Intergenerational Poverty and COVID-19 in Utah, 2020

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Background

In 2020, the coronavirus pandemic had disproportionately impacted the most impoverished populations in the U.S. This was seen in Utah, where the pandemic substantially affected the low-income and racial minority populations who lived in highly deprived areas. The most deprived areas in Utah had the highest incidence rate and highest hospitalization rate for COVID-19 (Lewis et al., 2020). This was based on the Utah Health Improvement Index, composed of income, unemployment, homeownership, education level, and population below the poverty level (Utah Department of Health, 2018). The impact of COVID-19 was expected to be severe among the intergenerational poverty (IGP) population, defined as the transmission of poverty from older to younger generations in Utah, who were already suffering from the vicious cycle of poverty, social disparity, and adverse health outcomes.

Among individuals experiencing IGP, institutional and intersectional factors can impair self-sufficiency to overcome the consequences of the pandemic (Martin-Howard, S., & Farmbry, K., 2020). Poor interconnected conditions of quality education, employment, quality food, affordable housing, and access to health care increase the risk of comorbidities and adverse COVID-19 outcomes (Najman et al., 2018; Snowden & Graaf, 2021). Social determinants of health have critical roles in health disparities as well as for COVID-19 outcomes.

A study conducted by Finch & Finch (2020) using COVID-19 incidence data from New York Times from January 21 to April 1, 2020, showed that among the 2,853 U.S. counties, more disadvantaged neighborhoods had a higher COVID-19 incidence rate. By April 1, 2020, the death rate was also higher for poor counties than advantaged areas. A more extensive study among 68,656 COVID-19 deaths in 3,142 U.S. counties from January 22 to May 5, 2020, showed that the death rate was 143.2 in high poverty counties vs. 83.3 (per 100,000 person-year) in low poverty counties (Chen & Krieger, 2021). Jobs types and education levels also contributed to a higher incidence rate among people with poverty (Wiemers et al., 2020). People working in low-paid essential jobs such as cleaners, delivery drivers, or supermarkets experienced a higher financial burden and had a lower level of education (Nguyen et al., 2021). They were also at a higher risk of contracting the virus at their workplace compared to those who work in non-essential jobs (Mutambudzi et al., 2021)

A cross-sectional study using COVID-19 Daily Status Report data from 159 counties in Georgia found that the percentage of children living in poverty was one of the significant predictors of COVID-19 cases, hospitalization, and death rates. (Nguyen et al., 2021). Literature also exhibits that children from low-income families experience long-lasting effects of poor health, educational and social attainments into adulthood (Dreyer B. P., 2013; Hair et al., 2015; McCarty A. T., 2016). Nguyen's study also showed that the percentage of people with severe housing problems and people not proficient in English were also significantly positively associated with COVID-19 cases, hospitalization, and death rates (Nguyen et al., 2021).

Among 2,595 tested adults between March 12 to March 31, 2020, in Milwaukee, being African-American adults (OR=1.85) or living in poverty (OR=3.84) were positively associated with COVID-19 hospitalization, but only poverty itself was associated with intensive care unit admission for COVID-19

complications (Muñoz-Price et al., 2020). In a spatial analysis study in Colorado, a higher COVID-19 death rate was associated with population density, asthma (indicative of urban areas), poverty, and unemployment (indicative of rural areas) (Ramírez & Lee, 2020). This study drew attention to a syndemic where higher rates of COVID-19 coincide with multiple chronic conditions as well as social determinants of health disparities (Ramírez & Lee, 2020).

Well-established county and zip code-level findings have shown an association between increased COVID-19 incidence, morbidity, and mortality rates and residing in disadvantaged neighborhoods and families below the federal poverty line (Fielding-Miller et al., 2020; Khanijahani, A., 2021). Several studies have looked into the impact of poverty on COVID-19 incidence and mortality. However, research has yet to be conducted to identify the effects of IGP on the severity of COVID-19 incidence, hospitalization, and mortality.

Objective

The objective of the current study is to explore the disparity of COVID-19 incidence, hospitalization, and mortality rates among the population experiencing IGP and the non-IGP population in Utah in 2020. This study will also identify the total hospital utilization, as measured by submitted claim charges for COVID-19 among the people experiencing IGP and non-IGP.

Data

The intergenerational poverty (IGP) and non-intergenerational poverty (non-IGP) database from the Utah Department of Workforce Services is used to identify unique populations experiencing IGP and not experiencing IGP for 2020. The IGP and the non-IGP groups are defined by months of public assistance usage as adults and children. Individuals experiencing IGP used public assistance services for 12 or more months as adults and 12 months or more as children. Individuals in the non-IGP group used public assistance services for less than 12 months as adults or less than 12 months as children. The non-IGP group is considered to be experiencing situational poverty rather than the IGP group's cycle of poverty. Because the IGP and non-IGP groups are similar, this study will present the rates for each group and compare them to the Utah state rates. Since the IGP and non-IGP cohorts data is limited to age<=50 years, the Utah population data is also limited to age<=50 years. The IGP and the non-IGP cohorts database include information on gender, county, cohort, and age for children (0-17 years), young adults (18-20 years), and adults (21-50 years).

Since the IGP & non-IGP cohorts database lacks information on fundamental socio-economic, demographic, health care, COVID 19 incidence, hospitalization, total charges or death data, it is merged with the Utah National Electronic Disease Surveillance System (UT-NEDSS) or EpiTrax data and Utah Facilities Database from the Utah Department of Health for the 2020 COVID 19 incidence, hospitalization, total charges, and mortality data.

1) UT-NEDSS or EpiTrax is an open-source software epidemiologic and disease surveillance system modeled after the National Electronic Disease Surveillance System (NEDSS) vision and is designed to support Utah's state and local public health agency surveillance and epidemiologic needs. This includes receiving or entering disease reports, conducting case/outbreak investigations, managing cases/outbreaks, analyzing data, and reporting to the Centers for Disease Control and Prevention (CDC). Variables from UT-NEDSS/EpiTrax after merging with the IGP and non-IGP data include age, county, gender, race, ethnicity, any comorbidities, smoking status (current and former), COVID-19 positive cases, and deaths caused by COVID-19.

2) Variables from the Healthcare Facility Database (HFD) contain encounter records for all licensed hospitals, emergency rooms, and ambulatory surgery centers in Utah. These data represent all hospitalizations, emergency department visits, and ambulatory surgeries and diagnostic procedures performed in Utah regardless of payer. The records contain information about providers, patients, and billed charges. After merging HFD data with the IGP and non-IGP data, variables included in this analysis from the database are age, gender, marital status, race and ethnicity, county, diagnosis codes, cohorts, and total charges (the total amount charged by the hospital for the hospital encounter) for hospitalized patients. The charges included are based on COVID-19 being the principal diagnosis code (following ICD 10 codes used by EMSA (Emergency Medical Service Authority) B34.2, B97.2, B97.21, B97.29, U07.1, Z20.822)) or secondary diagnosis code of COVID -19 for obstetrics patients for COVID-19 in pregnancy, childbirth, and the puerperium; or for patients with sepsis due to COVID-19.

According to the CDC coding guidelines, "when COVID-19 meets the definition of principal diagnosis of COVID-19, it should be sequenced first, followed by the appropriate codes for associated manifestations, except in the case of obstetrics patients for COVID-19 in pregnancy, childbirth, and the puerperium and patients that have progressed to sepsis due to COVID-19. These cases should receive a principal diagnosis code for pregnancy, childbirth, and the puerperium or sepsis respectively followed by the diagnosis for COVID-19" (CDC, ICD-10-CM Official Coding and Reporting Guidelines, 2020).

The Institutional Review Boards at the Utah Department of Health reviewed and approved this study (#624).

Methods

Descriptive analysis is performed to identify the COVID-19 incidence, mortality, and hospitalization rate among the IGP and non-IGP cohorts for 2020 by demographic, geographic, socio-economic, and healthcare characteristics such as age, race, ethnicity, gender, marital status, comorbidity, smoking status, county and type of insurance coverage. The total charges of COVID-19 hospitalization treatment are estimated for the IGP and non-IGP cohorts by age group, gender, race, ethnicity, marital status, and type of insurance coverage. The data analysis is performed in SAS software. The IGP and non-IGP cohorts population is restricted to the age group<=50 years.

Results

There are 372,486 total observations in the IGP and non-IGP cohorts for 2020. Of these, 8,951 observations were duplicates and were dropped from the analysis. The IGP cohort had 111,313 unique observations, of which 48.84% of the population was less than 18 years of age, and 55.04% were females. Salt Lake, Utah, Weber, and Davis comprised 68.49% of the cohort. In the non-IGP cohort, among 252,222 unique observations, 53.31% of the population was less than 18 years old, 52.52% were females, with Salt Lake, Utah, Weber, and Davis making up 72.15% of the cohort.

Descriptive Statistics

COVID-19 Cases:

Across the United States (population in 2020: 331,002,651), there were 20,405,307 COVID-19 cases in 2020 (CDC, U.S. COVID-19 Cases and Deaths by State). This showed a 6.16% COVID-19 rate across the country. Among all of Utah's population in 2020 (3,271,616), there were 281,731 positive COVID-19 cases (Utah IBIS, 2021). This showed an 8.61% COVID-19 rate in Utah.

Among Utah's population for age<=50 years (2,417,720), the total number of COVID-19 cases for age<=50 years is 219,910. This showed an 8.89% positive COVID-19 rate among the Utah population aged<=50 years.

Among 111,313 unique IGP observations, 57,919 observations were matched with the Epitrax data. Of these 57,919 matches, 10,728 individuals tested positive for COVID-19. Therefore, among the entire IGP cohort, 9.64% of the population had evidence of COVID-19 in 2020. Among 252,222 unique non-IGP cohort observations, 131,007 were matched with Epitrax data. Of these matches, 25,605 individuals were diagnosed with COVID-19. Therefore, 10.15% of the non-IGP cohort had evidence of COVID-19 in 2020. This showed that compared to the state rate for those <=50 years for COVID-19, both the IGP and the non-IGP cohorts had a higher COVID-19 case rate. Table 1 includes the frequency and percent of demographic characteristics of the populations. The IGP and non-IGP cohorts contain data till age<=50 years. The Utah population data is restricted to age groups<=50 years to match the IGP and non-IGP cohort age limit.

Table 1: Demographic characteristics of COVID-19 positive cases among IGP, non-IGP cohort, and <=50 Utah population, 2020.

	IGP		non-IGP		<= 50 years Utah	
Age group	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
<18 years	2766	25.78%	8794	34.34%	43,440	19.75%
18-24 years	2137	19.92%	3589	14.02%	51,739	23.52%
25-34 years	3659	34.11%	5455	21.30%	53,162	24.17%
35-44 years	1889	17.61%	5286	20.64%	47,172	21.45%
45-50 years	277	2.58%	2481	9.69%	24,395	11.09%
Gender						
Female	6406	59.71%	14243	55.63%	110,474	50.23%
Male	4322	40.29%	11362	44.37%	109,309	49.7%
Race						
American Indian/Alaska Native	816	7.61%	692	2.70%	3068	1.40%
Asian	109	1.02%	497	1.94%	4457	2.02%
Black or African-American	356	3.32%	767	3.00%	3433	1.56%
Native Hawaiian/Other Pacific Islander	381	3.55%	1043	4.07%	6203	2.82%
White	7683	71.62%	18,598	72.63%	133,161	60.55%
Other	775	7.22%	2362	9.22%	18,151	8.25%
Unknown	608	5.67%	1646	6.43%	51,437	23.39%
Ethnicity						
Hispanic or Latino	3065	28.62%	7667	29.94%	53,652	24.4%
Not Hispanic or Latino	7000	65.36%	16,193	63.24%	148,428	67.5%
Unknown	663	6.02%	1745	6.82%	17,830	8.11%

Any comorbidity						
No	483	4.5%	1245	4.86%	81,194	36.92%
Yes	1466	13.67%	3110	12.15%	28,003	12.7%
Unknown	8779	81.83%	21,250	82.99%	140,253	49.78%
County						
Beaver	10	0.09%	61	0.24%	302	0.14%
Box Elder	152	1.42%	346	1.35%	2,660	1.21%
Cache	334	3.11%	928	3.62%	9,393	4.27%
Carbon	134	1.25%	148	0.58%	723	0.33%
Daggett	<5	-	<5	-	15	0.01%
Davis	755	7.04%	2138	8.35%	19,721	8.97%
Duchesne	117	1.09%	132	0.52%	596	0.27%
Emery	42	0.39%	44	0.17%	408	0.19%
Garfield	7	0.07%	21	0.08%	212	0.10%
Grand	68	0.63%	77	0.30%	339	0.15%
Iron	213	1.99%	508	1.98%	2,487	1.13%
Juab	29	0.27%	59	0.23%	576	0.26%
Kane	10	0.09%	29	0.11%	217	0.10%
Millard	42	0.39%	114	0.45%	729	0.33%
Morgan	10	0.09%	38	0.15%	625	0.28%
Piute	<5	-	<5	-	50	0.02%
Rich	<5	-	7	0.03%	45	0.02%
Salt Lake	4268	39.78%	10,107	39.47%	84,355	38.36%
San Juan	357	3.33%	198	0.77%	916	0.42%
Sanpete	85	0.79%	229	0.89%	2,051	0.93%
Sevier	91	0.85%	161	0.63%	1,019	0.46%
Summit	18	0.17%	163	0.64%	2,351	1.07%
Tooele	237	2.21%	473	1.85%	3,622	1.65%
Uintah	224	2.09%	308	1.20%	1,161	0.53%
Utah	1553	14.48%	5309	20.73%	55,931	25.43%
Wasatch	40	0.37%	194	0.76%	2,407	1.09%
Washington	544	5.07%	1474	5.76%	10,357	4.71%
Wayne	<5	-	12	0.05%	51	0.02%
Weber	1361	12.69%	2211	8.64%	15,117	6.87%
Unknown	<5	-	41	0.16%	1,474	0.67%
Out of State	17	0.16%	69	0.27%	-	-
Current smoker						
No	642	5.98%	1607	6.28%	NA	
Yes	261	2.43%	404	1.58%	NA	

Unknown	9825	91.58%	23594	92.15%	NA	
Former smoker						
No	618	5.76%	1527	5.96%	NA	
Yes	205	1.91%	405	1.58%	NA	
Unknown	9905	92.33%	23673	92.45%	NA	
Total	**10,728**	**100%**	**25,605**	**100%**	**219,910**	**100%**

Frequencies less than 5 have been suppressed, N/A-Data not available

The IGP and the non-IGP cohort had higher COVID-19 case rates among the age group<=18 years compared to the Utah population in the age group<=18 years. The IGP cohort also had a higher rate among the age group 25-34 years compared to the general population in the age group 25-34 years. Females represented a larger percentage of COVID-19 positive cases for both the IGP (59.71%) and non-IGP (55.63%) cohort when compared to females in the <=50 years Utah population (50.23%). American Indians/Alaska Natives in the IGP group, Blacks or African-Americans, and Native Hawaiians/Pacific Islanders in both the IGP and non-IGP groups represented a higher percentage of COVID-19 positive cases among minorities in comparison to the minorities in the <=50 years Utah population.

The rate of COVID-19 positive cases was higher among the Hispanic/Latino population in the IGP (28.62%) and non-IGP (29.94%) groups in comparison to the Hispanic/Latino population in <=50 Utah (24.4%). Individuals in the IGP cohort with any comorbidities had higher COVID-19 positive rates compared to individuals with any comorbidities in the <=50 years Utah population. However, the majority of the COVID-19 cases had unknown comorbidities. Therefore the comparison of comorbidities among IGP, non-IGP, and <=50 years Utah population should be interpreted with caution.

Utah County had a lower COVID-19 positive rate for the IGP cohort in comparison to the COVID-19 positive rate in <=50 years population in Utah County. Weber County and San Juan had a higher COVID-19 positive rate for the IGP cohort in comparison to the COVID-19 positive rate in the <=50 years Weber County and San Juan County population. The rate of current and former smokers in both the IGP and the non-IGP groups is relatively low among COVID-19 positive cases because a majority of the data is unknown for the smoking status of the individuals.

Note that these differences were not tested for statistical significance.

COVID-19 Hospitalizations:

At the national level, there were 925,221 hospitalizations (CDC, COVID-19 Case Surveillance Public Use Data) due to COVID-19 leading to a 0.28% hospitalization rate due to COVID-19 across the population of the U.S. Among all COVID-19 positive cases in the U.S., there was a 4.53% hospitalization rate. At the state level, Utah had 11,742 hospitalizations due to COVID-19 in 2020 (Utah IBIS, 2021). This showed a 0.36% hospitalization rate due to COVID-19 across the Utah population in 2020 and a 4.17% hospitalization rate among all COVID-19 positive cases in Utah in 2020.

For Utah population aged <=50 years, the hospitalization due to COVID-19 was 4,586. This showed a hospitalization rate of 0.19% across the Utah population aged<=50 years and a 2.1% rate among all COVID-19 positive cases in Utah in 2020.

After matching the Utah Facilities Database with the IGP and non-IGP database for hospitalization cases, there were 1,235 unique IGP (368) and non-IGP (867) group patients hospitalized for COVID-19 in 2020 in Utah. This showed a 0.33% COVID-19 hospitalization rate among the population experiencing IGP and a 0.34% hospitalization rate among the population in the non-IGP cohort. This also estimated a 3.43 % hospitalization rate among COVID-19 positive cases in the IGP cohort and a 3.38% hospitalization rate among COVID-19 positive cases in the non-IGP cohort. The IGP and non-IGP cohorts have a higher hospitalization rate due to COVID-19 compared to the state or the country's rate of hospitalization. Table 2 shows the demographic characteristics of those hospitalized due to COVID-19. The IGP and non-IGP cohorts contain data till age<=50 years. The Utah population data is restricted to age<=50 years to match the IGP and non-IGP cohorts' age limit.

Table 2: Demographic and health care characteristics of hospitalization among IGP, non-IGP, and Utah population for COVID-19, 2020.

Cohort	**IGP**		**Non-IGP**		**<=50 Utah**	
Age Group	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
<18 years	23	6.25%	74	8.54%	361	7.87%
18-24 years	79	21.47%	99	11.42%	685	14.93%
25-34 years	157	42.66%	220	25.37%	1285	28.02%
35-44 years	89	24.18%	277	31.95%	1346	29.35%
45-50 years	20	5.43%	197	22.72%	909	19.82%
Gender						
Female	237	64.40%	549	63.32%	2605	56.8%
Male	131	35.60%	318	36.68%	1981	43.20%
Race						
American Indian/Alaska Native	16	4.35%	48	5.54%	151	3.29%
Asian	<5		14	1.61%	87	1.89%
Black /African American	16	4.35%	29	3.34%	112	2.44%
Native Hawaiian or Other Pacific Islander	25	6.79%	55	6.34%	357	7.78%
Other Race	46	12.50%	128	14.76%	464	10.11%
Unknown	<5	-	<5	-	1064	23.2%
White	260	70.65%	589	67.94%	2351	51.26%
Ethnicity						
Hispanic or Latino	108	29.35%	269	31.03%	1417	30.8%
Not Hispanic or Latino	252	68.5%	584	67.36%	3062	66.77%
Unknown	6	1.63%	14	1.61%	107	2.33%

Marital Status						
Divorced	21	5.71%	56	6.46%	NA	
Domestic Partner	<5	-	8	0.92%	NA	
Legally Separated	7	1.90%	18	2.08%	NA	
Married	113	30.71%	224	25.84%	NA	
Never Married/Single	159	43.21%	388	44.75%	NA	
Unknown	14	3.80%	38	4.38%	NA	
Unmarried	52	14.13%	126	14.53%	NA	
Widowed	<5	-	9	1.04%	NA	
County						
Beaver	-	-	<5	-	8	0.17%
Box Elder	<5	-	16	1.85%	59	1.29%
Cache	19	5.16%	27	3.12%	166	3.62%
Carbon	<5	-	<5	-	<5	-
Daggett	<5	-	-	-	<5	-
Davis	21	5.71%	56	6.47%	337	7.35%
Duchesne	<5	-	7	0.81%	24	0.52%
Emery	-	-	-	-	<5	
Garfield	-	-	-	-	5	0.11%
Grand	<5	-	<5	-	7	0.15%
Iron	5	1.36%	13	1.50%	48	1.05%
Juab	-	-	<5	-	17	0.37%
Kane	<5	-	<5	-	5	0.11%
Millard	<5	-	<5	-	17	0.37%
Morgan	<5	-	<5	-	10	0.22%
Piute	-	-	-	-	<5	-
Out of State	5	1.36%	<5	-	-	-
Rich	-	-	-	-	<5	-
Salt Lake	171	46.47%	360	41.57%	2166	47.23%
San Juan	<5	-	14	1.62%	41	0.89%
Sanpete	<5	-	5	0.58%	22	0.48%
Sevier	-	-	8	0.92%	14	0.31%
Summit	<5	-	8	0.92%	43	0.94%
Tooele	6	1.63%	19	2.19%	64	1.40%
Uintah	<5	-	7	0.81%	45	0.98%
Utah	55	14.95%	141	16.28%	863	18.82%
Wasatch	-	-	<5	-	17	0.37%
Washington	23	6.25%	61	7.04%	214	4.67%
Wayne	-	-	-	-	<5	-
Weber	41	11.14%	101	11.66%	364	7.94%

Unknown	-	-	-	-	19	0.41%
Primary Payer						
Medicare	27	7.34%	67	7.75%	NA	
Medicaid	247	67.12%	593	68.63%	NA	
Other Government	<5	-	11	1.27%	NA	
Private Health Insurance	64	17.39%	133	15.39%	NA	
Blue Cross/Blue Shield	14	3.80%	25	2.89%	NA	
Managed Care unspecified	<5	-	<5	-	NA	
No Payment from an Organization	9	2.45%	29	3.36%	NA	
Miscellaneous/Other	<5	-	<5	-	NA	
Grand Total	**368**	**100%**	**867**	**100%**	**4,586**	**100%**

Frequencies less than five have been suppressed
N/A-Data not available
*Data from Utah IBIS as of Aug 5, 2021

Table 2 showed the age groups 18-24 years and 25-34 years have higher hospitalization rates for COVID-19 compared to the hospitalization rates in the same age groups for the Utah population. Females in the IGP cohort (64.4%) and in the non-IGP cohort (63.32%) had higher rates of COVID-19 hospitalization when compared to the hospitalization rate among females in <=50 years Utah's population (56.8%). Among all racial minority groups, American Indian/Alaska Native (AI/AN), Blacks or African-Americans, and the Other race group for both the IGP and non-IGP cohorts had higher hospitalization rates compared to hospitalization rates in AI/AN, Blacks or African-Americans, and the other race group in the <=50 years Utah population. The hospitalization rate among the Hispanic/Latinos in the non-IGP (31.03%) groups was greater than the hospitalization rate among Hispanic/Latinos in <=50 years Utah's population (30.8%). At the county level, for the IGP cohort, Cache, Washington, and Weber counties had higher hospitalization rates compared to the hospitalization rate in <=50 yers population in Cache, Washington, and Weber counties. For the non-IGP cohort, Washington and Weber had higher rates compared to the respective <=50 years county rates. Utah County had a lower hospitalization rate for the IGP cohort compared to the hospitalization rate in <=50 years population in Utah County. For the non-IGP cohort, Salt Lake County had a lower hospitalization rate, and Weber County had a higher hospitalization rate compared to <=50 Salt Lake County and Weber County populations. The never-married or single population had a high rate of hospitalization in both the IGP (43.21%) and the non-IGP (44.75%) group. In both the IGP (67.12%) and non-IGP (68.63%) groups, the Medicaid population had the highest rate of hospitalization, followed by private health insurance coverage among all payers. Note that these differences were not tested for statistical significance.

Total Hospitalization Charges:

The distribution of hospitalization charges due to COVID-19 in 2020 U.S. Dollars for the IGP and non-IGP cohorts by demographic and health care characteristics are presented in Table 3. The mean and median hospitalization charges in the IGP group were $43,516 and $21,530, respectively, while the non-IGP group was $48,287 and $22,081, respectively. Therefore, the total charges for hospitalization due to COVID-19 were higher for the non-IGP cohort. The average total charge of hospitalization due to COVID-19 in Utah in 2020 was $62,300. The average total charge for females in Utah was $52,966 and

for males was $72,035. The average total charge for COVID-19 hospitalization in Utah for Medicaid is $58,890, for Medicare is $78,150 and for commercial insurance coverage is $57,420.

IGP cohort:

Compared to all age groups, the highest amount of average charges for COVID-19 hospitalization was for the age group of 45-50 years old (Average charges=$79,260) and the highest median charges were for the age group 35-44 years (Median charges=$26,413). Among all racial groups, the Native Hawaiian/Pacific Islander population had the highest average and median hospitalization charges for COVID-19 (Average charges=$52,943, Median charges= $24,995). The non-Hispanic/Latino population had the highest average charges (Average charges=$47,617) and had the highest median charges (Median charges=$22,285). The female population had higher average and median hospitalization charges (Average charges=$46,491, Median charges=$22,412) compared to the male population. Married people had the highest average hospitalization charges (Average charges=$48,848), and legally separated people had the highest median charges (Median charges=$31,950) compared to other marital status. People with miscellaneous/other payer insurance coverage had the lowest average and median hospitalization charges ($19,075).

Non-IGP cohort:

People aged 45-50 years old had the highest average and median COVID-19 hospitalization charges (Average charges=$84,365, Median=$32,922). The Other race group had the highest average hospitalization charges for COVID-19 (Average=$50,270), and the Black or African-American race had the highest median charges (Median=$23,327) among all racial groups. Females had higher average and median hospitalization charges for COVID-19 (Average charge=$50,094, Median charge=$22,792) in comparison to males. Unmarried people had the highest average hospitalization charges ($68,154), whereas widowed people had the highest median of hospitalization charges ($ 53,786) for COVID-19. People with Blue Cross/Blue Shield insurance coverage had the lowest average charges ($42,766) and median charges ($16,311) for COVID-19 hospitalization.

Table 3 shows the charges for COVID-19 hospitalizations by demographic characteristics. Differences noted above are central tendency measures and were not tested for statistical significance.

Table 3: Total charges by demographic and health care characteristics for COVID-19 among IGP and non-IGP group, 2020.

	IGP cohort		**Non-IGP cohort**	
Age group	**Average of charge**	**Median of charge**	**Average of charge**	**Median of charge**
<18 years	$34,825	$16,232	$42,812	$23,193
18-24 years	$34,720	$18,094	$25,384	$16,643
25-34 years	$33,273	$19,901	$28,025	$16,063
35-44 years	$63,605	$26,413	$48,369	$24,741
45-50 years	$79,260	$22,509	$84,365	$32,922
Race				
American Indian/Alaska Native	$32,167	$24,385	$48,629	$20,820
Asian	$17,121	$13,389	$24,994	$19,096

Black /African American	$22,820	$16,256	$50,258	$23,327
Native Hawaiian/Other Pacific islander	$52,943	$24,995	$50,013	$20,037
Other Race	$27,346	$22,113	$50,270	$22,933
Unknown	$17,193	$17,193	$15,425	$14,655
White	$45,579	$21,109	$48,347	$22,231
Ethnicity				
Hispanic or Latino	$34,714	$19,984	$46,343	$22,292
Not Hispanic or Latino	$47,617	$22,285	$49,004	$21,398
Unknown	$28,353	$24,413	$55,726	$41,808
Gender				
Female	$46,491	$22,412	$50,094	$22,792
Male	$38,134	$19,788	$45,168	$21,303
Marital Status				
Divorced	$39,683	$18,364	$49,647	$21,500
Domestic Partner	$14,119	$14,119	$33,682	$15,589
Legally Separated	$34,558	$31,950	$59,402	$15,767
Married	$48,848	$21,453	$42,336	$20,476
Never Married/Single	$39,855	$21,119	$45,720	$23,188
Unknown	$44,590	$22,395	$39,173	$20,342
Unmarried	$46,442	$23,842	$68,154	$23,957
Widowed	$18,095	$18,095	$49,700	$53,786
Primary Payer				
Medicare	$30,621	$19,529	$50,650	$17,584
Medicaid	$41,979	$21,065	$46,247	$22,450
Other Government	$79,310	$71,420	$86,433	$19,107
Private Health Insurance	$31,279	$21,488	$53,613	$23,356
Blue Cross/Blue Shield	$15,5753	$24,685	$42,766	$16,311
Managed Care unspecified	$36,468	$36,468	$61,802	$45,205
No Payment from an Organization	$25,182	$29,708	$46,253	$18,798
Miscellaneous/Other	$19,075	$19,075	$13,8672	$13,8672
Total	**$43,516**	**$21,530**	**$48,287**	**$22,081**

Mortality from COVID-19:

There were 385,246 COVID-19 related deaths in the United States in 2020 (NCHS, COVID-19 Death Counts by Week Ending Date and State). This showed a case fatality (Total COVID-19 deaths/Total COVID-19 cases) rate of 1.89% and a death (Total COVID-19 deaths/Total population) rate of 0.12%

across the U.S. population. There were 1,728 deaths in 2020 in Utah where the primary contributor of death was COVID-19 (Utah IBIS & Utah OVRS database). This shows a case fatality rate of 0.61% and a death rate of 0.052% across the Utah population caused by COVID-19.

For the age group<=50 years, there were 131 deaths in 2020 in Utah where COVID-19 was the primary cause. Therefore the Utah case fatality rate was 0.06% and the death rate 0.005% for the age group<=50 years.

Matching Epitrax data to the IGP and non-IGP cohort provided 99 unique deaths caused by COVID-19 among individuals in either cohort who had tested positive. The IGP and non-IGP deaths comprised 5.7% of all COVID-19 deaths in Utah in 2020. The IGP cohort had 27 deaths caused by COVID-19 among 10,728 positive COVID-19 cases (case fatality rate: 0.25%, death rate: 0.024%) and the non-IGP cohort had 72 deaths caused by COVID-19 among 25,605 positive COVID cases (case fatality rate: 0.28%, death rate: 0.028%). Case fatality rate and death rate among the IGP and non-IGP cohort were higher compared to the state rates. Table 4 has the demographic and health characteristics of those who died by COVID-19. The IGP and non-IGP cohorts contain data till age<=50 years. The Utah population data is restricted to age<=50 years to match the IGP and non-IGP cohorts' age limit to create the descriptive statistics.

Table 4: Demographic and health care characteristics of those who died due to COVID-19 among IGP, non-IGP cohort, and <=50 Utah population, 2020.

Cohort	**IGP**		**Non-IGP**		**<=50 Utah**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Age group						
<18 years	-	-	<5	-	<5	-
18-44 years	23	85.19%	32	44.44%	75	57.25%
45-50 years	4	14.81%	39	54.17%	55	41.98%
Gender						
Female	13	48.15%	30	41.67%	48	36.64%
Male	14	51.85%	42	58.33%	83	63.36%
Race						
American Indian/Alaska Native	5	18.52%	7	9.72%	13	8.39%
Asian	-	-	<5	-	<5	-
Black or African-American	-	-	5	6.94%	9	6.87%
Native Hawaiian/Other Pacific Islander	<5	-	-	-	<5	-
White	19	70.37%	50	69.44%	89	67.93%
Other	-	-	<5	-	9	6.87%
Unknown	<5	-	5	6.94%	6	4.58%
Ethnicity						
Hispanic or Latino	<5	-	20	28.17%	39	29.7%
Not Hispanic or Latino	21	77.78%	40	56.34%	81	61.83%
Unknown	<5	-	12	15.49%	11	8.40%

County						
Box Elder	-	-	<5	-	5	3.82%
Cache	<5	-	<5	-	5	3.82%
Carbon	-	-	-	-	<5	
Davis	<5	-	<5	-	10	7.63%
Duchesne	-	-	<5	-	<5	
Emery	-	-	-	-	-	
Garfield	-	-	-	-	<5	
Iron	-	-	-	-	-	
Juab	-	-	<5	-	<5	
Millard	-	-	<5	-	-	
Morgan	-	-	-	-	-	
Salt Lake	10	37.04%	33	45.83%	54	41.22%
San Juan	<5	-	<5	-	<5	
Sanpete	-	-	-	-	-	
Sevier	-	-	-	-	-	
Summit	-	-	-	-	<5	
Tooele	-	-	<5	-	<5	
Uintah	<5	-	-	-	-	
Utah	<5	-	11	15.28%	22	16.79%
Wasatch	-	-	-	-	-	
Washington	<5	-	<5	-	13	9.92%
Weber	<5	-	11	15.28%	13	8.39%
Unknown	-	-	-	-	<5	
Any comorbidity						
No	<5		<5		9	6.87%
Yes	10	37.04%	34	47.22%	70	53.43%
Unknown	16	59.26%	37	51.39%	52	39.69%
Current smoker						
No	<5	-	6	8.33%	NA	
Unknown	25	92.59%	62	86.11%	NA	
Yes	-	-	<5	-	NA	
Former smoker						
No	<5		6	8.33%	NA	
Unknown	25	92.59%	62	86.11%	NA	
Yes	-	-	<5	-	NA	
Total	**27**	**100%**	**72**	**100%**	**131**	**100%**

Frequencies less than 5 have been suppressed
N/A- Data not available
*Data as of Aug 13th, 2021

The rate of death due to COVID-19 was higher among females in the IGP (48.15%) and non-IGP (41.67%) cohorts compared to females in <=50 years Utah population (36.64%). Among racial minority groups, a higher number of deaths caused by COVID-19 occurred among the American Indians/Alaska Natives (AI/AN) in both the IGP (18.52%) and non-IGP (9.72%) groups in comparison to deaths in the <=50 years AI/AN population in Utah. The <=50 years Hispanic/Latinos in the Utah population had a higher fatality rate in comparison to the deaths among Hispanic/Latino people in the IGP and non-IGP cohorts. Salt Lake County had a lower death rate in the IGP group (37.04%) compared to the death rate in <=50 years population of Salt Lake County (41.22%). Weber County and Salt lake county had higher death rates in the non-IGP cohort in comparison to the death rates in <=50 years Weber and Salt Lake County's population. People with comorbidities in <=50 years Utah population had a higher death rate (53.43%) due to COVID-19 when compared to people with comorbidities in the IGP and non-IGP groups.

Discussion

The findings of the study are consistent with the literature. The demographic, socio-economic, behavioral, and healthcare inequalities are more likely to be associated with higher rates of COVID-19. The IGP and non-IGP cohorts have populations up to the age of 50 years old. Utah population has been limited to the age<=50 years. This excludes the hardest hit COVID-19 population (the older age groups). These limitations impact the incidence, hospitalization, and death rates.

Nationally, Blacks, African-Americans, and Latinos accounted for a high proportion of COVID-19 cases and hospitalization rates (SAMSHA, 2020). People of color are at an increased risk for serious illness if they contract COVID-19 due to higher rates of underlying health conditions, higher likelihood of being uninsured, higher likelihood of living in vulnerable housing situations, such as for multigenerational families where it is difficult to social distance or self-isolate. They are also at increased risk for exposure if they are working in jobs that are not amenable to teleworking and require the use of public transportation (SAMSHA, 2020).

American Indians and Alaska Natives (AI/AN) are 3·4 times more likely to be hospitalized than non-Hispanic whites, and their mortality rate is 2.4 times higher for COVID-19 in the U.S., according to the CDC (CDC, 2021). They are more likely to live in overcrowded and multi-generational households, more likely to live in food deserts, a contributory factor to chronic diseases, have a higher rate of smoking compared to the general population, high unemployment rate, low internet access coverage, and suboptimal health care are worsening the impact of COVID-19 (Burki, 2021).

Pacific Islanders are at a high risk of COVID-19 as well(A Report of the Hawai‘i Advisory Committee to the U.S. Commission on Civil Rights, 2021). The pandemic highlighted challenges that existed before the pandemic, including the need for translation and interpretation resources for Medicaid eligibility, higher rates of chronic diseases, being uninsured or under-insured, employed as essential workers and in the service industry or serving in the military increasing their risk of exposure to COVID-19 and communities living in large, multigenerational households leading to often crowded conditions (A Report of the Hawai‘i Advisory Committee to the U.S. Commission on Civil Rights, 2021).

Among the IGP cohort, people with comorbidities had higher rates of COVID-19. It has been seen that low-income adults and racial minorities are more likely to have comorbidities (Waits et al., 2014). Medicaid is a major source of insurance coverage for the population in the IGP and non-IGP groups. Therefore, it is no surprise that individuals covered under Medicaid insurance have the highest rate of hospitalization.

Conclusion

As of July 15th, 2021, around 33.8 million COVID-19 cases and 605,905 deaths have taken place in the United States (Centers for Disease Control and Prevention, 2021). Identifying the disproportionately impacted populations will empower public health administrators and state authorities to better control COVID-19 mortality and morbidity and tailor the implementation of mitigating policies.

In this study, compared to the <=50 years population Utah rates for COVID-19 in 2020, both the IGP and the non-IGP cohorts had higher COVID-19 positive case rates. Females in both the IGP and the non-IGP group, American Indians/Alaska Natives in the IGP group, Blacks or African-Americans and Native Hawaiians/Pacific Islanders in both the IGP and non-IGP groups, and Hispanic/Latinos in the IGP and the non-IGP group had higher COVID-19 positive cases compared to the <=50 years Utah population. Individuals with any comorbidities in the IGP group had a higher COVID-19 positive rate compared to individuals with any comorbidities in <=50 years Utah's population.

The IGP and non-IGP cohorts had higher hospitalization rates compared to the <=50 years Utah population. Females, American Indian/Alaska Native (AI/AN), Black or African-American, and other race groups had higher rates of hospitalization for COVID-19 for both the IGP and the non-IGP cohort compared to the <= 50 years Utah population. Hispanics had a higher rate of COVID-19 hospitalization for the non-IGP cohort compared to the Hispanics of the <=50 years Utah population.

The total charges for hospitalization due to COVID-19 were higher for the non-IGP cohort. The average total charge of hospitalization due to COVID-19 in Utah in 2020 was higher than the IGP and the non-IGP cohort. The average total charges were highest among the age group of 45-50 years old, Native Hawaiian/Pacific Islanders, non-Hispanics, females, and married for the IGP group. The median charge was the highest among 35-44 years old, Native Hawaiian/Pacific Islanders, non-Hispanics, females, and legally separated people in the IGP cohort. The average total charges were highest among the age group 45-50 years old, other race group, female and unmarried for the non-IGP group. The median charge was the highest among 45-50 years old, Black or African-American, females, and widowed people in the non-IGP cohort.

Compared to the <=50 years Utah state fatality rates, the IGP, and non-IGP cohorts had higher fatality rates. Females and American Indians/Alaska Natives (AI/AN) in both the IGP and non-IGP groups had higher death rates in comparison to deaths among <=50 years females and AI/AN population in Utah.

Limitations

The IGP and the non-IGP database do not contain data for individuals above the age of 50 years. So the IGP and non-IGP cohort is compared to the Utah population database limited to <=50 years. In addition, the comorbidities and smoking status of individuals with COVID-19 are largely unknown, which might not represent the real scenario.

Policy Implication

The impact of COVID-19 on families with intergenerational poverty has compounding effects on worsening their social and economic status beyond the pandemic health-related outcomes (Shah et al., 2020; Snowden & Graaf, 2021). Literature suggests focusing COVID-19 mitigation policies on supplementing these populations aggressively with necessary resources (Dunn et al., 2020). As an example, school closures and unemployment have exacerbated the poverty conditions in these families (Dunn et al., 2020). Further food assistance funding is needed to provide adequate nutrition for newly unemployed and low-income families to cease the perpetuation of poverty (Dunn et al., 2020).

Policies in reducing intergenerational poverty's intersectional factors can increase resilience to comorbidities and lower the morbidity and mortality of future pandemics such as COVID-19 (Duque, 2020). Better employment opportunities for populations with transgenerational poverty such as the option to telework, access to paid sick leaves, access to safe housing, quality health services, access to healthy food, internet services, and education on healthy living are emphasized for consideration by policymakers (Duque, 2020). The grassroots community needs assessment manifests the need for comprehensive universal healthcare, affordable healthy housing, accommodating access to local farmers' markets, and establishing a 211-like hotline for health information (Duque, 2020).

Another important aspect of overcoming the burden of COVID-19 is a cost-effective strategy of providing better data that is essential to guide resource allocation actions. Chen & Krieger (2021) used existing surveillance data to identify an unequal social burden of COVID-19 outcomes. They suggested a policy for enhancing the generation of data by demographics in county and zip code levels. This helps guide state and local health departments in modifying resource allocation to mitigate the social inequities of COVID-19 impact (Chen & Krieger, 2021). Utah provides much of this data on coronavirus.utah.gov, the Indicator-Based Information System for Public health (ibis.health.utah.gov), and through an internal dashboard available to Local Health Departments.

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