each condition by zip code. Zip codes were further labeled by municipality. This report will focus on rates of acute, chronic, and overall composites by zip code, however each condition is mapped individually by zip code in Appendix C.

### *Limitations*

All exclusion criteria outlined in the PQIs were observed, with a couple of exceptions: patients transferred from a different hospital were included because all hospital records analyzed in this study are from Allegheny County residents, and patients with any listed procedure code for cardiac procedure for the CHF total were included because there were approximately 1,800 ICD-10-CM codes listed for exclusion criteria. In addition, duplicate observations were not accounted for because multiple hospitalizations for the same person are still considered potentially preventable hospitalizations. Approximately 1% of hospitalizations were excluded when calculating racial disparities due to missing values. Also, when calculating age-adjusted rates for pediatric conditions with a population of 3 months-17 years, ages 0-2 months were included in the 2010 Census and standardized populations because the smallest division of age was 1 year old for these data sources. Finally, some hospitalizations were excluded due to an error in zip code reporting for census tracts.

## Definitions of Key Terms

**Crude Rate:** A rate to estimate the disease burden of the disease of interest in the total population of interest. The crude rate is calculated by dividing the number of disease occurrences by the total population and multiplying by 10,000 to determine the number of disease occurrences per 10,000 people. Using this rate to compare populations is not recommended because multiple factors including age, race, and sex have the potential to interfere with producing a realistic rate on the true disease-specific burden between populations. For example, if the disease of interest is breast cancer, populations with more females will most likely have higher rates of breast cancer compared to those populations who have more males.

**Age-Specific Rate:** A rate that estimates the disease burden present in a specific age range of a population, for instance between 18-24 year olds. Age-specific rates are calculated by dividing the number of occurrences of the disease of interest for a specific age range by the total population of this same age range and multiplying it by 10,000 to estimate the disease burden for this age range per 10,000 individuals of this age range.

**Age-Adjusted Rate:** A rate that accounts for the age of different populations when comparing the disease burden of multiple populations. As a person ages, he or she has an increased risk for developing most diseases. Therefore, if a higher percentage of older adults live in a specific area, the total count will be higher than surrounding areas; this higher total is most likely due to the age of the residents rather than community-specific inequities. Age-adjusted rates are calculated by finding the age specific rate for each age group out of 10,000 and multiplying the rate by that age group's weight as determined by the standard million population. All age-adjusted rates used in this report are adjusted by the direct methods using the 2000 U.S. Standard Million Population. Age-adjusted rates cannot be compared to crude rates and cannot be interpreted as an absolute measure of disease burden.

**Racial Disparity Rate Ratio-** A ratio to illustrate the contrast in occurrence of the same disease comparing the black and white adult population. The age-adjusted rate of the disease of interest for the black adult population is divided by the age-adjusted rate for the same disease of interest present in the white adult population. For instance, a racial disparity rate ratio of 3.2 estimates that black adults experienced 3.2 times higher rates than white adults for the same disease during the same time period.

**ICD Code-** The code used to define the condition or disease responsible for the patient's hospitalization admission or emergency department visit.

**ICD Code Change-** In October of 2015, the set of codes used to define patients' conditions changed from ICD-9-CM to ICD-10-CM. ICD-10-CM contains 68,000 available codes compared to 13,000 codes available for description with ICD-9-CM.<sup>14</sup> As there are more codes available to more specifically describe a patient's condition, there is a potential for changes in classification of diseases that may have been identified differently with the previous code. This change in classification may result in higher or lower rates and has the potential to lead to incorrect conclusions about data analyzed within this timeframe.<sup>4</sup>

## Formulas for Rates

Formulas are used to calculate several rates in this report allowing for comparable examination across populations of different sizes.

Age-Specific ACSC Rate =  $\frac{\text{Number of ACSCs in specified age group}}{\text{Population in specified age group}} \times 10,000$

Race-Specific ACSC Rate =  $\frac{\text{Number of ACSCs of specified race}}{\text{Population of specified race}} \times 10,000$

Cause-Specific ACSC Rate =  $\frac{\text{Number of ACSCs from specified cause}}{\text{Total population}} \times 10,000$

Racial Disparity Rate Ratio =  $\frac{\text{Age-Adjusted ACSC-specific rate for Black adult population}}{\text{Age-Adjusted ACSC-specific rate for White adult population}}$

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