Original Report:
COVID-19

Racial and Ethnic Disparities in COVID-19-Like Illness and Impacts of Social Distancing and Working from Home

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Objectives: To examine racial and ethnic disparities in COVID-19-like illness (CLI) during March – August 2020 in New York City, and to test effect modification by age, nativity, and working from home vs outside the home, and mediation via social distancing behavior.

Design: Analysis of the monthly Community Health Survey datasets.

Setting: New York City.

Participants: 5,305 adults living in New York City.

Methods: Prevalence of having CLI was compared among racial and ethnic groups using multivariable log-linear regression. Stratified and causal mediation analyses were conducted to test effect modification and mediation, respectively.

Main Outcome Measures: A binary indicator of having new onset of CLI in the past 30 days.

Results: Overall percentage of CLI decreased from 25% during March-May to 14% during June-August. In both periods, there was no increased prevalence of CLI among Black or Latino New Yorkers compared with White New Yorkers. However, in stratified analyses, Latino vs White New Yorkers had 2.05 times (95%CI=1.09, 3.83) higher prevalence of CLI among adults working outside the home. Mediation via social distancing was not statistically significant.

Conclusions: Excess burden of CLI among Latino adults working outside the home underscores inequitable impacts of COVID-19 in New York City. *Ethn Dis*. 2022;32(2):123-130; doi:10.18865/ed.32.2.123

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, as well as COVID-19 morbidity and death rates, have been disproportionately high among marginalized groups in the United States.[1] In New York City (NYC), surveillance data show that Black and Latino New Yorkers had COVID-19 case, hospitalization and death rates that were up to twice that of White New Yorkers during February 29–June 1, 2020.[2] These disparities in COVID-19 outcomes have underscored the fundamental role of structural racism – policies and practices shaped by racism and discrimination that create opportunity for some and foster disadvantage for others – as a root cause of health inequities in the United States.[3] In Black and Latino communities, social and economic conditions of disadvantage, such as household crowding and high levels of poverty, can elevate the risk of SARS-CoV-2 exposure and infection.[1,4-6]

In addition to existing inequities, policies to control SARS-CoV-2 infection may have exacerbated the burden of COVID-19 morbidity in these communities since the early stages of the pandemic. In NYC, the executive order to close non-essential businesses in March 2020 placed Black and Latino workers at higher risk of SARS-CoV-2 infection since they were more likely to be employed at essential businesses with limited safety measures (eg, lack of paid sick leave, limited access to personal protective equipment).[7] Recent findings from Denver, Colorado identified this occupational context as a major risk factor for excess COVID-19 morbidity and mortality among Latino residents.[8] While many jurisdictions have rapidly rolled out low-cost or free COVID-19 testing, researchers in California suggested that limited culturally sensitive community outreach led to Black persons testing at later stages of COVID-19 disease progression, contributing to

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higher COVID-19 hospitalization rates during January–April 2020.[9]

Current evidence on racial and ethnic disparities in COVID-19 morbidity in NYC is based on surveillance data of laboratory-confirmed cases with limited information about social and occupational characteristics.[2] Additional information was collected in a representative population-based survey conducted during March–April 2020 in NYC, including self-reported symptoms used to define COVID-19-like illness (CLI); however, no significant differences in CLI by race and ethnicity were observed.[10] This might reflect spread of the virus via undetected community transmission early in the pandemic before widespread implementation of mitigation measures that allowed certain groups to minimize exposure to the virus.[11] It is unknown whether this similarity in CLI in NYC persisted over time or was followed by more evident differences in CLI between racial and ethnic groups.

To better describe these gaps, we used the data from 2020 NYC Department of Health and Mental Hygiene (DOHMH) Community Health Survey to test the hypothesis that differences in CLI by race and ethnicity increased over time following the initial citywide surge in cases during March and April 2020. By examining March–August data, we attempted to measure any potential racial and ethnic differences once messaging about and implementation of mitigation measures was widespread.

Because COVID-19 cases, hospitalization and mortality rates differed by age and nativity,[2,12] and racial and ethnic disparities in COVID-19 mortality rates were amplified among younger age groups,[12,13] we tested if disparities by race and ethnicity were modified by age and nativity. In addition, given that many frontline workers did not have an option to work from home during the early stages of the pandemic and Black and Latino workers were more likely to be employed at essential businesses with limited safety measures,[7,14] we tested if racial and ethnic disparities in CLI differed by working from home vs outside the home. Lastly, we tested the hypothesis that racial and ethnic disparities in CLI are explained by an indirect pathway through social distancing behavior. We considered social distancing as a mediator because studies have examined compliance with social distancing measures as either an outcome or a mediator to explain disparities in COVID-19 outcomes by race and ethnicity, socioeconomic characteristics, and occupational characteristics.[15-17] We believe that the proposed effect modification and causal mediation analyses will improve understanding of racial and ethnic disparities in COVID-19 outcomes given that current evidence is drawn from cross-sectional and ecological studies.[12,13,15,18,19]

Methods

This study used monthly, cross-sectional COVID-19 data collected between March 20–August 31, 2020 via the phone-based NYC Community Health Survey. Information collected included demographics, new CLI symptoms within the last 30 days of interview, and exposure-related data on social distancing behavior and working from home vs outside the home. Weights were created for the final cumulative dataset (N=5,305 adults) and for each monthly dataset to account for differential selection probabilities, potential nonresponse bias, potential overlap between landline and cell phone sampling frames. Weights were further raked to make estimates representative of the NYC noninstitutionalized adult resident population using population control totals from the 2014- 2018 American Community Survey. Additional details about complex sample design and weighting for Community Health Survey and its COVID-19 questions can be found elsewhere.[10,20] For analysis by time period, the individual monthly data were combined due to small sample size (early period: March–May; later period: June–August) where month-specific weights were used for the analysis. The NYC DOHMH Institutional Review Board determined that this work, as a secondary data analysis, was exempted.

The outcome for the study was a binary indicator of having new onset of CLI in the past 30 days. CLI was determined using the Council of State and Territorial Epidemiologists interim definition of having at least two of the following self-reported symptoms: fever (measured or subjective), chills, myalgia, rigors, headache, sore throat, vomiting, diarrhea, fatigue, nasal congestion or at least one of the following self-reported symptoms: cough, shortness of breath, difficulty breathing, new olfactory or taste disorder(s).[21] We did not ask about rigors or fatigue so these symptoms were not included in the CLI definition.

The exposure variable was self-reported race and ethnicity, classified into mutually exclusive five categories (Black, Latino, Asian/Pacific Islander, White, and others); White persons were the reference group for all analyses. Race and ethnicity was considered a measure of experiences of structural racism shaped by historic and social processes, not a biologic trait. Findings from a recent study provide support that poor COVID-19 outcomes by race and ethnicity are not due to inherent biological susceptibility, but instead structural determinants that persist in Black and Latino communities.[22] This operationalization allowed us to test race and ethnicity as exposure using a counterfactual framework such as causal mediation analysis.[23]

Three variables were considered effect modifiers: 1) working from home vs outside the home; 2) nativity (born in the United States, Puerto Rico or US territories vs born outside of the United States); and 3) age (18-24, 25-44, 45-64, and ≥65 years old).

Working from home was determined by asking the following question for those who were employed: "Because of the Coronavirus or COVID-19 outbreak, have you been working [if currently employed] or before you lost your job, were you working [if lost a job because of COVID-19] mostly from home or working at a job that requires you to work outside your home?"

Social distancing was included as a potential mediator and determined by asking: "During the past 14 days, how often have you been staying at home and avoiding interacting with others outside your household aside from getting essential needs: none of the time, some of the time, most of the time, or all of the time?" We dichotomized the social distancing variable into "all or most of the time" (yes) and "none or some of the time" (no).

Additionally, respondents who reported having any symptoms in the past 30 days were asked "During the past 30 days, do you think you had the Coronavirus or COVID-19?"; participants who thought they possibly had COVID-19 were asked if they were aware of guidance to stay home and separate from others in the household and how well they thought they were able to follow it.

Lastly, we included the following individual-level covariates to account for potential confounding of racial and ethnic differences in CLI: age group, sex at birth, nativity, language of interview, number of household members, marital status, and underlying health conditions. Note that age group was not considered as a potential confounder in the regression analysis when age was tested as an effect modifier. To account for potential neighborhood-level confounding, we included a neighborhood-level poverty variable categorizing NYC ZIP code tabulation areas into 4 groups using percentage of residents whose income was below the federal poverty level according to the American Community Survey, 2014-18 low poverty [<10%]; medium poverty [10% to <20%]; high poverty [20% to <30%], very high poverty [≥30%].

Statistical Analyses

We calculated descriptive statistics to describe sociodemographic, behavioral, and clinical characteristics by race and ethnicity. We performed multivariable log-linear regression analysis to estimate racial and ethnic disparities in CLI, accounting for potential confounding. We included an interaction term between race and ethnicity and time (later vs early period) in the regression model to test if racial and ethnic disparities in CLI changed over time. We stratified data by age group, nativity, and working from home variables and repeated the regression analysis to evaluate effect modification. We performed causal mediation analysis and estimated direct and indirect effects via social distancing behaviors by drawing a directed acyclic graph and running R mediation package (Supplemental Figure 1 is available from corresponding author). Specifically, we fit two log-linear models (one with CLI as outcome; the other with social distancing behaviors as outcome) using the same set of covariates and summarized them to estimate and test indirect and direct effects via 1000 simulations. To account for complex sample design, we used survey weights and calculated robust standard errors. The indirect effect allowed us to estimate racial and ethnic disparities in CLI due to social distancing behavior. All the remaining racial and ethnic disparities in CLI were captured by the direct effect.

Statistical analyses were performed using SAS 14.1 software (Cary, NC) for data management, SUDAAN 11.0.1 software (Research Triangle Park, NC) for weighting and complex sample design adjustments, and R software 3.6.2 (Vienna, Austria) for causal mediation analysis. Statistical significance was determined using two-sided P<.05.

Results

Demographic characteristics were different across racial and ethnic groups in the NYC adult population (Supplemental Table 1 is available from corresponding author). Asian/Pacific Islander and Latino persons were less likely to be aged ≥65 years and to complete the survey in English, compared with White persons. Asian/Pacific Islander, Black, and Latino persons were more likely to be born outside of the United States, live with at least four household members, lack health insurance and employment, and live in neighborhoods with very high poverty levels, compared with White persons. For those who were employed, Black (65%) and Latino persons (74%) were more likely to work outside the home than Whites (38%). Underlying health conditions, including hypertension, diabetes, and obesity, were also higher among Black and Latino persons, compared with White persons.

The overall prevalence of self-reported CLI among NYC adults was 25% (weighted n=1,621,000) during March–May 2020, decreasing to 14% (weighted n=877,000) during June–August 2020. The age-adjusted prevalence of CLI was 27% Whites, 23% Blacks, and 28% Latinos during March–May 2020 and remained comparable across all three groups during June–August 2020 (Table 1). Overall prevalence of CLI was not different between Black or Latino and White persons after accounting for individual-level characteristics and neighborhood-level poverty (Table 2). Similar, null associations were found when each of the two time periods was examined separately. Disparities among Black or Latino vs White persons did not increase over time as interaction terms were not statistically significant (prevalence ratio [PR] for an interaction term between Black vs White persons and time = 1.03, 95%CI=.55, 1.92; PR for an interaction term between Latino vs White persons and time = 1.12, 95%CI=.69, 1.82). Asian and Pacific Islander persons had lower prevalence of CLI compared with White persons (PR=.59, 95%CI=.37, .97; Table 2).

Prevalence of CLI among Latino vs White persons was higher (PR = 2.05, 95%CI=1.09, 3.83; Table 3) for adults reporting working outside the home, whereas no such difference was found among those working from home. For those not working, lower prevalence of CLI among Black, Latino, and Asian and Pacific Islander New Yorkers vs Whites was observed and, of these, the differences for Black and Asian Pacific Islanders were statistically significant. There was no evidence for effect modification by nativity (Supplemental Table 2 is available from corresponding author) or age (Supplemental Table 3 is available from corresponding author). However, elevated burden of CLI among Latino vs White persons was observed when data were restricted to foreign-born New Yorkers working outside the home (PR=4.27, 95%CI=1.39, 13.18).

Latino persons were less likely to report that they were able to stay home and avoid contact with others outside of the home all or most of the time, compared with White persons (58% vs 71%; Supplemental Table 4 is available from corresponding author). This difference was consistent during both time periods. Black persons were also less likely than White persons to report staying home and avoiding others outside of the home during the earlier period (71% vs 82%; Supplemental Table 4). However, the indirect effect of race and ethnicity on CLI through social distancing was close to the null for all Latino respondents and

Table 1. Percentage of COVID-19-like illness by race and ethnicity among non-institutionalized adults living in New York City, March-May and June-August 2020

	March–May	June–August	All combined
	% (95%CI)	% (95%CI)	% (95%CI)
Overall	25.1 (21.7,28.9)	13.5 (11.5, 15.8)	16.6 (14.8, 18.5)
Race and ethnicity			
White	26.5 (20.9,33.0)	15.5 (11.8, 20.0)	19.3 (15.8, 23.3)
Black	23.1 (15.6, 32.7)	11.7 (7.9, 16.8)	14.6 (11.2, 18.9)
Latino	28.3 (22.3, 35.1)	16.7 (12.8, 21.4)	19.6 (16.3, 23.3)
Asian/Pacific Islanders	18.9 (11.6, 29.1)	6.5* (3.3, 12.3)	9.5 (6.3, 14.0)
Others	22.3[a] (10.8, 40.4)	16.4* (8.0, 30.8)	14.6 (8.0, 25.2)

CI, confidence interval
COVID-19-like illness (CLI) was defined by the Council of State and Territorial Epidemiologists definition[21]
All estimates are age-adjusted using United States Census 2000 population
The percentages of CLI were calculated by dividing cases broken down by race and ethnicity by corresponding racial and ethnic population counts in New York City
a. Estimate should be interpreted with caution due to large Relative Standard Error, small sample size, or wide 95%CI

Table 2. Prevalence ratio of COVID-19-like illness by race and ethnicity among non-institutionalized adults living in New York City, March-May and June-August 2020

	March–May		June–August		All combined	
	Crude	Adjusted	Crude	Adjusted	Crude	Adjusted
	Prevalence ratio (95%CI)	Prevalence ratio (95%CI)	Prevalence ratio (95%CI)	Prevalence ratio (95%CI)	Prevalence ratio (95%CI)	Prevalence ratio (95%CI)
Race and ethnicity						
White	Reference	Reference	Reference	Reference	Reference	Reference
Black	.85 (.55, 1.33)	.68 (.45, 1.04)	.82 (.52, 1.31)	.73 (.43, 1.22)	.82 (.60, 1.13)	.76 (.53, 1.09)
Latino	1.09 (.78, 1.53)	.97 (.68, 1.39)	1.15 (.79, 1.65)	1.04 (.66, 1.64)	1.09 (.84, 1.41)	1.04 (.77, 1.42)
Asian/Pacific Islanders	.74 (.43, 1.26)	.70 (.42, 1.17)	.43 (.22, .87)	.61 (.29, 1.29)	.53 (.34, .84)	.59 (.37, .97)
Others	.87 (.41, 1.82)	.78 (.40, 1.52)	1.05 (.47, 2.35)	.99 (.42, 2.30)	.81 (.43, 1.53)	.72 (.37, 1.38)

CI, confidence interval
Prevalence ratio and corresponding 95%CI were obtained from time-specific multivariable regression analyses
Covariates included age groups, sex, nativity, language, household composition, marital status, underlying health conditions, and neighborhood-level poverty
COVID-19-like illness was defined by the Council of State and Territorial Epidemiologists definition[21]

Latino respondents working outside the home (Table 4). Overall, being Latino was associated with a 15% increase in prevalence of CLI (total effect) compared with White persons, which was almost 100% explained by the direct effect. There was no evidence for indirect effects through social distancing for other racial and ethnic persons compared with White persons (Table 4). Among those who thought they had COVID-19 and lived with at least one other household member, 99% of Latino persons reported following guidance to socially isolate somewhat to very well compared with 90% of White persons (Supplemental Table 5 is available from corresponding author).

Discussion

Latino persons working outside the home in NYC experienced a higher burden of CLI than White persons during March–August 2020. Because we controlled for potential confounding, this excess burden might be attributed to the occupational context beyond individual or household characteristics or behaviors. This finding points to unequal circumstances created by the stay-at-home order that led to differential exposure to COVID-19 for essential service sector employees, a category disproportionately represented by Latino and Black persons.[5] With-

Table 3. Racial and ethnic disparities in COVID-19-like illness by working from home vs outside the home among non-institutionalized adults living in New York City, May-August 2020

	Working from home	Working outside the home	Not working
	Prevalence ratio (95%CI)	Prevalence ratio (95%CI)	Prevalence ratio (95%CI)
Race and ethnicity			
White	Reference	Reference	Reference
Black	1.24 (.60, 2.58)	1.00 (.47, 2.12)	.40 (.21, .76)
Latino	1.19 (.62, 2.26)	2.05 (1.09, 3.83)	.62 (.34, 1.14)
Asian/Pacific Islanders	1.79 (.98, 3.26)	.90 (.38, 2.13)	.22 (.07, .65)
Others	1.25 (.38, 4.12)	.04 (.004, .32)	1.44 (.71, 2.95)

CI, confidence interval
Prevalence ratio and corresponding 95%CI were obtained from multivariable regression analyses
Covariates included age groups (3 age groups), sex, nativity, language, household composition, marital status, underlying health conditions, and neighborhood-level poverty
COVID-19-like illness was defined by the Council of State and Territorial Epidemiologists definition[21]

Table 4. Estimates of indirect, direct, and total effects and proportion of total effect explained by social distancing behavior from causal mediation analysis among non-institutionalized adults living in New York City, 2020[a]

	Indirect effect	Direct effect	Total effect
	Estimates (95%CI)	Estimates (95%CI)	Estimates (95%CI)
All respondents			
Black vs White	-.001 (-.01, 0)	-.04 (-.10, .01)	-.05 (-.10, .01)
Latino vs White	-.002 (-.01, 0)	.01 (-.04, .07)	.01 (-.04, .06)
Asian/Pacific islanders vs White	.01 (-.002, .02)	-.08 (-.14, -.02)	-.08 (-.13, -.01)
Others vs White	-.0003 (-.01, .01)	-.04 (-.12, .07)	-.04 (-.11, .08)
Working outside of the home[b]			
Black vs White	.001 (-.01, .02)	.01 (-.13, .21)	.01 (-.12, .22)
Latino vs White	.001 (-.01, .02)	.15 (.002, .37)	.15 (.01, .36)
Asian/Pacific islanders vs White	.003 (-.02, .05)	.002 (-.16, .26)	.01 (-.15, .25)
Others vs White	.001 (-.02, .02)	-.15 (-.25, .04)	-.15 (-.25, .04)

CI, confidence interval
a. Direct, indirect, and total effects were expressed as an increased prevalence of COVID-19-like illness by one of race and ethnicity groups vs a reference group (White)
b. Estimates were based on cumulative Community Health Survey 2020 data, May–August 2020 since the question about working from home vs outside the home was first included in the survey in May

out a social safety net to guarantee wages and benefits during the stay-at-home order, these New Yorkers had to continue to work outside the home during a period of widespread, sustained community transmission.

Our finding that Latino persons working outside the home had higher prevalence of self-reported COVID-19-like illness supports the hypothesis that structural inequities contribute to someone developing COVID-19 symptoms. It further provides empirical evidence for the general argument that increased risk of COVID-19 among Black and Latino persons is attributed to the factors that determine who must work outside the home and travel on public transportation.[4,24]

Throughout 2020, NYC DOHMH conducted a series of rapid health opinion polls, some of which provide additional context to our study findings and support a possible explanation of occupational-related risks.[14,25] According to the March 22–23 poll, regardless of their race and ethnicity, NYC adults were taking similar precautions in their personal preparedness (eg, wearing a face mask, maintaining a distance of 6 feet in public) to prevent COVID-19. In a poll conducted April 16–23 after the closure of all non-essential business, the percentage of adults working outside of the home within the past 14 days was similar by race and ethnicity. Yet, the same poll indicated that among those working outside of the home, 68% of Latino respondents, compared with 50% of White respondents, reported being very concerned about COVID-19 safety while working outside of the home. Although we found excess burden of CLI among Latino persons who reported working outside the home, data did not support the hypothesis that Latino persons overall had a higher burden of COVID-19 or that this burden increased over time. It may be because those who had severe COVID-19 outcomes might not be able to participate in the survey as a disproportionately high number of Latino and Black New Yorkers were hospitalized during the early pandemic.[2]

Our study did not find increased prevalence of CLI among Black New Yorkers, which is unexpected given that the nationwide percentage of Black people confirmed with SARS-CoV-2 infections exceeds the percentage of Black population overall.[26] One potential explanation may be reluctance to disclose health information during the survey owing to distrust in health care systems and public health institutions. Prior experiences of racial discrimination are strongly associated with this distrust among Black Americans,[27] and a Pew Research Center survey from April 2020 indicated that Black respondents were less likely to have confidence in medical scientists than White respondents (35% vs 43%).[28] Differences in trust across racial and ethnic groups may have been further pronounced during the protests against racism and social inequities in summer 2020.[29,30] Furthermore, differences in self-reported symptoms[31] or differential recall of symptoms[32] by race and ethnicity have been described in research on other diseases. Future research is warranted to test the extent to which internal and external factors and events associated with racism could lead to underreporting symptoms.

Consistent with a recent ecological study,[17] social distancing was less likely to be reported among Latino or

Black persons compared with White persons, but it had no contribution to racial and ethnic disparities in CLI when mediation via social distancing was tested. This was determined using a counterfactual framework where bias due to confounding was accounted for in each of the pathways between exposure, outcome, and mediator. Moreover, in a subgroup analysis among people who thought they had COVID-19, 99% of Latino persons and 90% of White persons reported following social distancing guidelines - in line with DOHMH health poll data - indicating minimal difference across racial and ethnic groups in preventive actions to minimize infections. This implies that observed differences in social distancing practices across racial and ethnic groups are more likely to be a manifestation of structural inequities than of individual-level decisions. As such, efforts to counter racial and ethnic inequities in COVID-19 burden will require taking action to address inequities in social and occupational contexts.

Study Limitations

This study has several limitations. First, reporting CLI symptoms did not necessarily mean being infected with SARS-CoV-2. Although New York State influenza surveillance data indicated sporadic activity by April 2020, some individuals who reported CLI symptoms might have been infected with other respiratory pathogens.[33] Second, although data were based on self-reported responses collected via computer-assisted telephone interviews, results might have been affected by recall or social desirability bias. For example, our prevalence of having CLI was higher than that from the previous NYC research that used the same survey data.[10] This difference could be because the former assumed that everyone had equal person times whereas the latter used actual person-times as a denominator to account for differential look back time. Third, temporality was not established between variables since we analyzed monthly cross-sectional survey data. In particular, the recall period for CLI symptoms were from the past 30 days, while social distancing data were collected based on the past 14 days. Despite these limitations, the current study provided rigorous evidence on racial and ethnic disparities in COVID-19 thanks to the high-quality data collected via complex sample design. In addition, the population-representative data about sociodemographic, clinical, and COVID-19 related behaviors and practices allowed us to estimate COVID-19 trends, stratified by important factors, for the population served by the local government.

Conclusion

Our findings support the evidence that COVID-19 disparities stem from structural inequities and justify actions to strengthen the social safety net and COVID-19 prevention efforts for essential workers. For example, initiatives to supplement incomes and rent for front line workers, provision of free COVID-19 tests or vaccinations at worksites, and provision of personal protective equipment to essential businesses beyond hospitals and clinics are some actions that could reduce exposure to SARS-CoV-2 and ensure that all New Yorkers have the means to manage quarantine and isolation measures. Data on the racial and ethnic disparities in CLI are important to inform public health actions to reduce morbidity and mortality among marginalized groups in the short term and to understand the role of factors like working from home in COVID-19 prevention.

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Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: Lim, Alroy, Baquero, Crossa, Gould; Acquisition of data: Alroy, Crossa; Data analysis and interpretation: Lim, Dominianni, Alroy, Baquero, Crossa, Gould; Manuscript draft: Lim, Dominianni, Alroy, Baquero, Crossa; Statistical expertise: Lim, Dominianni, Crossa; Acquisition of funding: Gould; Administrative: Dominianni, Alroy, Baquero, Gould; Supervision: Lim, Gould

References

1. Webb Hooper M, Nápoles AM, Pérez-Stable EJ. COVID-19 and racial/ethnic disparities. *JAMA*. 2020;323(24):2466-2467. https://doi.org/10.1001/jama.2020.8598 PMID:32391864
2. Thompson CN, Baumgartner J, Pichardo C, et al. COVID-19 outbreak - New York City, February 29-June 1, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(46):1725-1729. https://doi.org/10.15585/mmwr.mm6946a2 PMID:33211680
3. Bailey ZD, Krieger N, Agénor M, Graves J, Linos N, Bassett MT. Structural racism and health inequities in the USA: evidence and interventions. *Lancet*. 2017;389(10077):1453-1463. https://doi.org/10.1016/S0140-6736(17)30569-X PMID:28402827
4. Williams DR, Cooper LA. COVID-19 and health equity—a new kind of "herd immunity." *JAMA*. 2020;323(24):2478-2480. https://doi.org/10.1001/jama.2020.8051 PMID:32391852
5. Arasteh K. Prevalence of comorbidities and

risks associated with COVID-19 among Black and Hispanic populations in New York City: an examination of the 2018 New York City Community Health Survey. *J Racial Ethn Health Disparities*. 2021;8(4):863-869. https://doi.org/10.1007/s40615-020-00844-1 PMID:32794024
6. Chen JT, Krieger N. Revealing the unequal burden of COVID-19 by income, race/ethnicity, and household crowding: US county versus zip code analyses. *J Public Health Manag Pract*. 2021;27(1)(Suppl 1, COVID-19 and Public Health: Looking Back, Moving Forward):S43-S56. https://doi.org/10.1097/PHH.0000000000001263 PMID:32956299
7. Hawkins D. Differential occupational risk for COVID-19 and other infection exposure according to race and ethnicity. *Am J Ind Med*. 2020;63(9):817-820. https://doi.org/10.1002/ajim.23145 PMID:32539166
8. Podewils LJ, Burket TL, Mettenbrink C, et al. Disproportionate incidence of COVID-19 infection, hospitalizations, and deaths among persons identifying as Hispanic or Latino—Denver, Colorado March–October 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(48):1812-1816. https://doi.org/10.15585/mmwr.mm6948a3 PMID:33270613
9. Azar KM, Shen Z, Romanelli RJ, et al. Disparities in outcomes among COVID-19 patients in a large health care system in California: study examines disparities in access and outcomes for COVID-19 patients who are members of racial and ethnic minorities and socioeconomically disadvantaged groups. *Health Aff (Millwood)*. 2020;39(7):1253-1262. https://doi.org/10.1377/hlthaff.2020.00598 PMID:32437224
10. Alroy KA, Crossa A, Dominianni C, et al. Population-based estimates of COVID-19-like illness, COVID-19 illness, and rates of case ascertainment, hospitalizations, and deaths-non-institutionalized New York City residents, March-April 2020. *Clin Infect Dis*. 2021;73(9):1707-1710. https://doi.org/10.1093/cid/ciab038
11. Dobosh K, Tiberio J, Dongchung TY, et al. Inequities in New Yorkers' experiences of the COVID-19 pandemic. New York City Department of Health and Mental Hygiene. Epi Data Brief; 2021:123:1-16.
12. Garcia E, Eckel SP, Chen Z, Li K, Gilliland FD. COVID-19 mortality in California based on death certificates: disproportionate impacts across racial/ethnic groups and nativity. *Ann Epidemiol*. 2021;58:69-75. https://doi.org/10.1016/j.annepidem.2021.03.006 PMID:33746033
13. Bassett MT, Chen JT, Krieger N. Variation in racial/ethnic disparities in COVID-19 mortality by age in the United States: A cross-sectional study. *PLoS Med*. 2020;17(10):e1003402. https://doi.org/10.1371/journal.pmed.1003402 PMID:33079941
14. Mutambudzi M, Niedwiedz C, Macdonald EB, et al. Occupation and risk of severe COVID-19: prospective cohort study of 120 075 UK Biobank participants. *Occup Environ Med*. 2020;78(5):307-314. https://doi.org/10.1136/oemed-2020-106731 PMID:33298533
15. Hu S, Luo W, Darzi A, et al. Do racial and ethnic disparities in following stay-at-home orders influence COVID-19 health outcomes? A mediation analysis approach. *PLoS One*. 2021;16(11):e0259803. https://doi.org/10.1371/journal.pone.0259803 PMID:34762685
16. Weill JA, Stigler M, Deschenes O, Springborn MR. Social distancing responses to COVID-19 emergency declarations strongly differentiated by income. *Proc Natl Acad Sci USA*. 2020;117(33):19658-19660. https://doi.org/10.1073/pnas.2009412117 PMID:32727905
17. Garnier R, Benetka JR, Kraemer J, Bansal S. Socioeconomic disparities in social distancing during the COVID-19 pandemic in the United States: an observational study. *J Med Internet Res*. 2021;23(1):e24591. https://doi.org/10.2196/24591 PMID:33351774
18. Smail E, Schneider KE, DeLong SM, et al. Health beliefs and preventive behaviors among adults during the early COVID-19 pandemic in the United States: a latent class analysis. *Prev Sci*. 2021;22(8):1013-1022. https://doi.org/10.1007/s11121-021-01273-0 PMID:34275054
19. Gibbons J. Distancing the socially distanced: Racial/ethnic composition's association with physical distancing in response to COVID-19 in the U.S. *PLoS One*. 2021;16(5):e0251960. https://doi.org/10.1371/journal.pone.0251960 PMID:34038459
20. New York City Department of Health and Mental Hygiene. Community Health Survey methodology - NYC health. 2021. Last accessed January 24, 2022 from https://www1.nyc.gov/site/doh/data/data-sets/community-health-survey-methodology.page.
21. Council of State and Territorial Epidemiologists. Update to the standardized surveillance case definition and national notification for 2019 novel coronavirus disease (COVID-19). 2020. Last accessed January 24, 2022 from https://cdn.ymaws.com/www.cste.org/resource/resmgr/ps/positionstatement2020/Interim-20-ID-02_COVID-19.pdf.
22. Ogedegbe G, Ravenell J, Adhikari S, et al. Assessment of racial/ethnic disparities in hospitalization and mortality in patients with COVID-19 in New York City. *JAMA Netw Open*. 2020;3(12):e2026881. https://doi.org/10.1001/jamanetworkopen.2020.26881 PMID:33275153
23. Kaufman JS, Cooper RS. Commentary: considerations for use of racial/ethnic classification in etiologic research. *Am J Epidemiol*. 2001;154(4):291-298. https://doi.org/10.1093/aje/154.4.291 PMID:11495850
24. Tai DBG, Shah A, Doubeni CA, Sia IG, Wieland ML. The disproportionate impact of COVID-19 on racial and ethnic minorities in the United States. *Clin Infect Dis*. 2021;72(4):703-706. https://doi.org/10.1093/cid/ciaa815 PMID:32562416
25. New York City Department of Health and Mental Hygiene. NYC Health Opinion Poll. 2020. Last accessed January 24, 2022 from https://www1.nyc.gov/site/doh/data/data-sets/health-opinion-poll.page.
26. Centers for Disease Control and Prevention. COVID-19 racial and ethnic health disparities. 2020. Last accessed December 21, 2020 from https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/racial-ethnic-disparities/index.html.
27. Armstrong K, Putt M, Halbert CH, et al. Prior experiences of racial discrimination and racial differences in health care system distrust. *Med Care*. 2013;51(2):144-150. https://doi.org/10.1097/MLR.0b013e31827310a1 PMID:23222499
28. Gramlich J, Funk C. Black Americans face higher COVID-19 risks, are more hesitant to trust medical scientists, get vaccinated. Pew Research Center. 2020. Last accessed January 24, 2022 from https://www.pewresearch.org/fact-tank/2020/06/04/black-americans-face-higher-covid-19-risks-are-more-hesitant-to-trust-medical-scientists-get-vaccinated/
29. Skewes MC, Gonzalez VM, Gameon JA, et al. Health disparities research with American Indian communities: the importance of trust and transparency. *Am J Community Psychol*. 2020;66(3-4):302-313. https://doi.org/10.1002/ajcp.12445 PMID:32652706
30. Bogart LM, Ojikutu BO, Tyagi K, et al. COVID-19 related medical mistrust, health impacts, and potential vaccine hesitancy among Black Americans Living With HIV. *J Acquir Immune Defic Syndr*. 2021;86(2):200-207. https://doi.org/10.1097/QAI.0000000000002570 PMID:33196555
31. Schnall R, Siegel K, Jia H, Olender S, Hirshfield S. Racial and socioeconomic disparities in the symptom reporting of persons living with HIV. *AIDS Care*. 2018;30(6):774-783. https://doi.org/10.1080/09540121.2017.1417532 PMID:29353489
32. Bui CN, Peng C, Mutchler JE, Burr JA. Race and ethnic group disparities in emotional distress among older adults during the COVID-19 pandemic. *Gerontologist*. 2021;61(2):262-272. https://doi.org/10.1093/geront/gnaa217 PMID:33367785
33. New York State Department of Health. Weekly influenza surveillance report. 2020. Last accessed January 24, 2022 from https://www.health.ny.gov/diseases/communicable/influenza/surveillance/2019-2020/archive/2020-04-04_flu_report.pdf