


Actionable Analysis: Toward a Jurisdictional Evaluation of Primary Care Access in the Community Context

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Abstract

Primary care is the foundation of health care systems and has potential to alleviate inequities in population health. We examined multiple measures of adult primary care access, health status, and socioeconomic position at the New York City Council District level—a unit of analysis both relevant to and actionable by local policymakers. The results showed significant associations between measures of primary care access and health status after adjustment for socioeconomic factors. We found that an increase of 1 provider per 10 000 people was associated with a 1% decrease in diabetes rates and a 5% decrease in rates of adults without an influenza immunization. Furthermore, higher rates of primary care providers in high-poverty districts accepted Medicaid and had Patient-Centered Medical Home recognition, increasing constituent accessibility. Our findings highlight the significant contribution of primary care access to community health; policies and resource allocation must prioritize primary care facility siting and provider recruitment in low-access areas.

Keywords

primary care access, health equity, provider availability, health status, socioeconomic position, New York City

Introduction

Primary care is the foundation of health care systems and a cornerstone of healthy, thriving communities. In the United States (US), primary care serves as a gateway to the health care system. In addition, the use of primary care services has consistently been shown to improve health outcomes and reduce health care costs.^{1,2} Conditions once managed by specialists, such as HIV and behavioral health, are increasingly managed in primary care settings due to advances in technology, clinical therapies, and recognition of best practices.^{3,4} Costs of delivering primary care are consistently lower than specialty care, and the use of preventive care reduces costs associated with later stage disease.^{5,6} However, primary care can only be effective if it is accessible. Across the US, there are notable inequities in access to care.^{7,8} Intra region and intracity disparities in access to primary care have been associated with the racial, ethnic, and socioeconomic composition of neighborhoods, perpetuating or intensifying health inequities.^{9,10}

Systematically measuring access to primary care has proven a challenge for health researchers. At present, there is a lack of common metrics and shared definitions for both primary care and access to care. Some researchers consider

primary care to be defined as care provided by a specific set of health practitioners (eg, internists, family practitioners)¹¹ while others consider primary care to be the provision of specific services (eg, immunizations, annual exams).¹ Furthermore, foundational research has defined primary care by pathways or dimensions of care, through which it positively affects health outcomes, including higher quality of care, greater focus on preventive care, and management of health conditions.^{1,12-17}

The concept of access to care is also multidimensional in nature. Factors that impact access to care include provider availability, proximity to providers and health care facilities in terms of distance and time, affordability of services, including insurance acceptance, and the bidirectional acceptability of patients and providers.^{18,19} Much of the existing research on primary care access includes only a

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single measure of access, likely due to difficulties integrating multiple data sources and metrics. Adding to this challenge, access to care is further affected by community and individual-level socioeconomic factors that are difficult to observe and measure.^{20,21} Despite its challenges, simultaneously examining multiple measures of primary care access—in conjunction with evaluation of a community's need for primary care—is critical for understanding the contribution of primary care access to health status and designing actionable strategies to address health equity.

Notable advances in epidemiologic and spatial access analysis have been made over the past decades, particularly in the use of small-area analyses. Much of the movement has been toward using smaller, often more homogenous geographic units for analysis. This approach has led to a dearth of health and socioeconomic data available at local and state political levels, which are ultimately of interest to elected officials, policymakers, and many public health officials. An over-looked consequence, as is evident by the lack of similar jurisdictional research, is few analyses designed to directly inform public health policy. The use of political boundaries in health services research may generate more policy-relevant and actionable analyses, targeted to areas with defined constituents and elected officials.²²

Our study aims to evaluate primary care access using multiple constructs and to demonstrate the application of such analyses along political boundaries at the New York City (NYC) Council District (District) level. Specifically, we aim to (1) examine measures of adult primary care access in NYC at the district level, (2) explore associations between primary care access, health status, and socioeconomic position (SEP), and (3) model health status as a function of primary care access, controlling for SEP. Finally, we provide recommendations for strengthening primary care systems using targeted data.

Methods

New York City Council Districts

The present study is an ecological analysis set within the 5 boroughs of NYC. NYC is the largest metropolitan area in the United States, with approximately 8.6 million residents in 2017.²³ The many socially and culturally diverse communities within NYC experience some of the nation's largest income inequalities; approximately 1.7 million residents (20%) reside in poverty.²⁴ The NYC Council is a legislative body representing 51 districts with jurisdiction over both the City's Department of Health and Mental Hygiene and Health and Hospitals Corporation, and is responsible for creating legislation that impacts the development and budgeting of NYC resources.

At present, few data are available by NYC Council District. To account for this and to calculate measures at the

district level, data were obtained at either the Zip Code Tabulation Area (ZCTA) or the census tract (CT) level. Data available at the ZIP Code level were first cross-walked to modified ZCTAs in NYC. For all data, a spatial overlay was used to calculate proportion of data in each ZCTA or CT that was within a Council District, and the proportion (or count) of data was then assigned to the district and summed to create totals for each district.

Primary Care Access Measures

Five measures of potential access to adult primary care were used to capture the multidimensional nature of access. We define primary care access as when a person is able to receive needed primary care services that are timely, affordable, and in a geographically proximate location. The 5 access measures were (1) number of primary care providers (PCPs) per 10 000 district adults aged 18 years and older, (2) percent of uninsured adults ages 18 to 64 years, (3) percent of PCPs accepting Medicaid, (4) percent of PCPs accepting Medicare, and (5) percent of primary care access points with Patient-Centered Medical Home (PCMH) recognition. PCMH is a model where patient care is coordinated between the patient, their primary care physician, and care teams to deliver higher quality care and achieve improved health outcomes.²⁵⁻²⁸ These 5 measures are intended to capture the primary care access dimensions of provider availability, insurance acceptance, and quality of primary care.

PCP data, including address and Medicaid and Medicare acceptance, were obtained from public and purchased datasets in 2017, including Specialized Knowledge & Applications (SK&A), the National Plan & Provider Enumeration System (NPPES), and the New York State Provider Network Data System (PNDS). A PCP was defined as a medical doctor (MD) or doctor of osteopathy (DO) with a primary specialty designation of "family practitioner," "general practitioner," or "internist." Primary care access points were defined as a location (latitude, longitude) with ≥ 1 PCP. Population and uninsured counts were obtained from the 2016 American Community Survey estimates. PCMH-recognized provider locations were obtained from the National Center for Quality Assurance (NCQA) database in April 2018.

Health Status Measures

Health status of the district adult populations was examined through health indicators intended to be reflective of primary care need or preventive care utilization. The 4 measures captured elements of health status known to be related to primary care, including chronic disease burden, preventive health care use, and mortality from chronic disease.¹

Diabetes prevalence was used as a measure of chronic disease burden at the district level. Diabetes data were

obtained from the 2015 Behavioral Risk Factors Surveillance System (BRFSS) at the census tract level through the Centers for Disease Control and Prevention (CDC) 500 Cities estimates. This measure reflects the percent of District residents that report ever being told by a doctor, nurse, or health professional that they have diabetes (excluding gestational diabetes).

Potentially preventable emergency department (ED) visits were used as a measure of both poor health status and health conditions that could be managed in a primary care setting.²⁹ ED visit data were obtained from the New York State Department of Health's 2016 Statewide Planning and Research Cooperative System (SPARCS) dataset at the ZIP Code level.

Immunization rates were measured through prevalence of flu shot/spray in the past 12 months, serving as a proxy for preventive health care usage. Flu immunization data were obtained from the NYC Community Health Survey. The data were at the ZIP Code level, 2009-2013, weighted to the NYC adult residential population per the American Community Survey (ACS).

Heart disease mortality rates were included as a measure of mortality from chronic disease. The heart disease mortality data were obtained from NYC Department of Health and Mental Hygiene's Vital Statistics SAS Microdata at the ZIP Code level, 2011-2013. Heart disease mortality rates include deaths due to acute rheumatic fever and chronic rheumatic heart diseases (ICD10 codes I00-I09), hypertensive heart disease (I11), hypertensive heart and renal disease (I13), chronic ischemic heart disease (I20, I25), acute myocardial infarction (I21-I22), cardiomyopathy (I42), and heart failure (I50).

Socioeconomic Position Measures

SEP measures included in the analysis were selected *a priori* through a review of literature to identify social and demographic factors previously associated both with access to health care and with health status. To address potential collinearity among SEP variables, we conducted preliminary correlation analysis to identify associations. We selected measures based on strongest support in the literature, with priority given to measures that represented social determinants of health. The final set of SEP measures included in the analysis were percent of residents below 100% of the Federal Poverty Level (FPL), percent of Black, non-Hispanic (NH) residents, and percent of residents aged 65 years and older. All SEP data were 2011-2016 estimates obtained from the ACS at the census tract level.

Statistical Analysis

Descriptive statistics (mean, SD) and choropleth maps were produced for all variables included in the analysis. To identify independent associations between primary care access,

health status, and SEP, bivariate correlations between all variables were examined. Data transformations for nonnormally distributed data were used to meet the assumptions of Pearson's correlation and linear regression. To model health status as a function of primary care access and SEP, 4 linear regression models were built with the 4 health status measures as the dependent variables, adjusting for potential confounding factors with the primary care access and SEP variables. Variables with a statistically significant correlation with each health status measure in bivariate analysis were included in the multivariable linear model. A backward stepwise approach was used to identify the model of best fit, using adjusted R^2 values to assess goodness of fit. The α -level was set at .05 for all analyses. Marginally significant associations at $\alpha < .10$ were reported for discussion purposes to account for potential reduction of power due to small sample size ($n = 51$). All statistical analyses were conducted in SAS 9.4 and all maps were created in ArcGIS 10.5.1.

Results

Adult primary care access varied across NYC Council Districts (Figure 1). The highest rates of PCP availability (PCPs per 10 000 people) were concentrated in Manhattan. Districts in the Bronx, North and Western Queens, and Northeastern Brooklyn had the highest uninsured rates among adults. Percentages of PCPs accepting Medicaid and Medicare also varied across the city; Medicaid acceptance among PCPs was highest in the Bronx and Central Brooklyn, and the highest Medicare acceptance was found in Eastern Brooklyn. Districts with the highest percentage of PCMH-recognized access points were distributed similarly to uninsured rates; concentrated in the Bronx, North and Western Queens, and Northeastern Brooklyn. Health status and socioeconomic position measures also displayed distinct patterns across NYC (Figures 2 and 3).

Independently, primary care access measures were associated with health status and SEP measures. Increases in PCP availability (more PCPs per 10 000 people) were associated with decreased preventable ED visits rates ($r = -0.35$, $P < .05$), diabetes prevalence ($r = -0.49$, $P < .001$), and the percent of unimmunized people ($r = -0.63$, $P < .001$; Table 1). PCP availability was negatively correlated with the percent of Black, NH residents ($r = -0.28$, $P < .05$). Uninsured rates were positively correlated with diabetes prevalence and preventable ED visits rates ($r = 0.57$, $P < .001$ and $r = 0.45$, $P < .01$, respectively) and negatively correlated with heart disease mortality rates ($r = -0.45$, $P < .01$).

Medicaid and Medicare acceptance rates among PCPs were also associated with health status and SEP indicators (Table 1). Medicaid acceptance was positively correlated with diabetes prevalence ($r = 0.48$, $P < .001$). Medicare acceptance was positively correlated with diabetes prevalence ($r = 0.41$, $P < .01$), as well as with the proportion of

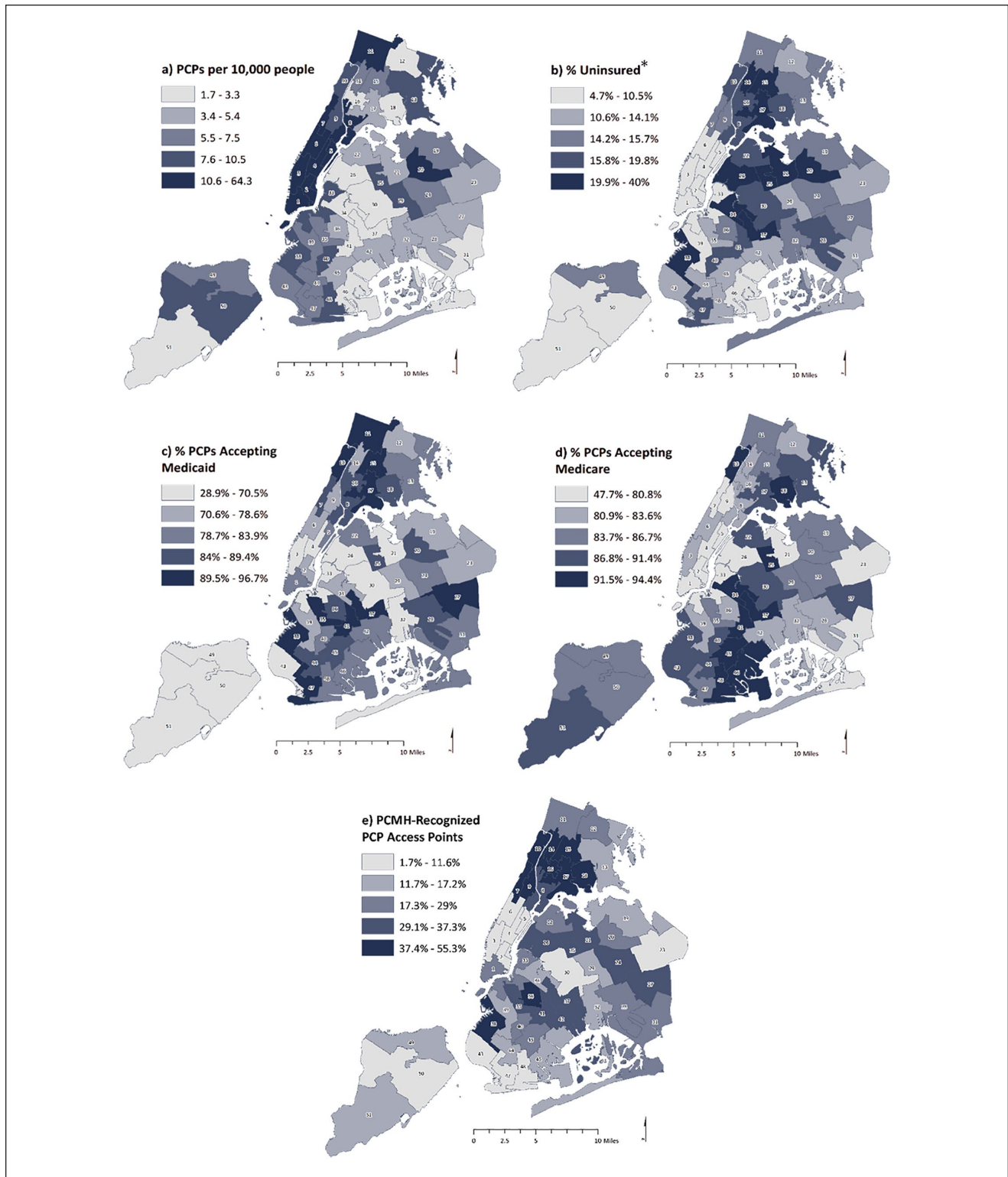


Figure 1. The distribution of primary care access measures by New York City Council District, 2016-2017.

*Represents the percent of uninsured residents aged 18 to 64 years.

Source: Authors' analysis of data from (a) Specialized Knowledge & Applications (SKA), 2016-2017, Provider Network Data System (PNDS), 2017, National Plan and Provider Enumeration System (NPPES), 2017; (b) United States Census via the American Community Survey, 2016 Estimate; (c) SKA 2016-2017, PNDS 2017, NPPES 2017; (d) SKA 2016-2017, PNDS 2017, NPPES 2017; (e) SKA 2016-2017, PNDS 2017, NPPES 2017, National Committee for Quality Assurance, 2017.

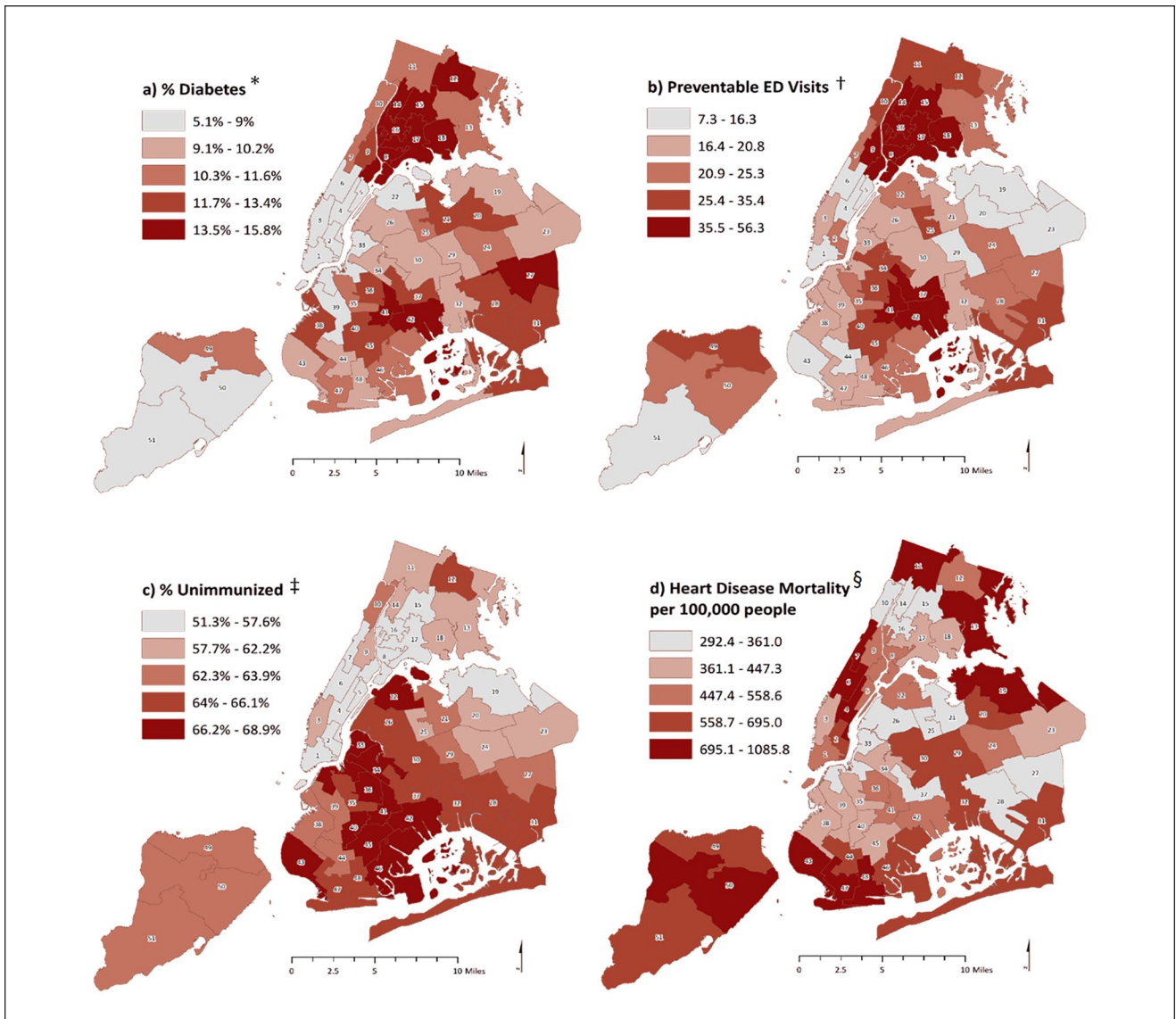


Figure 2. The distribution of health status measures by New York City Council District, 2011-2016.

*Represents the percent of adult residents ≥ 18 years who have ever been told by a doctor, nurse, or other health professional that they have diabetes other than diabetes during pregnancy.

†Represents the average number of potentially preventable emergency department (ED) visits per 100 people.

‡Represents the percent of adults who have not been immunized for influenza.

§Heart disease is defined as any of the following: acute rheumatic fever and chronic rheumatic heart disease (I00-I09), hypertensive heart disease (I11), hypertensive heart and renal disease (I13), chronic ischemic heart disease (I20, I25), acute myocardial infarction (I21-I22), cardiomyopathy (I42).

Source: Authors' analysis of data from (a) Centers for Disease Control and Prevention Behavioral Risk Factors and Surveillance System via 500 Cities Project, 2015; (b) Statewide Planning and Research Cooperative System, 2016; (c) New York City Department of Health and Mental Hygiene Community Health Survey, 2009-2013; (d) New York City Vital Statistics, 2011-2013.

unimmunized district residents ($r = 0.50$, $P < .001$). Increases in PCMH-recognized PC access points were associated with higher rates of diabetes ($r = 0.73$, $P < .001$) and potentially preventable ED visits ($r = 0.65$, $P < .001$), higher rates of poverty ($r = 0.71$, $P < .001$), lower heart disease mortality rates ($r = -0.59$, $P < .001$), and lower proportions of district residents older than 65 years ($r =$

-0.60 , $P < .001$). Correlations between health status and SEP measures were observed at the Council District level (Table 1).

The multivariable analyses indicated that many measures of primary care access remain associated with health status, after adjusting for socioeconomic position (Table 2).³⁰ Higher diabetes prevalence was associated with

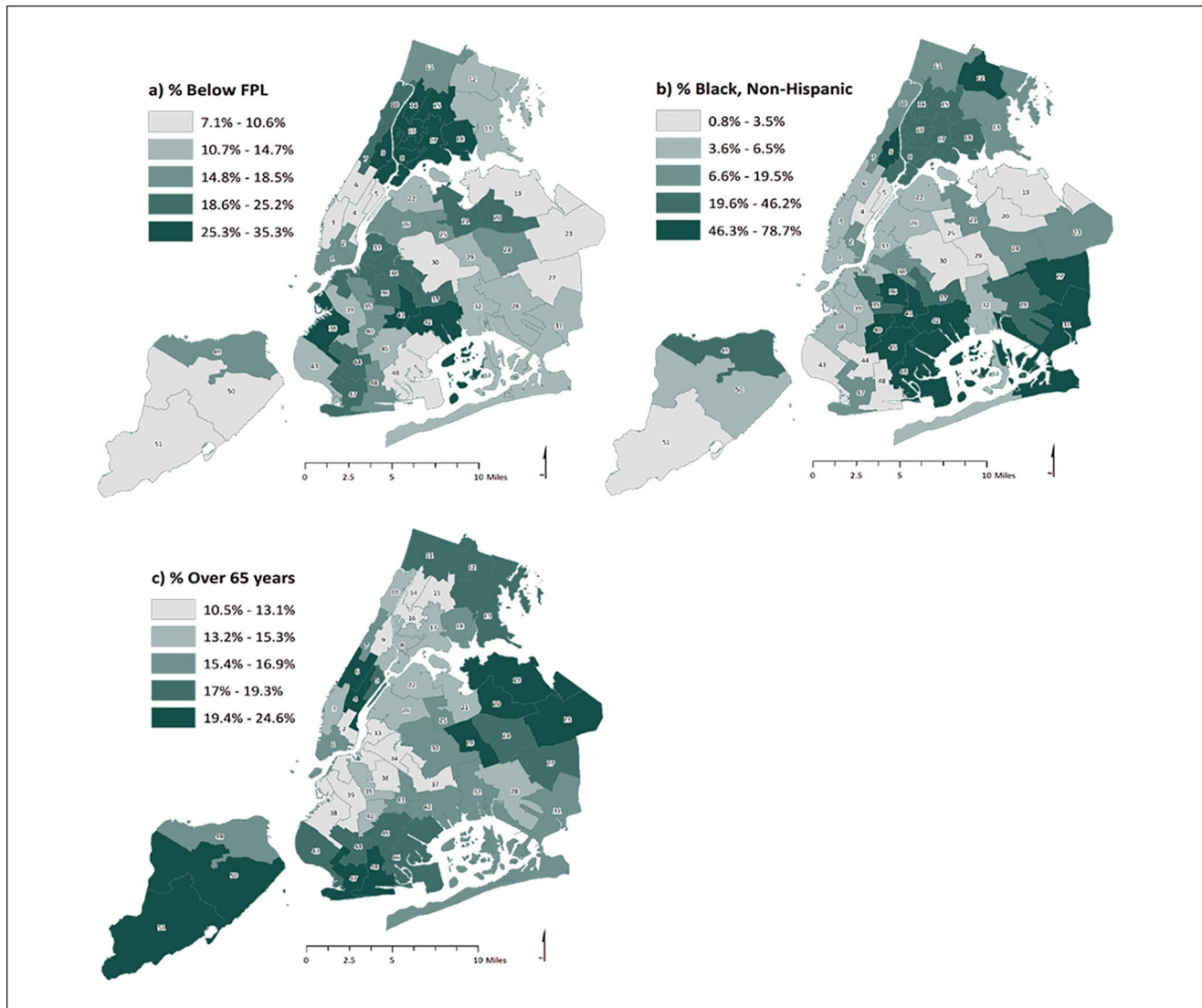


Figure 3. The distribution of socioeconomic position measures by New York City Council District, 2016.

*Represents the percent of adult residents aged ≥ 18 years with annual income below the federal poverty level in 2016 ($\leq \$11\ 880$ for an individual, $\leq \$24\ 300$ for a family of 4).

Source: Author's analysis of data from the United States Census via the American Community Survey, 2016 Estimate.

decreases in the availability of PCPs ($\beta = -0.01$, $P < .0001$) and an increase uninsured rates ($\beta = 0.13$, $P < .0001$), when controlling for socioeconomic factors. Lower potentially preventable ED rates were associated with increases in Medicaid acceptance among PCPs ($\beta = -0.43$, $P < .05$) and lower uninsured rates ($\beta = 1.54$, $P < .01$). Unimmunized rates for adults decreased with higher PCP availability ($\beta = -0.05$, $P < .0001$) and with Medicare acceptance among PCPs ($\beta = 0.19$, $P = .02$). Heart disease mortality was associated with PCMH recognition ($\beta = -3.10$, $P < .01$) and poverty ($\beta = 4.59$, $P < .05$), after adjusting for age. Both poverty and Black, NH race population proportions remained significantly associated with

diabetes, potentially preventable ED visits, and immunization rates, after adjustment.

Discussion

The present study identifies that access to primary care varies across NYC and is associated with the underlying health status and socioeconomic position of City Council District residents. Primary care access was a significant contributing factor to the health status of neighborhoods across NYC, even when adjusting for socioeconomic factors. Greater PCP availability at the district level was associated with lower rates of diabetes and potentially preventable ED rates

Table 1. Bivariate Correlations Between Measures of Primary Care Access, Health Status, and Socioeconomic Position at the New York City Council District Level.^a

Measure	1. PCPs per 10 000		2. % Uninsured		3. % PCPs Accepting Medicaid		4. % PCPs Accepting Medicare		5. % PCMH-Recognized PCP Access Points		7. Potentially Preventable ED Visits		8. % Unimmunized		9. Heart Disease Mortality Rate per 100 000 Persons		10. % Below FPL		11. % Black, Non-Hispanic		12. % Older Than 65 Years		
1.	—																						
2.	-0.36**	—																					
3.	0.02	0.34*	—																				
4.	-0.42**	0.24*	0.19	—																			
5.	-0.32*	0.60***	0.43**	0.17	—																		
6.	-0.49***	0.57***	0.48***	0.41**	0.73***	—																	
7.	-0.36*	0.36*	0.43**	0.38**	0.65***	0.77***	—																
8.	-0.63***	0.23	-0.01	0.50***	0.65***	0.77***	0.27	—															
9.	0.34*	-0.45**	-0.24*	0.01	-0.59***	-0.29*	-0.34*	-0.07	—														
10.	-0.11	0.48***	0.48***	0.20	0.71***	0.71***	0.74***	0.00	0.00	—													
11.	-0.28*	0.11	0.45**	0.11	0.51***	0.66***	0.71***	0.22	0.22	0.41**	—												
12.	0.23	-0.40**	-0.29*	-0.06	-0.61***	-0.31*	-0.60***	-0.16	-0.16	0.73***	0.73***	—											

Abbreviations: PCP, primary care provider; PCMH, patient-centered medical home; ED, emergency department; FPL, federal poverty level.

^aThe strength of correlation between any 2 measures can be found by selecting one of the measures along the column edge, then picking the second measure as the complementary row, and then finding the space where the two measures meet. Positive values indicate a positive correlation and negative values indicate a negative correlation, ranging from -1 to 1. Pearson correlations were calculated at the .05-alpha level. Source: Authors' analysis of data from Specialized Knowledge & Applications, 2016-2017; Provider Network Data System, 2017; National Plan and Provider Enumeration System, 2017; United States Census estimate via the American Community Survey, 2016; National Committee for Quality Assurance, 2017; Centers for Disease Control and Prevention Behavioral Risk Factors and Surveillance System via 500 Cities Project, 2015; Statewide Planning and Research Cooperative System, 2016; New York City Department of Health and Mental Hygiene Community Health Survey, 2009-2013; New York City Vital Statistics, 2011-2013.

*.05 < P < .10, **P < .01, ***p < .001.

Table 2. Linear Regressions Modeling Health Status as a Function of Primary Care Access and Socioeconomic Position at the New York City Council District Level.^a

Parameter	β Estimate	Standard Error	P	95% Confidence Level
<i>(a) Potentially preventable ED visits</i>				
Primary care accessibility				
% Medicaid	-0.43	0.13	<.0001	(-0.78, -0.08)
% Uninsured (18-64 years)	1.54	0.49	<.01	(0.55, 2.54)
Socioeconomic position				
% Below FPL	2.18	0.45	<.0001	(1.27, 3.09)
% Black, Non-Hispanic	0.20	0.02	<.0001	(0.15, 0.25)
Adjusted $R^2 = 0.78$				
<i>(b) Diabetes prevalence among adults</i>				
Primary care accessibility				
PCPs per 10 000 population	-0.01	0.00	<.0001	(-0.01, -0.01)
% Uninsured (18-64 years)	0.13	0.02	<.0001	(0.08, 0.17)
Socioeconomic position				
% Below FPL	0.20	0.02	<.0001	(0.16, 0.25)
% Black, Non-Hispanic	0.01	0.00	<.0001	(0.01, 0.01)
% Older than 65 years	0.31	0.04	<.0001	(0.22, 0.40)
Adjusted $R^2 = 0.90$				
<i>(c) Percent unimmunized</i>				
Primary care accessibility				
PCPs per 10 000 population	-0.05	0.01	<.0001	(-0.07, -0.02)
% PCPs accepting Medicare	0.19	0.08	.02	(0.03, 0.36)
Adjusted $R^2 = 0.54$				
<i>(d) Heart disease mortality rates per 100 000 persons</i>				
Primary care accessibility				
PCMH-recognized PCP access points	-3.10	1.44	<.01	(-6.41, -1.50)
Socioeconomic position				
% Below FPL	4.59	1.83	<.05	(1.36, 15.52)
% Older than 65 years	611.36	3.17	<.0001	(60.18, 6210.71)
Adjusted $R^2 = 0.59$				

Abbreviations: ED, emergency department; FPL, federal poverty level; PCP, primary care provider; PCMH, patient-centered medical home.

^aSource: Authors' analysis of data from Specialized Knowledge & Applications 2016-2017, Provider Network Data System, 2017, National Plan and Provider Enumeration System, 2017, United States Census, 2016 Estimate via the American Community Survey National Committee for Quality Assurance, 2017, Centers for Disease Control and Prevention Behavioral Risk Factors and Surveillance System via 500 Cities Project, 2015, Statewide Planning and Research Cooperative System, 2016, New York City Department of Health and Mental Hygiene Community Health Survey, 2009-2013, New York City Vital Statistics, 2011-2013.

and with higher immunization rates, suggesting that a sufficient supply of PCPs may help increase use of preventive care and reduce chronic disease burden. Uninsured rates were similarly associated with higher prevalence of diabetes, a finding aligned with previous research.^{30,31} Furthermore, Black, NH race remained significant in 3 of the 4 health models and poverty remained significant in all four after adjustment, underpinning sociodemographic inequities in health status and validating these associations previously found at other geographies.^{9,32}

Beyond identifying areas of disparity, our analysis highlights ways in which the primary care safety net is responsive to population needs. In NYC, the proportion of PCMH-recognized sites was greater in Council Districts with higher rates of diabetes, preventable ED visits,

poverty, and higher percentages of uninsured residents. This finding suggests that primary care practices in high-need, low-resource communities may have strategically adopted operational improvements to support population needs in the surrounding communities. In another example, the percent of PCPs accepting Medicaid was greater in districts with a higher poverty and, similarly, the percent of PCPs accepting Medicare was higher in districts with more residents older than 65 years. Thus, in many districts, public insurance types accepted by PCPs reflect constituent socioeconomic and demographic composition.

The identification of neighborhoods that simultaneously have low primary care access, poor health status, and low SEP is essential to addressing health equity. These neighborhoods must be prioritized for place-based approaches to

coordinating and delivering additional resources. Such health systems resources should include the siting or placement of new health facilities, recruitment of PCPs, and training to expand the capacity of and coordination among existing practices.

Based on our findings, we offer several recommendations aimed at strengthening primary care systems and research, ultimately to improve health equity. First, the contribution of primary care access to community health status cannot be understated. Increasing access to primary care for both people and communities is essential to improving health overall and closing the gaps in health disparities. Investment in primary care has the greatest potential for return on investment, arguably—being relatively low-cost care, while providing high yields in health outcomes.³³⁻³⁶ Second, research on primary care should consider multiple measures of access that simultaneously include measures of health status and SEP to ensure analyses adequately capture the important characteristics of populations being examined. Lastly, researchers should consider applying analyses to political units, where appropriate, to ensure research is relevant to policymakers and government officials who have influence over budgets and resource allocations. Our findings indicate that analyses conducted at a jurisdictional level do not result in the loss of established or generation of spurious associations, supporting the validation of the analyses. Information is power; it is essential that data and analyses are constructed and offered in ways that make information useful to decision makers.

Our study is subject to several limitations. Results may be subject to the ecological fallacy, whereby associations identified at the Council District level may not translate to individual level associations. Additionally, the Modifiable Area Unit Problem (MAUP) may mean that results found at the Council District level may not be found between the same factors when analyzed at another unit of geography. The primary care access measures used in our study represent potential access to care, based primarily on the locations of PCPs. We were not able to include measures of realized access (eg, utilization of services) or consumer behaviors, both of which play a role in the delivery of primary care and associations with health status and SEP. Additionally, specialties listed in one of the provider datasets used, PNDS, are self-identified by physicians and some providers may therefore be misclassified. Lastly, because of lags in data availability, the health status measures included in the analysis preceded many of the provider measure data, despite being considered the dependent variable in regression analyses. Our results are intended to be exploratory in nature—identifying where further research is warranted, and to generate discussions around the contribution of primary care to health equity.

In conclusion, the contribution of primary care access cannot be ignored in the contexts of community health and

social determinants of health. The results of our study can inform health care strategies and future research on health care access. Our study demonstrates the feasibility of conducting such analyses at a political unit. By using City Council District as the unit of analysis, findings may be presented to and discussed with city policymakers and public health officials who are directly involved in the making decisions about funding allocation and siting of health care facilities.

Declaration of Conflicting Interests

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