



Alarming Health Inequalities in Impoverished Black and Brown NYC Neighborhoods Impacted by COVID-19

Author: Monali Bhosle, MS, PhD, CPESN USA

HIGHLIGHTS

- In this study, we find that Black and Brown, lower income neighborhoods disproportionately impacted by the COVID-19 pandemic also have the highest rates of preventable diabetes-related amputations. These disturbing patterns uncover the underlying social and economic vulnerabilities that expose lower income communities to public health emergencies.
- NYC boroughs with the most alarming racial/ethnic disparities in COVID-19 deaths and diabetes-related amputations overwhelmingly have the highest rates of poverty.
- Proactively addressing health disparities that disproportionately affect lower income, racial/ethnic minority (majority) neighborhoods must be an *all-hands on deck* effort until these alarming inequities are eliminated.

Health inequalities are defined as “*the systematic, avoidable and unfair differences in health outcomes that can be observed between populations, between social groups within the same population or as a gradient across a population ranked by social position.*” [1] For many years, health inequalities across racial and geographic clusters have existed across the nation, due in large part to systemic racism and unequal allocation of resources. The current COVID-19 pandemic, and the disproportionate toll it has taken on communities of color, highlights these inequalities. In New York state (NY), which became a COVID-19 hotspot early in the pandemic, it became clear that socioeconomically disadvantaged minority communities were experiencing the brunt of COVID-19-related hospitalization and mortality. Census

tract data revealed COVID-19 geographic hotspots were comprised of predominantly African-American neighborhoods with high poverty rates. [2] The Bronx, a borough of neighborhoods with disproportionately higher concentrations of low-income communities of color, has been the most affected area in the state.

These trends are alarming. Evidence suggests that geographic areas with higher poverty rates and a greater concentration of minority populations have poor health care access and receive care that is of suboptimal quality. [3], [4], [5] These barriers may result in health complications that are otherwise avoidable with good preventive care. One classic example of such avoidable untoward complication is diabetes-related lower extremity amputations (LEA). While among one of the worst complications of diabetes, amputations are preventable with proper patient education, self-management, and timely and coordinated care. [6] The inclusion of amputation rates as one of the Prevention Quality Indicators measures by the Agency for Healthcare Research and Quality emphasizes that these complications can potentially be avoided with proactive team-based interventions. [7] However, factors such as social and environmental conditions, differential access to health care systems, and limited resources can act as barriers for socioeconomically disadvantaged populations to receive optimal care. [1], [3] These barriers can lead to devastating outcomes, irrespective of the disease/condition. By magnifying glaring health inequities, COVID-19 has opened the door for new opportunities to address alarming public health trends, such as disparities in diabetes-related amputations. To further

understand this phenomenon, we explored the socioeconomic disparities in amputation rates in NY.

METHODS

We compared racial and socioeconomic disparities in LEA and COVID-19 hospitalization and mortality rates using publicly available hospital and census data.

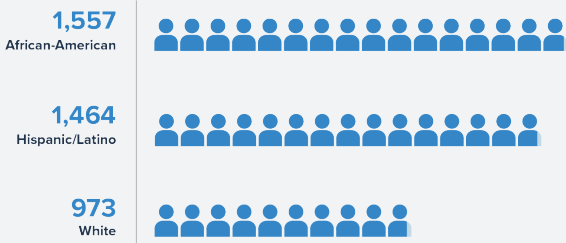
Data Sources and Definitions

Inpatient hospitalization data were obtained from the New York State Department of Health’s Statewide Planning and Research Cooperative System (SPARCS) (2016). [8] SPARCS is a comprehensive de-identified patient-level all payer data reporting system including every hospital discharge in NY. Patients with discharges for diabetes with complications and lower extremity amputation LEA procedures were identified from the SPARCS inpatient hospitalization data. We

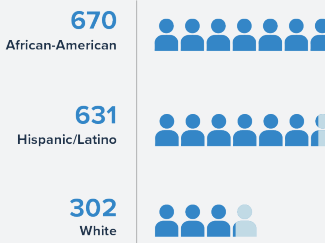
merged socioeconomic and neighborhood profiles utilizing the New York City Department of Health and Mental Hygiene (DOHMH) Bureau of Epidemiology Services interpolated intercensal population estimates from the United States (US) Census Bureau and county and ZIP code-level poverty groups with poverty status based on the 2016 American Community Survey (ACS) poverty definitions. [9] Neighborhood poverty was defined as the percent of the population with a household income below the federal poverty threshold. [10] The prevalence estimates of diabetes-related amputations were adjusted for age, gender, and Centers for Disease Control (CDC) prevalence rates of diabetes. [11] The LEA rates are reported per 100,000 hospital discharges. We obtained publicly available cumulative COVID-19 hospitalization and mortality data from the NY Health department. [12] Prevalence estimates of COVID-19 mortality and hospitalizations were adjusted for age and gender

Figure 1: COVID-19 and Diabetes Lower Extremity Amputation Rates in NY State, by Race.

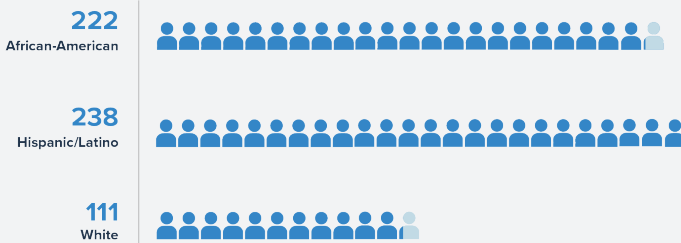
COVID-19 Infection Rate per 100,000 People



COVID-19 Hospitalization Rate per 100,000 People



COVID-19 Mortality Rate per 100,000 People



Diabetes-Prevalence Adjusted D-LEA Rate per 100,000 Hospital Discharges



Note: COVID-19 rates are adjusted for age and gender and are reported per 100,000 people. LEA rates are adjusted for age, gender, and diabetes prevalence and are reported per 100,000 hospital discharges.

and are reported per 100,000 people. We stratified the analysis by NY borough to examine patterns in diabetes-related amputations and COVID-19 mortality disparities across communities. All statistical analyses were performed using SAS® Release 9.3 (SAS Institute Inc., Cary, NC).

RESULTS

In 2016, there were 3,130 discharges in NY for diabetes-related lower leg amputations, accounting for nearly 8.9% of inpatient discharges for total diabetes-related complications. When compared across race and ethnicity, the diabetes prevalence-adjusted amputation rate for African American adults (189 per 100,000 hospital discharges) was 50% higher than for the White population (122 per 100,000 hospital discharges). For Hispanics, the rate was 40% higher than White population (162 per 100,000 hospital discharges). Furthermore, COVID-19 hospitalization and mortality rates were almost double among African American and Hispanic adults as compared to White adults.

In the neighborhood-level analyses, the amputation geographic hotspots aligned with the COVID-19 hotspots. The following illustration shows COVID-19 mortality rates and amputation rates in select NY boroughs (Figure 2). From these analyses, it is evident that health disparities have taken a disproportionate toll on the Bronx, which has been hit the hardest by COVID-19 and has the highest rates of diabetes-related amputations. When compared across area poverty levels, we found that areas with very high poverty had the highest rates of both COVID-19 mortality and amputations. Poverty and racial data for all available boroughs/counties are reported in Appendix 1.

DISCUSSION

Our study shows that preventable complications such as diabetes-related amputations are highest in areas with the highest rates of poverty and areas with a higher proportion of communities of color. In alignment with a long-standing body of disparities research demonstrating a link between lower-income areas and worse health outcomes [13], we saw starkly higher COVID-19 mortality rates among these same socioeconomically disadvantaged communities. These comparisons warrant an evaluation of current strategies used to address health inequalities and

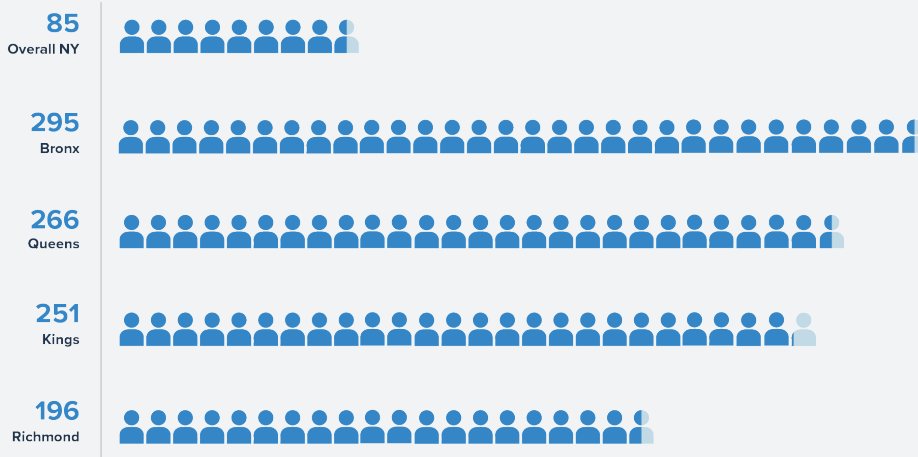
their effectiveness. Numerous research reports have identified “what” leads to health disparities, but the conversation needs to change to “how” to ameliorate and prevent them. We already know who will be hit the hardest by future health crises. While it is too late for many Americans in communities of color, many lives can still be saved, and severe health complications avoided by redirecting resources to eliminate systematic barriers to care for minority and disadvantaged populations.

The COVID-19 pandemic presents an opportunity to rethink our strategies to achieve health equity across the nation. Promising approaches may include strengthening safety net programs, creating economic opportunities, and continuously monitoring social and environmental determinants to reduce socioeconomic gaps within the population. In addition, we need better data collection [14] and complete racial/ethnicity reporting across states to better understand ongoing health trends [15]. As of December 8, 2020, the American Public Media (APM) Research Lab has compiled race/ethnicity data for 94% of COVID-19 related deaths in the US. However, considerable gaps remain in the reporting of race/ethnicity for COVID-19 related cases and deaths at the state-level. For example, Texas has only reported race/ethnicity data for 6% of confirmed COVID-19 cases (whether resulting in death or not). In regard to reporting of race/ethnicity data for COVID-19 related deaths, Wyoming has only reported race data for less than 90% of COVID-19 deaths [16]. In tandem, reporting is poor for Indigenous populations, Pacific Islanders, and other smaller sample size groups across states. These data shortcomings limit the ability to examine racial/ethnic health disparities in COVID-19 outcomes in communities that have been marginalized.

The COVID-19 crisis highlights the need for systematic monitoring of health disparities and proactive and targeted public health efforts to support low-income minority populations by addressing underlying factors that lead to higher health risks. An all-hands on deck approach is needed to address racial/ethnic and socioeconomic health inequities—during the COVID-19 pandemic and beyond—until egregious examples of injustice are no longer commonplace. Now more than ever, an effective public policy response with collaboration between communities, stakeholders, and the health care system is required to ensure that health inequalities are truly avoidable for future generations.

Figure 2: COVID-19 and Diabetes Lower Extremity Amputation Rates in NY State, by Select Boroughs.

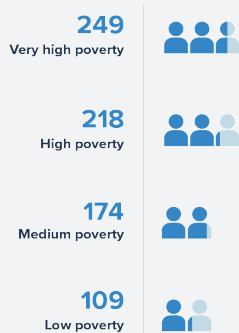
COVID-19 Mortality Rates per 100,000 People



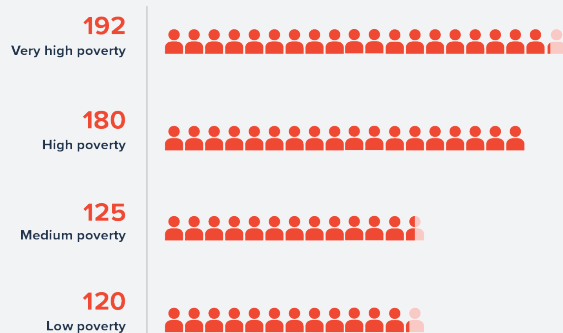
Diabetes-Prevalence Adjusted D-LEA Rates per 100,000 Hospital Discharges



COVID-19 Mortality by Poverty



D-LEA Rates by Poverty



References

- [1] McCartney G, Popham F, McMaster R, Cumbers A. Defining health and health inequalities. *Public Health*. 2019;172:22-30. <https://doi.org/10.1016/j.puhe.2019.03.023>
- [2] Adhikari S, Pantaleo NP, Feldman JM, Ogedegbe O, Thorpe L, Troxel AB. Assessment of Community-Level Disparities in Coronavirus Disease 2019 (COVID-19) Infections and Deaths in Large US Metropolitan Areas. *JAMA Netw Open*. 2020;3(7):e2016938. doi:10.1001/jamanetworkopen.2020.16938
- [3] Kevin Fiscella and Mechelle R Sanders. Racial and Ethnic Disparities in the Quality of Health Care. *Annu Rev Public Health*. 2016;37:375-394. doi: 10.1146/annurev-publhealth-032315-021439.
- [4] Glenn Firebaugh and Francesco Acciai. For blacks in America, the gap in neighborhood poverty has declined faster than segregation. *Proc Natl Acad Sci U S A*. 2016;113(47):13372-13377. doi: 10.1073/pnas.1607220113
- [5] Beyer D. Joint Economic Committee. The Economic State of Black America in 2020. Updated 11 June, 2020. Available at: <https://www.jec.senate.gov/public/index.cfm/democrats/press-releases>. Accessed 21 October 2020.
- [6] Barshes NR, Saedi S, Wrobel J, Koungias P, Kundakcioglu OE, Armstrong DG. A model to estimate cost-savings in diabetic foot ulcer prevention efforts. *J Diabetes Complications*. 2017 Apr;31(4):700-707. doi: 10.1016/j.jdiacomp.2016.12.017. Epub 2017 Jan 21.
- [7] Prevention Quality Indicators #16, Technical Specifications, Lower-Extremity Amputation among Patients with Diabetes Rate. Agency for Healthcare Quality and Research. Version 4.5, 2013 Mar. Available from: <https://www.qualityindicators.ahrq.gov/Downloads/Modules/PQI/V45/TechSpecs/PQI%2016%20Lower-Extremity%20Amputation%20Diabetes%20Rate.pdf>
- [8] Hospital Inpatient Discharges Data (SPARCS De-identified): 2016. Available at: <https://health.data.ny.gov/Health/Hospital-Inpatient-Discharges-SPARCS-De-Identified/gnzp-ekau>
- [9] The Household Pulse Survey Data Tables. US Census Bureau. Updated 28 May, 2020. Accessed May 23, 2020. <https://www.census.gov/programs-surveys/household-pulse-survey/data.html>
- [10] How the Census Bureau Measures Poverty. US Census Bureau. Updated 26 August, 2020. Accessed 21 October, 2020. Available at: <https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html>
- [11] United States Diabetes Surveillance System. Centers for Disease Control and Prevention. Available at: <https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html#>
- [12] NY Github Data Repository. Available at <https://github.com/nychealth/coronavirus-data>. Accessed June 11, 2020.
- [13] Dhruv Khullar and Dave A. Chokshi. Health, Income & PovertyL Where We Are & What Could Help. *Health Affairs*. Health Policy Brief. 2018. doi: 10.1377/hpb20180817.901935
- [14] Sara Berg. Targeting COVID-19 Inequities Requires a Data-driven Approach. *AMA*. Updated May 29, 2020. Accessed 22 October, 2020. Available at: <https://www.ama-assn.org/delivering-care/health-equity/targeting-covid-19-inequities-requires-data-driven-approach>
- [15] The Color of Coronavirus: COVID-19 Deaths by Race and Ethnicity in the U.S. *APM Research Lab*. Updated Oct 15, 2020. Accessed 10 December, 2020. Available at: <https://www.apmresearchlab.org/covid/deaths-by-race>
- [16] Racial Data Dashboard. The COVID Tracking Project. 2020. Reviewed 3 November 2020. Available at: <https://covidtracking.com/race/dashboard>.

Appendix 1:

County/borough-level poverty and racial data

County/ Borough	Total Population	% White	% Black	% American Indian	% Asian	% Native Hawaiian	% Some other race alone	% Two or more races	Below poverty %	Mean households income	Standard deviation household income	Median household income
Albany	288,865	76.56%	12.51%	0.15%	6.05%	0.05%	1.33%	3.35%	13.66%	\$ 78,877.18	\$ 26,059.70	\$ 60,904.00
Allegany	48,417	95.57%	1.49%	0.27%	1.19%	0.00%	0.44%	1.03%	17.09%	\$ 54,835.58	\$ 7,861.10	\$ 44,085.00
Bronx	1,438,753	20.56%	33.17%	0.58%	3.65%	0.05%	38.40%	3.59%	30.53%	\$ 54,530.04	\$ 20,951.72	\$ 35,302.00
Broome	201,853	86.39%	5.59%	0.21%	4.09%	0.04%	1.05%	2.64%	17.15%	\$ 63,879.62	\$ 8,508.80	\$ 47,744.00
Cattaraugus	81,605	92.08%	1.62%	2.86%	0.82%	0.00%	0.48%	2.13%	17.78%	\$ 55,244.68	\$ 8,781.06	\$ 43,884.00
Cayuga	76,355	92.14%	4.32%	0.38%	0.49%	0.00%	0.66%	2.01%	11.69%	\$ 69,629.88	\$ 9,803.04	\$ 53,114.00
Chautauqua	133,475	92.85%	2.63%	0.39%	0.62%	0.08%	1.64%	1.79%	19.31%	\$ 58,100.88	\$ 12,358.49	\$ 43,211.00
Chemung	85,881	88.31%	5.86%	0.45%	1.56%	0.01%	0.43%	3.38%	16.06%	\$ 66,121.47	\$ 12,013.36	\$ 49,578.00
Chenango	53,599	96.25%	0.90%	0.28%	0.45%	0.06%	0.49%	1.57%	15.33%	\$ 56,571.37	\$ 5,153.09	\$ 46,979.00
Clinton	80,719	91.30%	4.27%	0.20%	1.35%	0.01%	1.39%	1.48%	15.78%	\$ 62,797.17	\$ 10,489.89	\$ 50,502.00
Columbia	59,360	89.53%	4.35%	0.02%	1.90%	0.03%	1.09%	3.07%	12.79%	\$ 84,221.76	\$ 28,985.76	\$ 59,916.00
Cortland	48,913	94.20%	1.64%	0.14%	0.93%	0.04%	1.02%	2.03%	13.93%	\$ 65,131.50	\$ 16,621.10	\$ 50,910.00
Delaware	42,132	95.01%	1.93%	0.12%	0.73%	0.00%	0.74%	1.47%	15.96%	\$ 62,611.59	\$ 12,684.79	\$ 46,055.00
Dutchess	298,740	78.85%	10.36%	0.42%	3.76%	0.05%	3.44%	3.13%	9.16%	\$ 100,308.19	\$ 17,256.73	\$ 72,706.00
Erie	921,850	78.37%	13.38%	0.47%	3.32%	0.03%	2.20%	2.23%	14.71%	\$ 72,089.13	\$ 23,782.99	\$ 52,744.00
Essex	37,708	93.10%	3.09%	0.28%	0.48%	0.02%	1.25%	1.79%	11.20%	\$ 63,298.07	\$ 13,713.88	\$ 53,244.00
Franklin	53,771	82.97%	5.62%	6.95%	0.45%	0.17%	2.02%	1.81%	18.40%	\$ 62,041.60	\$ 9,924.98	\$ 49,782.00
Fulton	50,083	94.87%	1.62%	0.29%	0.70%	0.02%	0.91%	1.60%	17.16%	\$ 62,765.86	\$ 7,662.14	\$ 46,090.00
Genesee	59,245	92.35%	2.49%	1.07%	0.66%	0.00%	1.29%	2.14%	12.44%	\$ 65,939.50	\$ 5,556.01	\$ 52,641.00
Greene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hamilton	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Herkimer	60,863	96.12%	1.10%	0.20%	0.50%	0.21%	0.35%	1.51%	14.26%	\$ 60,838.47	\$ 8,077.35	\$ 48,893.00
Jefferson	119,382	86.43%	5.82%	0.53%	1.44%	0.26%	1.50%	4.02%	14.55%	\$ 67,261.62	\$ 17,147.55	\$ 49,911.00
Kings	2,606,852	43.31%	33.42%	0.33%	11.66%	0.04%	8.66%	2.57%	22.73%	\$ 76,426.57	\$ 29,046.04	\$ 50,640.00
Lewis	36,775	96.84%	0.84%	0.18%	0.45%	0.06%	0.61%	1.01%	15.08%	\$ 61,442.06	\$ 9,314.93	\$ 49,976.00
Livingston	66,765	93.31%	2.54%	0.19%	1.37%	0.03%	0.77%	1.80%	14.64%	\$ 65,744.15	\$ 12,313.37	\$ 52,724.00
Madison	67,115	94.91%	2.05%	0.58%	0.86%	0.04%	0.18%	1.38%	12.04%	\$ 65,205.57	\$ 13,557.99	\$ 55,858.00
Monroe	749,633	76.01%	15.33%	0.40%	3.58%	0.03%	1.95%	2.71%	14.85%	\$ 72,173.56	\$ 27,099.63	\$ 53,568.00
Montgomery	58,382	88.24%	2.09%	0.11%	0.74%	0.01%	6.16%	2.64%	18.59%	\$ 64,193.14	\$ 10,554.15	\$ 44,455.00
Nassau	1,369,041	69.71%	11.47%	0.23%	8.72%	0.02%	6.54%	3.32%	6.01%	\$ 150,100.58	\$ 54,397.87	\$ 102,044.00
New York	1,572,159	56.81%	14.97%	0.38%	11.78%	0.06%	11.76%	4.24%	17.55%	\$ 151,932.09	\$ 75,714.82	\$ 75,513.00
Niagara	213,109	87.88%	7.15%	1.01%	1.08%	0.04%	0.58%	2.26%	13.58%	\$ 65,481.78	\$ 14,227.53	\$ 50,094.00
Oneida	234,011	85.99%	6.10%	0.18%	3.79%	0.03%	1.45%	2.46%	16.43%	\$ 68,816.04	\$ 19,350.44	\$ 49,838.00
Onondaga	472,290	80.15%	11.11%	0.57%	3.66%	0.03%	1.11%	3.38%	15.15%	\$ 75,021.00	\$ 24,016.54	\$ 55,717.00
Ontario	106,581	93.20%	2.49%	0.38%	1.20%	0.11%	1.02%	1.60%	10.42%	\$ 70,908.80	\$ 17,155.73	\$ 58,070.00
Orange	377,335	74.85%	10.28%	0.35%	2.67%	0.02%	8.38%	3.45%	12.71%	\$ 99,496.95	\$ 21,812.83	\$ 71,910.00
Orleans	48,667	89.78%	6.26%	0.35%	0.66%	0.07%	1.13%	1.75%	14.57%	\$ 62,822.89	\$ 8,057.11	\$ 48,731.00
Oswego	123,267	95.64%	0.96%	0.16%	0.67%	0.01%	0.79%	1.77%	18.23%	\$ 64,865.61	\$ 15,951.20	\$ 49,571.00
Otsego	71,745	94.04%	1.81%	0.27%	1.22%	0.00%	0.78%	1.88%	16.44%	\$ 62,955.73	\$ 10,439.38	\$ 49,689.00
Putnam	99,754	89.53%	2.37%	0.75%	2.25%	0.02%	3.03%	2.06%	5.19%	\$ 120,442.13	\$ 22,629.00	\$ 97,606.00
Queens	2,311,382	40.54%	18.33%	0.39%	24.79%	0.05%	12.50%	3.40%	14.65%	\$ 83,008.03	\$ 17,389.43	\$ 59,758.00
Rensselaer	162,873	86.91%	6.21%	0.13%	2.46%	0.00%	0.80%	3.48%	12.23%	\$ 83,123.07	\$ 20,215.57	\$ 61,754.00

Richmond	473,324	75.09%	10.34%	0.24%	8.04%	0.05%	3.93%	2.31%	12.94%	\$ 90,355.67	\$ 15,046.43	\$ 74,021.00
Rockland	322,642	70.80%	12.58%	0.19%	6.07%	0.01%	7.94%	2.42%	14.51%	\$ 117,370.12	\$ 27,208.20	\$ 86,134.00
Saratoga	220,020	93.57%	1.59%	0.17%	2.66%	0.03%	0.45%	1.53%	6.40%	\$ 86,709.33	\$ 16,054.42	\$ 74,080.00
Schenectady	172,329	77.97%	10.00%	0.23%	4.46%	0.03%	3.52%	3.79%	11.09%	\$ 74,851.85	\$ 24,494.28	\$ 59,959.00
Schoharie	29,533	95.75%	1.54%	0.10%	0.81%	0.03%	0.36%	1.39%	14.59%	\$ 61,114.24	\$ 7,023.08	\$ 50,607.00
Schuyler	98,001	96.67%	1.05%	0.26%	0.52%	0.00%	0.11%	1.39%	15.16%	\$ 64,649.10	\$ 12,247.22	\$ 47,229.00
Seneca	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
St. Lawrence	113,045	93.13%	2.39%	0.77%	1.12%	0.04%	0.71%	1.83%	19.34%	\$ 60,791.46	\$ 11,375.59	\$ 46,313.00
Steuben	98,001	94.99%	1.53%	0.13%	1.48%	0.01%	0.30%	1.56%	15.16%	\$ 58,885.89	\$ 11,667.36	\$ 48,823.00
Suffolk	1,492,022	80.91%	7.63%	0.23%	3.79%	0.03%	4.95%	2.46%	7.26%	\$ 119,647.07	\$ 32,813.71	\$ 90,128.00
Sullivan	77,713	81.75%	8.57%	0.24%	1.58%	0.00%	3.76%	4.10%	16.91%	\$ 69,749.96	\$ 16,171.41	\$ 52,027.00
Tioga	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tompkins	105,856	80.75%	4.04%	0.29%	10.20%	0.00%	1.08%	3.64%	19.96%	\$ 77,040.40	\$ 13,002.21	\$ 54,133.00
Ulster	188,808	86.28%	5.91%	0.15%	1.94%	0.03%	1.90%	3.79%	12.75%	\$ 80,037.76	\$ 25,509.71	\$ 60,393.00
Warren	64,821	96.14%	1.15%	0.26%	0.92%	0.09%	0.28%	1.15%	11.15%	\$ 67,951.86	\$ 16,519.44	\$ 57,174.00
Washington	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wayne	95,015	93.24%	3.14%	0.18%	0.68%	0.07%	0.90%	1.80%	11.80%	\$ 63,068.56	\$ 12,096.17	\$ 51,627.00
Westchester	968,209	66.14%	14.45%	0.40%	5.71%	0.02%	10.26%	3.03%	9.80%	\$ 158,358.63	\$ 69,357.64	\$ 86,226.00
Wyoming	41,182	91.61%	5.53%	0.36%	0.34%	0.00%	0.85%	1.31%	11.69%	\$ 63,485.78	\$ 7,484.41	\$ 53,612.00
Yates	26,983	96.67%	0.82%	0.14%	0.90%	0.00%	0.45%	1.02%	14.13%	\$ 69,797.80	\$ 7,966.82	\$ 50,105.00