Bridging Gaps: Investigating COVID-19's Influence on Health Disparities in Connecticut

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Abstract

Social determinants of health (SDoH) are the conditions in which people are born, grow, live, work, and age, significantly influencing their overall health and well-being. These determinants include socioeconomic status, education, access to healthcare, and the physical environment. Understanding the interactions of these elements will be essential for addressing health disparities and developing more effective public health policies and interventions.

1 Introduction

I. Prevalence of Social Determinants of Health

Current research focuses on how social determinants of health (SDoH) play a massive impact on one's health; it is estimated that 80 percent of a population's health outcomes are dictated by SDoH (Hood et al., 2016) . Often, SDoH, when referring to an individual, can result in racial disparities in care when looking at a population (Monroe et al., 2023) . It

has been shown that major inefficiencies in the health system are attributed to overlooked prevention opportunities and unequal access to care (**?**).

Understanding the interplay of these social determinants is crucial in addressing health disparities and developing effective public health policies and interventions. The COVID-19 pandemic has shed new light on these disparities, amplifying existing inequalities within various communities. This research topic gains paramount importance in the current context as it seeks to delve into the specific impact of COVID-19 on key social determinants of health in different counties and racial groups in Connecticut.

The existing literature underscores the pressing need for research in this area. Studies have shown that predominantly black counties in the United States experience significantly higher COVID-19 infection and mortality rates, emphasizing the racial disparities prevalent in healthcare outcomes. The pandemic has magnified these discrepancies, leading to mortality rates among historically marginalized minority communities that are 1.9 to 2.4 times higher compared to the general population (Badalov et al., 2022). Additionally, inefficiencies in the healthcare system have been attributed to overlooked prevention opportunities and unequal access to care, necessitating a comprehensive examination of these social determinants in the context of the pandemic.

Despite the growing body of research on SDoH, there is a notable gap concerning the specific impact of COVID-19 on these determinants within diverse communities. This research aims to bridge this gap by comprehensively assessing how the pandemic has influenced key social determinants of health across the 8 CT counties and a four year timeframe prior to the start of the COVID pandemic. By identifying the specific ways in which different communities were affected, this study contributes valuable insights for targeted interventions, policy-making, and the development of equitable healthcare strategies.

II. Introduction to the Impact of Social Needs

This study will compare each of the following social needs by Year(2017-2020) and by 8 CT Counties: Median Income, Education, Food Access Housing Stability, Health Insurance,

Reshospitalization rates.

Level of income directly affects an individual's access to essential resources such as nutritious food, healthcare, and secure housing. Those with lower incomes often face barriers to healthcare services and struggle to afford a balanced diet, leading to higher risks of chronic illnesses. Income disparities contribute to inequalities in health outcomes, as those with limited financial resources may experience higher stress levels and reduced access to preventive care. Data on income and mortality from (Thomson, 2006) reveals that a continued drop in mortality results as income increases with a more significant drop towards the lower portion of the distribution. Addressing income inequality is crucial for promoting overall well-being and reducing health disparities in communities.

Higher levels of education are associated with better health outcomes, as education enhances one's ability to make informed decisions about lifestyle choices, healthcare utilization, and disease prevention. In CT, it is revealed there has been a spike in chronic absenteeism during the onset of the pandemic. "Specifically, between the 2018-19 and 2021-22 school years, the share of students chronically absent grew by 13.5 percentage points."(CTGov, 2023) There is also evidence of decreased Connecticut Performance Index (CPI) below the state target levels from 2019 to 2022 in mathematics, science, and language arts (CTGov, 2023). Limited educational opportunities can result in lower health literacy, reducing an individual's capacity to navigate complex healthcare systems and understand preventive measures. Educational disparities contribute to a cycle of poor health outcomes, as individuals with lower levels of education may face challenges in securing stable employment and accessing adequate healthcare resources. COVID-19 has only exaggerated the pre-existing opportunity gap between urban schools and suburban schools in providing equal educational opportunities (MFoxCNBC, 2020). (National Center for Health Statistics (US), 2004) reveals that death rates are lower for those with more education for all-cause mortality. The gap between high school graduates and those with some post-secondary education are larger compared to the latter group consisting of a mixture of secondary education including college

and advanced degrees.

Food insecurity, often linked to low income, can lead to malnutrition, obesity, and various health issues. Lack of access to fresh and healthy foods contributes to the prevalence of chronic conditions such as diabetes and cardiovascular diseases. Current issues related to food include disparities in food availability, affordability, and nutritional quality, disproportionately affecting marginalized communities. In 2009, a nationwide analysis conducted by the USDA underscored the significance of both income inequality and racial segregation (US Department of Agriculture, Economic Research Service, 2009). The analysis indicated that in low-income areas, corner stores and similar establishments often provide a surplus of processed foods with limited access to fresh items. However, healthier food options are typically more prevalent in predominantly white communities compared to non-white communities. Addressing these issues involves promoting food equity, supporting local agriculture, and implementing policies that ensure everyone has access to nutritious food, ultimately improving overall public health.

Housing plays a vital role in determining health outcomes. Inadequate or unstable housing conditions can lead to physical and mental health issues. Homelessness and substandard living conditions expose individuals to environmental hazards, increase stress levels, and contribute to the spread of infectious diseases. Recent literature (Taylor, 2018) has assessed the relationship between outcomes of health and housing factors of physical health; mental health; chronic and infectious disease; maternal, infant, reproductive, and sexual health; and injury. Studies have revealed that low income populations and those with high proportions of racial and ethnic minority groups face greater exposures to environmental hazards (Taylor, 2018). Four pillars of housing has been used as a framework for assessing health-related aspects of housing (Swope and Hernández, 2019): 1) conditions (quality of housing); 2) cost (affordability); 3) consistency (residential stability); and 4) context (neighborhood opportunities). The current housing crisis in many regions exacerbates these issues, with rising costs and limited affordable housing options. Addressing housing as a social need involves

implementing policies to ensure affordable housing, preventing homelessness, and improving living conditions to create a foundation for better health outcomes.

Access to healthcare through insurance is a critical social need that significantly impacts health outcomes. Lack of health insurance can lead to delayed or forgone medical care, resulting in the progression of illnesses and poorer health. Large disparities in health insurance coverage related to race and ethnicity remain a persistent issue within the US health care system and contribute to inequalities in healthcare access and health outcomes (Buchmueller et al., 2016). Addressing these challenges involves expanding access to affordable health insurance, implementing healthcare reforms, and promoting policies that ensure comprehensive coverage for all individuals.

Rehospitalization refers to the phenomenon where individuals experience repeated hospital admissions, often due to complications or inadequate follow-up care. High rates of rehospitalization indicate gaps in healthcare delivery and management, impacting both individual well-being and healthcare system efficiency (Hudali et al., 2017). In 2011, around 3.3 million adults experienced hospital readmissions, incurring associated costs amounting to approximately $41.3 billion (Hudali et al., 2017). This social need is indicative of issues such as insufficient post-discharge support, medication management, and coordination of care. Repeated hospitalizations not only strain healthcare resources but also have significant implications for the individuals involved, leading to increased morbidity, reduced quality of life, and higher healthcare costs (Hudali et al., 2017) . Addressing rehospitalization requires improvements in transitional care, enhanced coordination among healthcare providers, and better support systems for patients. Recognizing and addressing these factors can contribute to overall health improvement, prevent unnecessary healthcare utilization, and enhance the effectiveness of healthcare services.

The rest of the paper is organized as follows.

- The data will be presented in Section2

- The methods are described in Section3

2   Data

Data was collected from The Agency for Healthcare Research and Quality (AHRQ).The dataset comprises 7 variables spanning a period of 4 years (2017, 2018, 2019, 2020) with observations across the 8 counties(Fairfield County, Hartford County, Litchfield County, Middlesex County, New Haven County, New London County, Tolland County, Windham County) in Connecticut. These variables encompass a total of 56 observations. The variables questions include housing affordability, education level, median income, health insurance, rehospitalization rates, food stamps usage, and population racial characteristics. The dataset includes a range of calculated percentages, median values, and raw observations, providing a holistic view of various factors affecting the communities in these counties.

3   Methods

In this study, descriptive statistics is utilized to outline the total population, racial composition, and education levels across the 8 counties in Connecticut. ANOVA analyses were conducted to assess the significance difference of the variables including median income, health insurance, food access, housing, and rehospitalization rates between counties and across the four years using SAS v.9.4. Additional Tukey's HSD tests were conducted to determine the significant impact of individual counties and years on each of the variables for each county and year using SAS v.9.4 and SPSS v.29.

4   Results

County names are assigned to a respective county number: 1 Fairfield County, 2 Hartford County, 3 Litchfield County, 4 Middlesex County, 5 New Haven County, 6 New London County, 7 Tolland County, 8 Windham County. Years are assigned to a respective number: 1 2020, 2 2019, 3 2018, 4 2017.

The racial and ethnic distribution of the population of the 8 counties investigated in this study is displayed in the following graphs: 4 4

Table 1: Demographics and Education Levels for Counties 1-4

Category	Fairfield County	Hartford County	Litchfield County	Middlesex County
Total Population	944,977	894,465.25	182,657.5	163,318.25
Race (Percent)				
American Indian and Alaska Native	0.24	0.3075	0.2025	0.195
Asian	5.2925	5.2925	1.9	3.0625
Black or African American	11.405	13.7025	1.83	5.385
Native Hawaiian and Pacific Islander	0.055	0.035	0	0.005
White	72.6325	70.67	92.6025	88.0875
Ethnicity (Percent)				
Hispanic	19.53	17.8275	6.15	6.12

Table 2: Demographics and Education Levels for Counties 5-8

Category	New Haven County	New London County	Tolland County	Windham County
Total Population	858,678	268,477.75	151,218.75	116,608.75
Race (Percent)				
American Indian and Alaska Native	0.1725	0.605	0.05	0.565
Asian	4.005	4.12	4.675	1.3675
Black or African American	13.34	5.8175	3.1075	2.33
Native Hawaiian and Pacific Islander	0.0225	0.025	0	0.015
White	73.2875	80.6175	88.025	88.8725
Ethnicity (Percent)				
Hispanic	17.885	10.5	5.4475	11.6375

5   Discussion

In Figure 1 4 , clear distinctions among the eight counties are evident. Specifically, Fairfield County stands out with the highest proportion of individuals attaining a bachelor's degree as their highest level of education. Conversely, Windham County appears to lead in the percentage of residents with a high school diploma as their highest educational attainment.
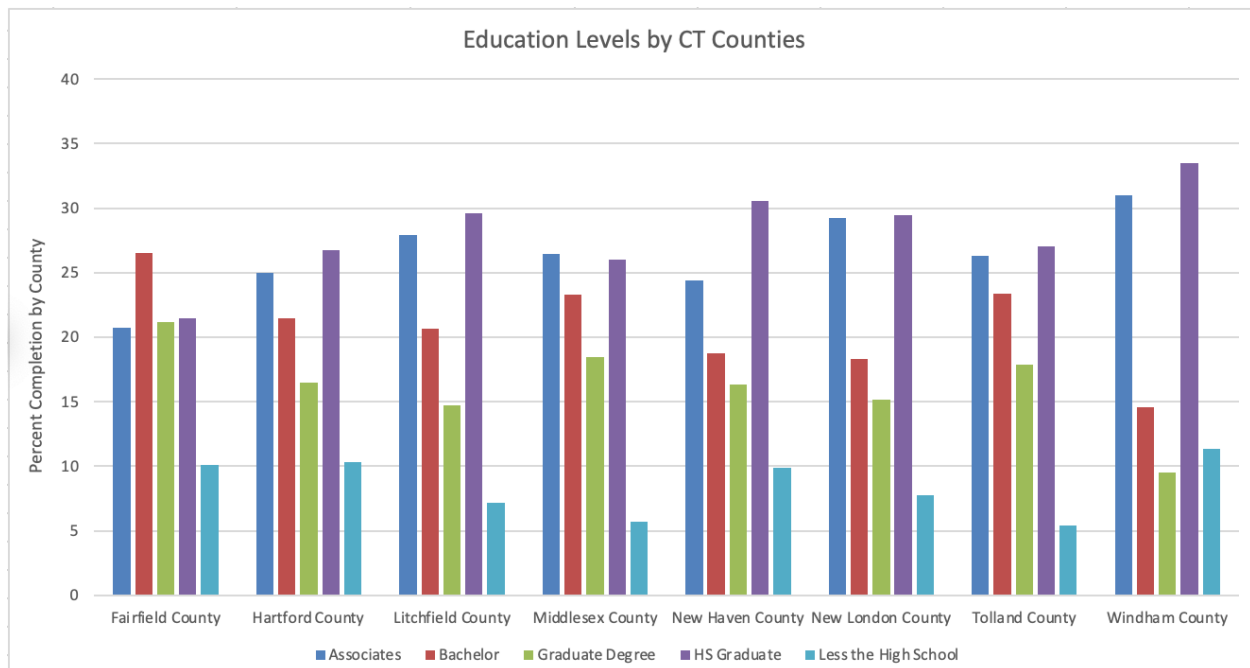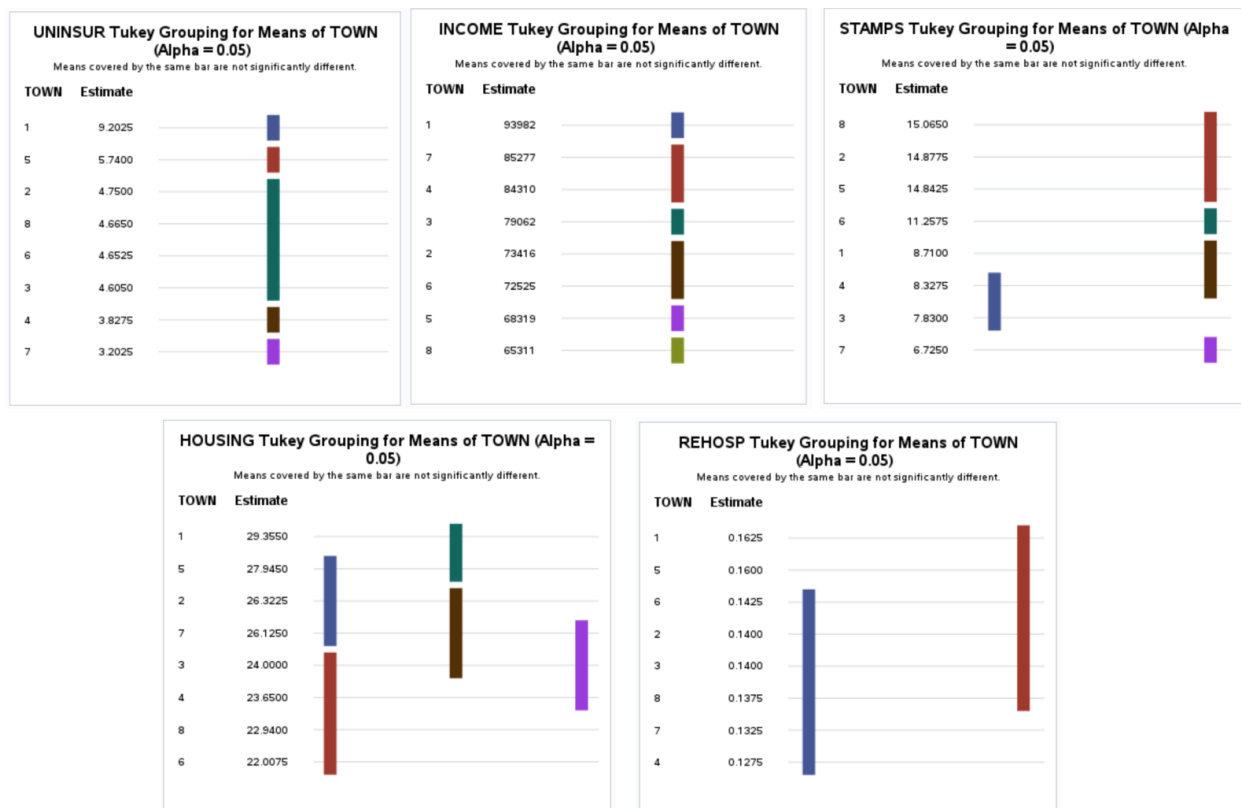
Figure 1: Education Levels by County.

Figure 2: Social Needs Multiple Comparisons by County.

Table 3: Median Income Multiple Comparison by County

County 1(I)	County 2(J)	Mean Difference(I-J)	Std. Error	Sig.	95% Confidence	
					Lower Bound	Upper Bound
Fairfield County	Hartford County	20565.50*	1883.47	<0.001	14327.60	26803.40
	Litchfield County	14919.50*	1883.47	<0.001	8681.60	21157.40
	Middlesex County	9671.75*	1883.47	<0.001	3433.85	15909.65
	New Haven County	25662.75*	1883.47	<0.001	19424.85	31900.65
	New London County	21456.50*	1883.47	<0.001	15218.60	27694.40
	Tolland County	8705.00*	1883.47	0.002	2467.10	14942.90
	Windham County	28671.00*	1883.47	<0.001	22433.10	34908.90
Hartford County	Fairfield County	-20565.50*	1883.47	<0.001	-26803.40	-14327.60
	Litchfield County	-5646	1883.47	0.096	-11883.90	591.90
	Middlesex County	-10893.75*	1883.47	<0.001	-17131.65	-4655.85
	New Haven County	5097.25	1883.47	0.169	-1140.65	11335.15
	New London County	891	1883.47	1	-5346.90	7128.90
	Tolland County	-11860.50*	1883.47	<0.001	-18098.40	-5622.60
	Windham County	8105.50*	1883.47	0.005	1867.60	14343.40
Litchfield County	Fairfield County	-14919.50*	1883.47	<0.001	-21157.40	-8681.60
	Hartford County	5646	1883.47	0.096	-591.90	11883.90
	Middlesex County	-5247.75	1883.47	0.145	-11485.65	990.15
	New Haven County	10743.25*	1883.47	<0.001	4505.35	16981.15
	New London County	6537	1883.47	0.035	299.10	12774.90
	Tolland County	-6214.5	1883.47	0.051	-12452.40	23.40
	Windham County	13751.50*	1883.47	<0.001	7513.60	19989.40
Middlesex County	Fairfield County	-9671.75*	1883.47	<0.001	-15909.65	-3433.85
	Hartford County	10893.75*	1883.47	<0.001	4655.85	17131.65
	Litchfield County	5247.75	1883.47	0.145	-990.15	11485.65
	New Haven County	15991.00*	1883.47	<0.001	9753.10	22228.90
	New London County	11784.75*	1883.47	<0.001	5546.85	18022.65
	Tolland County	-966.75	1883.47	0.999	-7204.65	5271.15
	Windham County	18999.25*	1883.47	<0.001	12761.35	25237.15
New Haven County	Fairfield County	-25662.75*	1883.47	<0.001	-31900.65	-19424.85
	Hartford County	-5097.25	1883.47	0.169	-11335.15	1140.65
	Litchfield County	-10743.25*	1883.47	<0.001	-16981.15	-4505.35
	Middlesex County	-15991.00*	1883.47	<0.001	-22228.90	-9753.10
	New London County	-4206.25	1883.47	0.368	-10444.15	2031.65
	Tolland County	-16957.75*	1883.47	<0.001	-23195.65	-10719.85
	Windham County	3008.25	1883.47	0.747	-3229.65	9246
New London County	Fairfield County	-21456.50*	1883.47	<0.001	-27694.40	-15218.60
	Hartford County	-891	1883.47	1	-7128.90	5346.90
	Litchfield County	-6537.00*	1883.47	0.035	-12774.90	-299.10
	Middlesex County	-11784.75*	1883.47	<0.001	-18022.65	-5546.85
	New Haven County	4206.25	1883.47	0.368	-2031.65	10444.15
	Tolland County	-12751.50*	1883.47	<0.001	-18989.40	-6513.60
	Windham County	7214.50*	1883.47	0.016	976.60	13452.40
Tolland County	Fairfield County	-8705.00*	1883.47	0.002	-14942.90	-2467.10
	Hartford County	11860.50*	1883.47	<0.001	5622.60	18098.40
	Litchfield County	6214.50	1883.47	0.051	-23.40	12452.40
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	Hartford County	-8105.50*	1883.47	0.005	-14343.40	-1867.60
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	Middlesex County	-18999.25*	1883.47	<0.001	-25237.15	-12761.35
	New Haven County	-3008.25	1883.47	0.747	-9246.15	3229.65
	New London County	-7214.50*	1883.47	0.016	-13452.40	-976.60
	Tolland County	-19966.00*	1883.47	<0.001	-26203.90	-13728.10

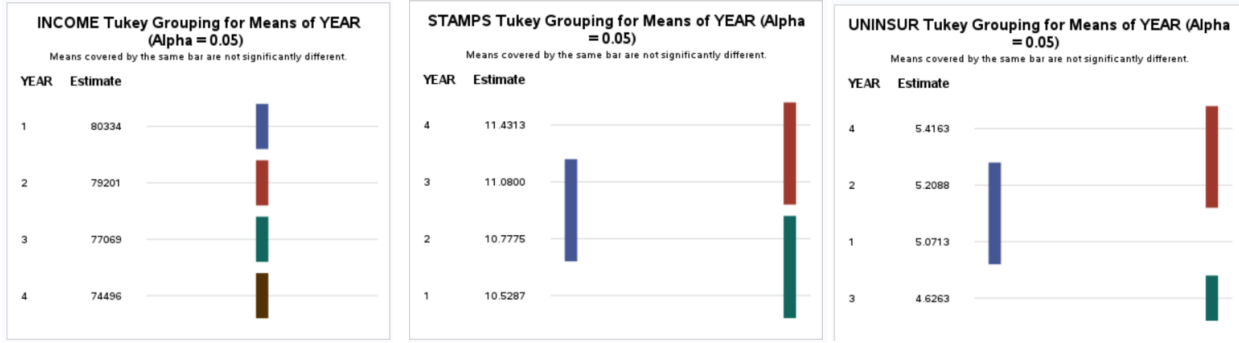* The mean difference is significant at the 0.05 level

Figure 3: Social Needs Multiple Comparisons by County.

Table 4: Multiple Comparisons by Year and Town

Social Need	Comparison by	DF	Sum of Squares	Mean Square	F Value	p Value
Median Income	Year	3	158657606	52885869	95.57	<0.001
	Town	7	2618521106	374074444	675.99	<0.001
Food	Year	3	3.6450625	1.2150208	10.08	0.0003
	Town	7	348.3382875	49.7626125	412.72	<0.001
Housing	Year	3	1.4535125	0.4845042	0.41	0.7506
	Town	7	183.9498375	26.2785482	21.99	<0.001
Rehospitalization Rate	Year	3	0.00050938	0.00016979	1.45	0.2578
	Town	7	0.00427188	0.00061027	5.2	0.0015
Uninsured Rate	Year	3	2.6848375	0.89494583	17.17	<0.001
	Town	7	92.8554875	13.26506964	254.57	<0.001

* The mean difference is significant at the 0.05 level

These findings align with the median income comparisons presented in Figure 2 4 , covering the years 2017 to 2020. During this period, Fairfield County consistently displayed the highest median income, while Windham County consistently ranked lowest in terms of median income. This suggests a correlation between counties with highest median income and those with a higher prevalence of individuals achieving higher levels of educational attainment.

Table 4 4 reveals a significant difference between social need variables by year (2017-2020) for median income, food, and uninsured rate. Table 4 also reveals that all five variables analyzes(median income, food, housing, rehospitalization rate, and uninsured rate) are significantly different. Multiple Comparison tests are conducted to identify the specific similarities and differences between the 8 CT counties.

I. Comparison by County

The results of the Tukey multiple comparison analysis 4 shed light on the relationship between county and key variables such as median income, housing affordability, rehospitalization rates, food stamps usage, and uninsured rates. Understanding these correlations is vital

in comprehending the socio-economic and racial disparities prevalent in the studied region.

The disparity in median income over the studied years, particularly the peak observed in 2020, signifies economic fluctuations. Notably, county 1 stands out with significantly higher income compared to other counties, indicating potential disparities in resource access and opportunities. 4 displays the individual significant levels of comparison with County 1. All counties 2-8 appear to be significantly different compared to county 1 with county 8 having the lowest median income.

The results pertaining to housing defined by renters whose rent is 50 percent of their income, reveal noteworthy patterns with respect to social needs. Examining the data across the four-year span indicates a consistent trend, as no significant differences were observed. However, significant differences are revealed when comparing between counties. Counties 1 and 5 exhibited a statistically significant higher percentage of renters facing housing costs amounting to 50 percent of their income compared to counties 2, 7, and 3. Intriguingly, there was no statistically significant distinction between counties 1 and 5. These findings underscore the importance of localized interventions and policy considerations to address the distinct socio-economic dynamics influencing housing affordability across different counties.

Food access was assesses through investigating the proportion of the population involved in the use of Food Stamps programs. AHRQ data reveals notable variations across different counties. Counties 8, 2, and 5 exhibit a statistically significant higher percentage of the population relying on Food Stamps, suggesting a potentially elevated level of economic vulnerability or socio-economic challenges in these areas. County 6 also demonstrates a substantial proportion of its population on Food Stamps. Conversely, County 7 stands out with the lowest percentage of its population depending on Food Stamps, implying comparatively better economic conditions or potentially more effective social support systems. These findings underscore the importance of targeted interventions and resource allocation to address social needs, particularly in counties with higher reliance on Food Stamps. Further exploration into the underlying factors contributing to these variations is needed for informed

policy development and community-specific interventions.

Rehospitalization rates demonstrate stability across counties and years leading up to 2020, suggesting a consistent healthcare landscape. Figure 2 reveals that there is not a significant overall difference in rehospitalization rates between counties. However, Counties 1,5,6,2,3,8 appears to have the highest rehospitalization rates.

The notably high uninsured rate in county 1 raises concerns about healthcare accessibility, likely linked to economic factors impacting insurance affordability. Conversely, the lower uninsured rate in Year 3 (2019) signifies positive progress. Analyzing the policies or interventions implemented during this period could provide valuable insights for effective healthcare reforms, offering potential guidance for future initiatives.

These analyses reveals the presence of a drastic inequality in County 1(Fairfield County). Although Farfield County is revealed to have the highest median income, greatest educational attainment, Farfield County also maintains the greatest percent population uninsured with health insurance and the greatest proportion of population whose renters pay rent 50 percent of their income. According to a study by the Federal Reserve Bank of New York (Abel and Deitz, 2021), the most highest paid workers in Fairfield County earn a salary that is nine times greater than their lower-wage counterparts.

II. Comparison by Year

An analysis spanning four years indicates significant differences in median income, with the highest observed in 2020 and the lowest in 2017. While there doesn't seem to be a notable overall difference in the proportion of the population relying on food stamp programs or facing uninsured rates, distinctions emerge when considering specific timeframes. The use of food stamps was higher in 2020 and 2019 compared to 2017, showcasing a shift in reliance on such programs over the years. Similarly, the uninsured rates were notably higher in 2020 and 2018 compared to 2019. These findings suggest despite an overall increase in income over time, there was a simultaneous growing demand for food stamp programs and a pressing need for improved access to affordable health insurance leading up to the onset of the

COVID-19 pandemic. This suggests that, while income is on the rise, significant portions of the population still faced challenges in meeting basic needs and accessing essential services. Addressing these trends requires comprehensive strategies that go beyond income growth alone.

5.1 Limitations

One limitation lies in the availability and quality of data. This dataset does not have any data from years after 2020 which may serve to limit potential external validity considerations. There may also be variability in data collection methods and discrepancies in reporting standards leading to missing or incomplete data over the course of 4 years. Another limitation involves the scope of the study, focusing on specific counties in Connecticut may not fully capture nationwide disparities. Additionally, the research is limited to the factor parameters selected to investigate which might not encompass all relevant social determinants affecting health outcomes.

5.2 Future Directions

These findings underscore the complex interplay between socio-economic status, race, and health outcomes. Addressing these disparities requires multifaceted interventions, including economic support, affordable housing initiatives, and targeted healthcare access programs. Future research should delve deeper into the root causes of these disparities, considering historical and systemic factors. Additionally, policy interventions and community-based programs should be designed to specifically target areas and populations facing the most significant challenges, aiming for a more equitable healthcare landscape for all residents.

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