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## Brief Communication

## Years of potential life lost secondary to COVID-19: Cook County, Illinois

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## ABSTRACT

The COVID-19 pandemic caused by the SARS-CoV-2 virus has led to substantial morbidity and mortality world-wide. Evidence suggests that ethnic and racial minorities have been disproportionately affected in the United States, particularly within major population centers. In this study, we evaluated the effect of the COVID-19 pandemic in Cook County, Illinois, and found that the rate of years of potential life lost (YPLL) was 4.8 times greater in the most affected racial group (YPLL: 2289/100,000 population in Hispanic people) than in the least affected group (YPLL: 480/100,000 population in Asian people).

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On March 11, 2020, the World Health Organization (WHO) declared COVID-19, the disease caused by the SARS-CoV-2 virus, a pandemic. Since then, SARS-CoV-2 has caused significant morbidity and mortality world-wide [1]. At the end of December 2020, more than 20 million cases of COVID-19 and 400,000 deaths were reported in the United States alone [2]. To date, the mortality rate of COVID-19 is higher among racial and ethnic minority groups, with disparities being particularly evident in large population centers and among Black people [3].

Cook County is the most populous county in the state of Illinois and has had one of the highest rates of infection and mortality in the United States [2]. The purposes of this study were to understand the years of potential life lost (YPLL) in Cook County from March 16, 2020, to December 31, 2020, and to assess for racial/ethnic differences in the population-weighted YPLL rate. The YPLL metric quantifies premature deaths and, when used in conjunction with mortality rates, is a useful way to measure the impact of a disease [4]. It is calculated by determining the number of

years lost by every individual who died before reaching a predetermined age, usually 65- or 75-year-old (YPLL<sub>65</sub> or YPLL<sub>75</sub>) [5,6]. Deaths at younger ages are weighted more heavily than deaths at older ages. The YPLL for a population is computed as the sum of all the individual YPLLs for those who died during a specific period [6].

To measure YPLL in Cook County, we downloaded mortality data from the Medical Examiner's case archive via the Cook County Open Data Portal, a publicly accessible website detailing COVID-19 morbidity and mortality in Cook County since March 16, 2020. The Medical Examiners case archive contains information about deaths that occurred in Cook County that were under the Medical Examiner's jurisdiction. The Medical Examiner's Office determines cause of death and updates this information on a daily basis [7]. We stratified the deaths by race and ethnicity then adjusted for age. Only deaths with race/ethnicity documentation were included in our analysis. Ages at which deaths occurred were grouped into residents age less than 15 years, and thereafter 10-year increments (15–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–84), up to the age of 85 years and above. The YPLL was calculated according to the formula  $YPLL = \sum (X_{ac} (75 - MP_{ac}) / P_{ac}) * S_{ac}$ . The upper reference age for calculations was set at 75-year-old and the midpoint of each age bracket (MP<sub>ac</sub>) was subtracted from 75. Each resulting value was then multiplied by the number of deaths in the cor-

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**Table 1**  
 COVID-19 related deaths, YPLL, crude, age adjusted, and YPLL rates per 100,000 population by race/ethnicity and age group for Cook County, Illinois residents.

Age group	Hispanic			Asian			Black			White			All		
	Deaths	Population	Crude Rate	Deaths	Population	Crude rate	Deaths	Population	Crude Rate	Deaths	Population	Crude rate	Deaths	Population	Crude rate
Less 15 Y	*	325,760	*	*	64,184	*	*	229,407	*	*	306,567	*	*	925,918	*
15–24 Y	*	215,421	*	*	46,692	*	*	160,400	*	*	209,427	*	18	631,940	3
25–34 Y	30	208,217	14	*	82,624	*	39	183,728	21	11	365,017	3	83	839,586	10
35–44 Y	110	196,688	56	*	67,624	*	68	144,070	47	28	290,339	10	209	698,721	30
45–54 Ye	238	162,640	146	15	52,375	29	139	149,932	93	108	271,311	40	500	636,258	79
55–64 Y	390	111,975	348	26	43,000	60	399	158,544	252	335	319,920	105	1150	633,439	182
65–74 Y	433	62,107	697	70	34,829	201	658	104,789	628	754	242,722	311	1,915	444,447	431
75–84 Y	346	26,306	1315	85	16,850	504	559	54,824	1,020	970	128,092	757	1,960	226,072	867
85 Y and above	247	10,169	2429	128	5,838	2,193	478	21,666	2,206	1385	66,748	2075	2238	104,421	2143
All	1799	1,319,283	136	331	414,016	80	2,350	1,207,360	195	3595	2,200,143	163	8075	5,140,802	157
Age adjusted rate /100,000	204			81			167			103			134		
YPLL 65															
Total Cook County population < 65	1,220,701			356,499			1,026,081			1,762,581			4,365,862		
Total deaths <65 due to COVID-19	773			48			654			485			1960		
Age adjusted per 100,000 Population (Age 65)	62			11			45			17			68		
Total YPLL65 from COVID-19	9545			580			7550			4515			22,190		
YPLL65 rate per 100,000 population	809			203			675			186			443		
YPLL65 rate ratio comparison with White as reference	3			1			3			1					
YPLL65 differences with White as reference group	5,030			-3,571			3035			0					
YPLL 75															
Total Cook County population <75	1,282,808			391,328			1,130,870			2,005,303			4,810,309		
Total deaths <75 due to COVID-19	1206			118			1312			1239			3875		
Age adjusted per 100,000 population (Age 75)	108			24			87			37			62		
Total YPLL75 from COVID-19	20,043			1469			18,036			13,755			53,303		
YPLL75 rate per 100,000 population	2289			480			1536			600			1213		
YPLL75 rate ratio comparison with White as reference	2			1			2			1					
YPLL75 differences with White as reference group	6288			-12,286			4281			0					

(1) Grand total baseline Cook County population estimate is derived from the sum of the individual race estimates.

(2) Age-Adjusted Death rate is calculated using the 2000 United States standard million population.

\* Exact numbers suppressed for cells that are less than 10 people.

responding age group ( $X_{ac}$ ) to determine YPLL. The sum of YPLL for each age bracket yielded the total YPLL for each racial/ethnic group. The race specific YPLL per 100,000 population was calculated using population data available from the 2018 United States Census Bureau American Community Survey 1-year estimates for Cook County [8].

We chose 75 years as the cutoff age because it approximates the life expectancy for Americans of both sexes and for the following reasons: (1) Persons older than 75 years, may have underlying causes of death that are difficult to determine (2) Deaths after age 75 may not be readily preventable or manageable [9]. Because YPLL is sensitive to the size of the population and differences in the age distribution for racial/ethnic groups, we calculated the YPLL<sub>65</sub> using age 65 years as the reference point for comparison. Age-adjusted death rates were calculated to control for differences in population age distributions between racial/ethnic groups in Cook County by multiplying each crude rate with the 2000 standard-million population proportion and totaling the results as outlined by Klein and Schoenborn [10,11].

Overall, 8283 Cook County residents died from COVID-19 during the study period with Black and Hispanic people accounting for 4150 (~50%) of the deaths. We excluded 204 (2.5%) deaths from analysis because of missing demographic information. Of the 8,075 deaths included in the final analysis, 1962 (24%) were aged less than 65 years and 3877 (48%) less than 75 years. For all metrics measured (crude, YPLL, age adjusted rates, rate differences, and counts), Hispanic and Black people had higher numbers when compared with White people, even though White people have a larger population. The YPLL and YPLL<sub>75</sub> rate per 100,000 population for Cook County during the study period was 53,437 and 1111 per 100,000 population compared with 22,300 and 511 per 100,000 population for YPLL<sub>65</sub>, representing a 58% and 54% change, respectively. Using White population as the reference group, the YPLL<sub>75</sub> rate ratios were 2.3, 0.6, and 2.3 for Hispanic, Asian, and Black populations compared with YPLL<sub>65</sub> rate ratios of 3.0, 0.6, and 2.9. The age-adjusted mortality rates per 100,000 populations before age 65 years was 62/100,000 for Hispanic people, 11/100,000 for Asian people, 45/100,000 for Black people, and 17/100,000 for White people. For deaths before age 75, the age-adjusted rates per 100,000 populations were 108/100,000 for Hispanic people, 24/100,000 for Asian people, 87/100,000 for Black people, and 37/100,000 for White people. For all racial/ethnic groups the YPLL<sub>75</sub> was 2 to 3 times larger than YPLL<sub>65</sub>. The race/ethnic YPLL<sub>75</sub> and YPLL<sub>65</sub> rate ratio using White people as the reference group also showed rates 2–3 times larger than those for Hispanic and Black people (Table 1).

Our findings are consistent with recent literature suggesting that racial/ethnic minorities have been disproportionately affected by the COVID-19 pandemic. Mahajan and Larkins-Pettigrew found in a nation-wide analysis of U.S. counties that positive correlations existed between (1) the percentage of Black people residing in a county and the percentage of the county diagnosed with COVID-19; (2) the percentage who died from COVID-19; and (3) the case mortality rate. Further, a negative correlation existed between the percentage of White people and each factor [12]. Reports from the City of Chicago in Cook County, suggest that Black people experienced 70% of the total COVID-19 deaths despite accounting for around 30% of the total city population [3]. Our study supports these findings by demonstrating that YPLL and age-adjusted death rates exhibit substantial racial differences in Cook County, with Black and Hispanic people being most affected as demonstrated in a similar nationwide study [13].

The underlying causes for the differential impact of COVID-19 among racial/ethnic groups are multifactorial. Numerous socioeconomic and environmental factors have contributed to higher rates of pre-existing medical comorbidities in minority communi-

ties. Higher levels of air pollutants, higher community population density, lack of hospitals in minority predominant areas, long distances to medical centers, lack of financial resources, and historical mistrust of healthcare systems have contributed not only to higher rates of co-morbid disease but also may have increased susceptibility to COVID-19 disease and mortality [13]. Socioeconomic status alone does not explain all COVID-19 racial disparities. Recent literature explores the role of stress and a term called “weathering,” or advanced aging caused by physical wear and tear from fight-or-flight responses to external stressors, especially racial discrimination. Weathering is also associated with cardiovascular disease and diabetes, 2 conditions that have been associated, in preliminary research, with elevated risk for severe COVID-19 [14].

Implicit bias and structural racism are major factors contributing to the mortality disparities noted between racial/ethnic groups. Implicit bias among healthcare professionals leads to disparities in healthcare delivery and years of inequality have systematically oppressed our country’s minority populations leading to unequal access to care and an underlying mistrust of the healthcare system. This ingrained inequality has shaped our society into one that has normalized the poorer health outcomes for minority populations [15].

At the onset of the pandemic, there was a baseline lack of recognition of health inequities as well as a delayed acknowledgment of racial, health, and economic data to predict populations at high risk of morbidity and mortality from COVID-19. Early application of that data may have provided local officials a more informed framework to provide targeted messaging to minority residents about disease prevention and mitigation that may have reduced mortality rates in these communities.

COVID-19 caused disproportionate premature loss of life and future economic activity among Black and Hispanic people. These losses have cascading negative effects on the future economic potentials for future generations. As COVID-19 continues to be at the forefront of U.S. policy discussions, and recovery efforts are initiated on national, regional, and local levels, the findings in this report may help identify communities that could benefit from increased support and screening efforts.

## Authors contributions

Daniel Lily: Conceptualization, Methodology, Original draft preparation Writing and Reviewing; Simi Akintonrin: Writing and Reviewing Original draft preparation; Larissa Unruh: Writing and Reviewing Original draft preparation; Dharmapuri Sadhana: Writing and Reviewing Original draft preparation; Kenneth Soyemi: Conceptualization, Methodology, Original draft preparation Writing, Reviewing and supervision.

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