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Racial Disparities in Access to Community Water Supply Service in Wake County, North Carolina

Jacqueline MacDonald Gibson
University of North Carolina at Chapel Hill, jackie.macdonald@unc.edu

Nicholas DeFelice
University of North Carolina at Chapel Hill, ndefelice@gmail.com

Daniel Sebastian
University of North Carolina at Chapel Hill, dsebasti@live.unc.edu

Hannah Leker
University of North Carolina at Chapel Hill, hleker@live.unc.edu

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Racial Disparities in Access to Community Water Supply Service in Wake County, North Carolina

Abstract

Anecdotal evidence suggests that historically African American communities on the fringes of cities and towns in North Carolina have been systematically denied access to municipal drinking water service. This paper presents the first statistical analysis of the role of race in determining water access in these fringe areas, known as extraterritorial jurisdictions. Using publicly available property tax data, we quantified the percentage of residences with municipal water service in each census block in Wake County (the second-largest by population in North Carolina). Using the resulting water service maps plus 2010 U.S. Census data, we employed a logistic regression to assess whether race is a significant predictor of water service access in census blocks within extraterritorial jurisdictions when controlling for property value and population density. We find that every 10% increase in the African American population proportion within a census block increases the odds of exclusion from municipal water service by 3.8% ($p<0.05$). These results suggest the need for follow-up research to explore the resulting health implications, especially because previous studies have shown that the private wells upon which such communities rely for potable water are at elevated risk of contamination from leaking septic tanks and other sources.

Keywords

drinking water, disparities, public health services

Cover Page Footnote

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The advent of community water service was one of the greatest public health advances of the twentieth century, yet there is evidence that minority communities on the fringes of cities and towns across North Carolina lack this core public health service. This disparity is a legacy of racial segregation. North Carolina law allows cities to exercise powers of planning and development in areas known as "extra-territorial jurisdictions" (ETJs) that extend as far as three miles beyond city limits.[†] Historically, many cities and towns drew their boundaries to exclude African American neighborhoods from city limits while encompassing them within ETJs over which majority white town councils retained control—a practice known as "racial underbounding."[1,2] These underbounded communities were denied access to basic municipal services, including water and sanitation service, and the legacy of these practices persists. This study is the first to systematically examine the role of race in access to municipal water service in in North Carolina ETJs. We combined county tax records, maps of jurisdictional boundaries, and U.S. Census data to map African American neighborhoods in ETJs in Wake County (the state's second-largest county by population) and characterize their access to community water service. We find that access to water service is significantly lower in African American neighborhoods than in other ETJ neighborhoods. Given the important role of clean drinking water in protecting public health, public health practitioners should play a role in advocating for the extension of water services into these underserved communities.

METHODS

U.S. Census blocks within ETJs of Wake County municipalities were identified from the Wake County Geographic Information Systems Division. For each such census block, county tax records from the year 2008 were obtained from the Wake County Division of Revenue. Using these tax records, in each census block, the percentage of homes served by municipal water supplies was calculated, and median residential property values were estimated. Racial composition and population density within each block were obtained for the year 2010 from the U.S. Census. In total, 2,105 census blocks in Wake County are located within ETJs. However, 538 of these blocks are unpopulated and so were excluded from the analysis. Hence, the units of analysis were the remaining 1,567 census blocks. Blocks were coded as 1 if all households within them lacked water service and as 0 otherwise. To assess the relationship between race and water service access, a logistic regression was run with the 0-1 coding of water service availability as the dependent variable and percent black, median property value, and population density as the independent variables. All statistical analyses were conducted in *R* using a significance level of 0.05.

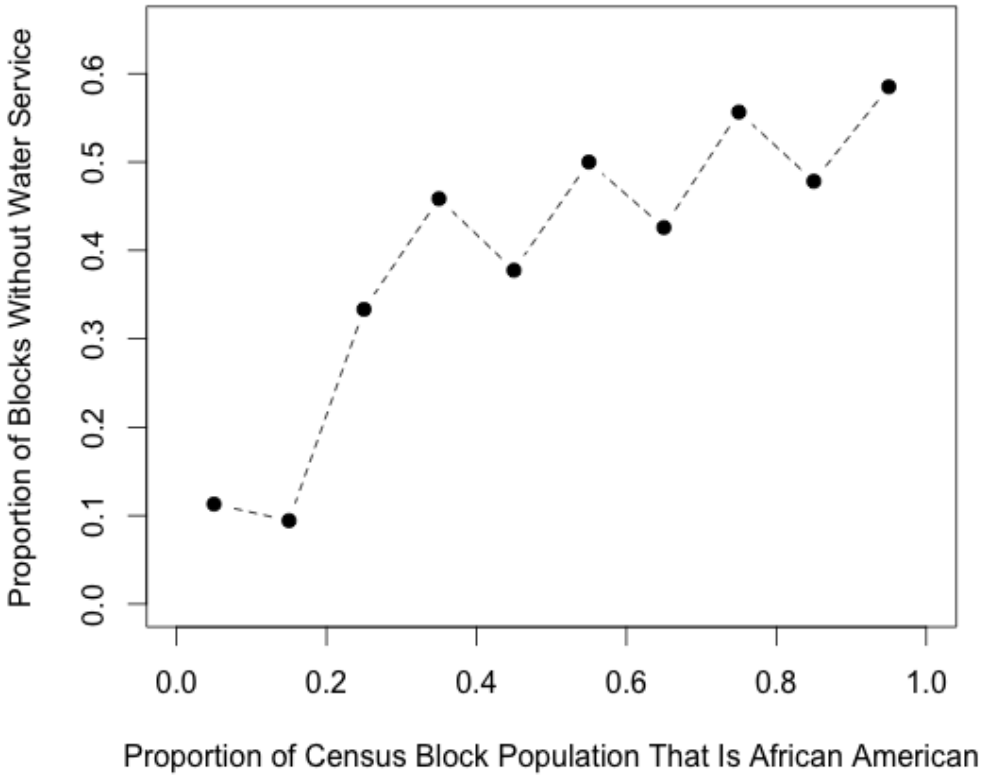
RESULTS

Results for Wake County support the hypothesis that race may play a role in access to community water service in areas at the fringes of North Carolina towns and cities. Controlling for property value and population density, every 10% increase in the African American population proportion

[†] North Carolina General Assembly, Article 19, Chapter 160A-360, Planning and Regulation of Development.

increases the odds of being without water service by about 3.8% (exp(β) for logistic regression =1.5, $p<0.05$). **Figure 1** shows the relationship between access to community water service and African American population percentage in census blocks within Wake County ETJs. The horizontal axis shows the racial composition of the census blocks, and the vertical axis shows the percentage of census blocks without community water access. As the figure illustrates, access to water decreases as the African American portion of the population increases.

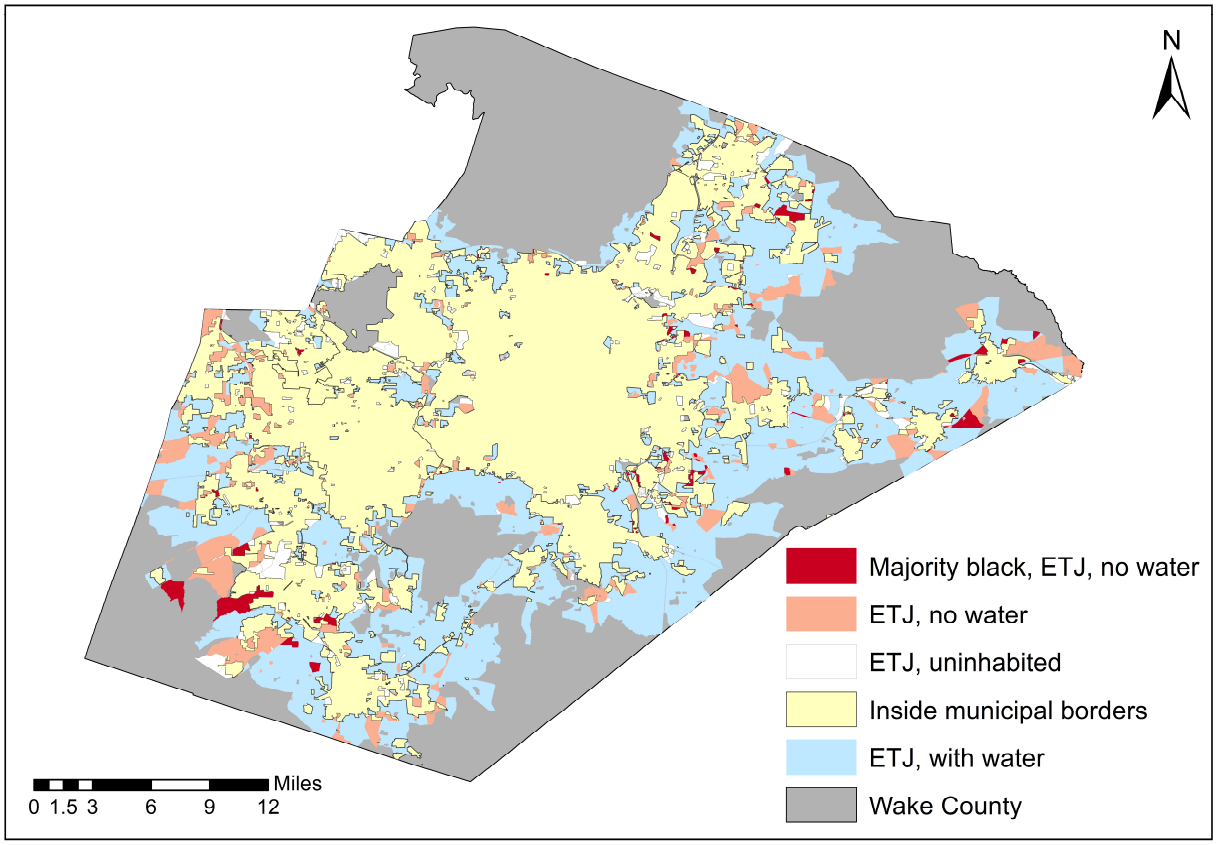
Figure 1: Percentage of Wake County Census Blocks Lacking Community Water Service as a Function of Racial Composition



In total, about 11,300 residents of Wake County ETJs lack access to community water service—12.6% of the total ETJ population of 89,600. About 6,610 residents of the ETJs (7.3% of the total population) live in majority African American neighborhoods, and about 1,220 (18.4%) residents of these African American communities lack water service.

Figure 2 maps the locations of under-served ETJ communities with majority African American populations. As shown, these communities (shaded in red) are at the edges of neighborhoods with full access to municipal water service (shaded in yellow or light blue). Some unserved African American neighborhoods are completely enclosed by municipal boundaries. Further, in some cases, municipal boundaries bypass African American neighborhoods at the edge of town, extending to more distant communities that are not adjacent to town borders. Services are provided to these distant outposts but not to the underbounded African American neighborhoods. Notably, some ETJ census blocks that are not majority African American also lack municipal water service. Nonetheless, the odds of being excluded from water service are significantly higher in African American than in non-majority-African American communities.

Figure 2: Wake County, NC, ETJ Census Blocks Without Community Water Service



IMPLICATIONS

Numerous recent studies suggest that the increasing disparities in health between people of color and white Americans are linked to the physical and social environments under the traditional domains of planning and civil/environmental engineering.[3] This research reveals a disparity in the physical environment—access to treated municipal drinking water—that potentially could contribute to observed racial disparities in health in Wake County. For example, the infant mortality rate among Wake County African Americans is more than three times that among white residents, and the death rate from all causes among African Americans is more than 30% greater than among whites. Previous evidence suggests that the private wells upon which these communities rely are at risk of contamination. For example, a study of an underbounded community in nearby Orange County found that 9 of 11 wells exceeded drinking water guideline values from the U.S. Environmental Protection Agency for at least one contaminant.[4] Furthermore, these areas also lack municipal sewer service and therefore rely on septic systems. A survey of 45 septic systems in the same Orange County community found that only 47% complied with guidelines for septic system performance.[4] Failing systems in close proximity to private wells place residents at risk of exposure to fecal pathogens and chemical contaminants from septage. While further research is needed to document how lack of municipal water service affects health in ETJs, the evidence of well water contamination and septic system failures in these communities suggests a potential link between water service disparities and observed health disparities.

Decisions about extending water service traditionally are made by local governments and local utility providers. However, public health practitioners in Wake County (and in the North Carolina Division of Public Health) could use information such as presented in this study to encourage a new dialogue with local water utilities and governments about options for extending municipal water service into these unserved areas. Historically, public health practitioners played a critical role in persuading municipalities to adopt water treatment systems. As Cutler and Miller observe, "early sanitarians fought uphill battles for many years or even decades to persuade city councils to take action against poor water quality."[5] Despite the ultimate victories, some citizens, such as the communities documented in this research, were left behind.

As Figure 2 illustrates, the communities considered in this research are located within a short distance of areas that are fully served by public water supplies. Hence, it should be possible to connect these communities to existing municipal water lines. Cutler and Miller estimated that the social rate of return on historic investments in water treatment systems for municipalities exceeded 23 to 1, with a cost per life-year saved of about $500 in 2003 dollars.[5] The close proximity of underbounded minority communities to existing municipal water treatment systems, along with the historic evidence of the high rates of return on connecting populations to treated municipal water supplies, suggests that the benefits of extending water service could far exceed the costs, if public health is taken into consideration.

SUMMARY BOX:

What is Already Known about This Topic? Previous anecdotal evidence suggests that African American communities at the fringes of North Carolina towns and cities—in areas known as "extra-territorial jurisdictions" (ETJs)—have been denied access to nearby municipal services, including connections to municipal water supply systems. These communities rely on private wells. Evidence of well contamination from failing septic systems and other sources suggests that some ETJ communities are at risk of adverse health effects from consuming contaminated water.

What is Added by this Report? This report provides the first systematic identification of communities in ETJs in Wake County, North Carolina, lacking access to municipal water service. It provides the first statistical analysis of the role of race in access to municipal water service in these areas and reveals that African American communities are significantly less likely than white communities to be connected to a municipal water supply system.

What are the Implications for Public Health Practice, Policy, and Research? Public health practitioners in North Carolina can use the information in this report to advocate for the elimination of disparities in access to municipal water services in communities within ETJs of cities and towns.

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