10 Years Later: Changes in Food Access Disparities in New Orleans since Hurricane Katrina

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ABSTRACT *Inadequate access to healthy food is a problem in many urban neighborhoods, particularly for racial-ethnic minorities and low-income groups who are more likely to reside in food deserts. Although substantial research throughout the country has documented the existence of these disparities, few studies have focused on how this access changes over time or is affected by environmental shocks. This study examined citywide supermarket access in New Orleans as well as racial-ethnic disparities in this access, prior to Hurricane Katrina and at three times afterwards. On-the-ground verification of supermarket locations was conducted in 2004–2005, 2007, 2009, and 2014 and was mapped with secondary demographic data. Census tracts were defined as predominantly African-American neighborhoods if 80 % or more of the population identified as such. HLM Poisson regression analyses were conducted in 2014 to identify the difference in likelihood of finding supermarkets in a neighborhood by race-ethnicity and across all years of interest. Racial-ethnic disparities existed before the storm and worsened after it (IRR=0.35; 95 % CI=0.21, 0.60). Improvements in disparities to pre-storm levels were not seen until 2009, 4 years after the storm. By 2014, supermarket access, on average, was not significantly different in African-American neighborhoods than in others (IRR=0.90; 95 % CI=0.65, 1.26). The slow recovery of New Orleans' retail food infrastructure after Hurricane Katrina highlights the need for an increased focus on long-term planning to address disparities, especially those that may be exaggerated by shocks.*

INTRODUCTION

The retail food environment is important for enabling a population's consumption of a healthy diet. Unfortunately, disparities in geographic food access are commonplace in the USA, particularly in urban settings.¹ Despite a number of recommendations from authoritative sources to improve such environments,^{2–4} disparities have persisted, and little is known about how they might change over time. Only a few studies have examined changes in the retail food landscape, highlighting differences over time across socioeconomic and demographic factors.^{5–7} Even less studied is the recovery of an urban community's retail food infrastructure after disaster. Understanding the evolution of changes after severe weather events is important for policy and planning, especially given the increase in such events. Five years after the storm, an evaluation of the changes in food

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access in New Orleans investigated short-term changes to the food environment.⁸ As the city nears the 10-year anniversary of Hurricane Katrina, this study uses similar methods to better understand long-term changes in the food environment, including changes in racial-ethnic disparities in food access.

METHODS

The number of supermarkets per neighborhood served as the measure of food access, and the racial-ethnic makeup of these neighborhoods was used to document disparities. All supermarkets in the City of New Orleans were mapped, starting with existing directories and followed by on-the-ground verification, at four points in time—prior to Hurricane Katrina in 2004–2005 and after it in 2007, 2009, and 2014.

Consistent with previous research in New Orleans, “census-tract neighborhoods” were defined as the area within a 2-km buffer along the network of streets from the center point of a census tract.^{8,9} This approach enabled the use of census-based data to describe demographic characteristics but also allows for the possibility that residents shop beyond tract borders. Tract boundaries and race and population density data from the 2000 Census¹⁰ were used for the pre-Katrina baseline. Subsequent tract-level data were obtained from the Environmental Systems Research Institute,^{11–13} which uses complex demographic algorithms to make population estimates. To account for changes in census tracts between the 2000 and 2010 censuses, demographic data from the 2014 observation were normalized to the 2000 census tract boundaries using the reverse crosswalk provided by the Longitudinal Tract Database.^{14,15} Although most New Orleans tract boundaries did not change, this approach accounted for any tract splits, consolidations, or minor changes that did occur. Census tracts were defined as predominately African-American if 80 % or more of the population identified as such.

Statistical Analysis

Poisson regression analysis was conducted to identify the difference in likelihood of finding supermarkets in a neighborhood by race ethnicity. Dummy variables were created to distinguish each year, with the baseline (2004–2005) as the reference. An interaction term was created by multiplying the race variable with each year indicator. To account for potential influence of population density on supermarket placement, all models controlled for this. Statistical analysis was conducted in 2014 using StataMP 12.0.¹⁶ Human subjects were not involved in this study.

RESULTS

Descriptive data on demographic characteristics and supermarket access of the census-tract neighborhoods is displayed in Table 1. Population size in 2014 had still not recovered to pre-Katrina levels. Population density was higher in predominantly African-American neighborhoods before the storm, but the opposite was true after the storm.

The number of supermarkets dropped precipitously after Katrina, from 31 in 2004–2005 to 15 in 2007 (data not shown). Diminished neighborhood access to a supermarket was a citywide phenomenon, with residents in 2007 about 43 % less likely to have access to an additional supermarket than before the storm (Table 2, model 1: IRR=0.57; 95 % CI=0.44, 0.73). By 2009, access had improved, though not to pre-Katrina levels. In 2014, citywide neighborhood access to supermarkets exceeded 2004–2005 levels (IRR=1.33; 95 % CI=1.10, 1.61).

TABLE 1 Demographic and food access characteristics of census-tract neighborhoods by racial composition, New Orleans, LA (N=177)

	2004–2005		2007		2009		2014	
	African-American n=82	Racially mixed n=95	African-American n=85	Racially mixed n=92	African-American n=92	Racially mixed n=85	African-American n=77	Racially mixed n=100
	Mean (SD) or %		Mean (SD) or %		Mean (SD) or %		Mean (SD) or %	
Demographic characteristic								
Population size	2936 (1709)	2522						
(1616)	1161 (797)	1795 (1475)*	1736 (1107)	1944 (1352)	2218 (1731)	2118 (1343)		
Population density, pop/km ²	4383 (2478)	3087 (1661)*	1860 (1410)	2408 (1748)*	2538 (1760)	2735 (1702)	2566 (1429)	3015 (1550)*
African-American, % ^a	92.0 (5.7)	37.7 (26.1)	92.3 (6.0)	37.0 (25.5)	93.6 (5.1)	41.4 (26.6)	90.9 (4.6)	36.6 (25.1)
Neighborhood food access								
Supermarkets/ neighborhood	1.1 (1.1)	1.5 (1.4)*	0.2 (0.5)	0.9 (1.3)*	0.6 (0.8)	1.2 (1.2)*	1.2 (1.1)	1.7 (1.4)*
Supermarkets/10,000 people	5.0 (6.0)	9.4 (13.3)*	2.1 (5.0)	6.5 (12.9)*	4.3 (5.5)	7.2 (7.3)*	10.1 (24.8)	11.9 (17.2)
Frequency distribution ^b								
No supermarkets	37.8 %	32.6 %	80.0 %	55.4 %	50.0 %	38.8 %	36.4	25.0
One supermarket	31.7 %	22.1 %	16.5 %	19.6 %	41.3 %	27.1 %	24.7	24.0
>1 supermarket	30.5 %	45.3 %	3.5 %	25.0 %	8.7 %	34.1 %	39.0	51.0

*p<0.05

^aPercentage of African-Americans in a tract, averaged across all tracts in a category. Statistical test not performed because differences were by design, i.e., based on construction of tract categories (AA tract if percent of African Americans >80 %)

^bPercent of neighborhoods in each supermarket access category. The distribution of neighborhoods by supermarket access category is significantly different (p<0.05) between African-American neighborhoods and racially mixed neighborhoods in 2007 and 2009

TABLE 2 HLM Poisson regression results on disparities in store access over time, New Orleans, LA

	Model I ^a		Model II ^b	
	IRR	95 % CI	IRR	95 % CI
Time period				
Pre-Katrina, 2004–2005 (reference)	1.00	1.00	1.00	1.00
Post-Katrina I, 2007	0.57	0.44–0.73	0.67	0.50–0.88
Post-Katrina II, 2009	0.81	0.65–1.00	0.83	0.64–1.07
Post-Katrina III, 2014	1.33	1.10–1.61	1.18	0.94–1.48
Neighborhood				
Racially mixed (reference)	–	–	1.00	1.00
African-American	–	–	0.65	0.45–0.94
Neighborhood interactions × time				
African-American × post-Katrina I	–	–	0.54	0.30–0.96
African-American × post-Katrina II	–	–	0.98	0.63–1.52
African-American × post-Katrina III	–	–	1.38	0.93–2.07
Summary of model II results: neighborhood disparity by time period ^c				
African-American vs. mixed, pre-Katrina			0.65	0.45–0.94
African-American vs. mixed, post-Katrina I			0.35	0.21–0.60
African-American vs. mixed, post-Katrina II			0.64	0.43–0.94
African-American vs. mixed, post-Katrina III			0.90	0.65–1.26

Model results control for population density (pop/km²)

IRR incidence rate ratio, CI confidence interval

^aModel I controls only for the time period, providing evidence of overall citywide changes in supermarket access between baseline (pre-Katrina) and follow-up times (post-Katrina). It does not consider disparities in access. Dashes are placed in cells under model I for variables that were not included in this model

^bModel II is the complete model. It provides evidence of differences in supermarket access over time, by neighborhood racial makeup, and by interactions between the two

^cIRRs presented in this section of the table are based on the model II estimations and report differences between African-American and racially mixed neighborhoods for each time period. They include intercept as well as interaction effects into one rate

The results of the analysis on access by racial-ethnic composition of neighborhoods (Table 2, model 2) showed that fewer supermarkets were located in predominantly African-American neighborhoods than in other neighborhoods prior to Hurricane Katrina (IRR=0.65; 95 % CI=0.45, 0.94). Disparities by race-ethnicity worsened immediately after the storm. In 2007, residents of African-American tracts were 65 % less likely to have an additional supermarket in their neighborhood than were residents of other neighborhoods (IRR=0.35; 95 % CI=0.21, 0.60). By 2009, the disparities in access remained but had improved to pre-Katrina levels. In 2014, mean access to a supermarket was not significantly lower in predominately African-American neighborhoods compared to other neighborhoods (IRR=0.90; 95 % CI=0.65, 1.26).

DISCUSSION

Racial disparities in food access existed pre-Katrina, and they worsened after the storm. Not until 2009 did the disparities in access return to pre-storm levels. By

2014, nearly 10 years after the storm, supermarket access, on average, was not significantly different in African-American neighborhoods than in others.

Food access is a complex phenomenon involving geographic and economic factors.¹⁷ This study did not investigate the type of supermarket, the quality of contents inside these stores, other means of food provisioning (e.g., small stores, farmer's markets, or community gardens), or transportation. Still, supermarket distribution provides a reasonable proxy for an urban community's retail food access.

Of the stores that remained closed after Katrina, the vast majority were replaced by new retailers. These improvements were likely due to a mix of private and public investments. The city's Fresh Food Retailer Initiative^{18,19} consciously sought to foster neighborhood development through investments that would make food access more equitable, and two supermarkets funded through this program opened in 2014. But the program was not enacted until 2011, 6 years after the storm, so previous improvements were limited to private investments. More work is needed in understanding the impact on health disparities that might have resulted from such developments, in addressing those disparities that still remain and in mitigating the effects of future shocks on disparities.

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