Title

This Ain’t Yo Laboratory: Centering Home to Examine the Relationship Between Racial Residential Segregation, Medical Underservice, and Community Health Center Expansion Nationally and Locally

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Publication Date

2022

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA

Los Angeles

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A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Health Policy and Management

by

Natalie J. Bradford

2022

ABSTRACT OF THE DISSERTATION

This Ain't Yo Laboratory: Centering Home to Examine the Relationship Between Racial Residential Segregation, Medical Underservice, and Community Health Center Expansion Nationally and Locally

by

Natalie J. Bradford

Doctor of Philosophy in Health Policy and Management

University of California, Los Angeles, 2022

Professor Ninez A. Ponce, Co-Chair

Professor Chandra L. Ford, Co-Chair

Background: The first community health centers (CHCs) were created to address the lack of health care services in segregated Black communities, but little research has empirically investigated the relationship between CHC access, medical underservice, and racial residential segregation.

Objective: Using Black feminist thought, Critical Race Theory, and the Public Health Critical Race Praxis, this study examined how the residential segregation of Black Americans was associated with medical underservice and CHC expansion between fiscal years 2011 and 2019 among 3 populations: 1) US metropolitan counties; 2) Cook County, IL municipalities; and 3) Chicago census tracts (i.e., neighborhoods).

Data: I linked CHC and medically underserved area/population (MUA/P) data from the Health Resources and Services Administration (2010-2019) to demographic, population health, and

housing data from multiple sources including the: American Community Survey (2011-2015), Home Mortgage Disclosure Act (2010) and Home Owners' Loan Corporation (HOLC) (1940).

Measures: CHC expansion was first measured as a binary indicator of whether an area had at least 1 new CHC between FYs 2011 and 2019, and then as the number of new CHCs an area gained. MUA/P designation was a binary indicator of whether an area had at least 1 MUA/P designation between FYs 2011 and 2019. Segregation was measured using the dissimilarity and isolation indices for US counties and the index of concentration at the extremes for Cook County municipalities. For Chicago census tracts I measured contemporary redlining using racialized neighborhood credit refusal (an indication of whether a tract has a high proportion of denied mortgage loans and a majority Black population) and historical redlining using perceived mortgage foreclosure risk (a grade from A to D assigned by the HOLC).

Analysis: The descriptive analysis compared the characteristics of CHC expansion and nonexpansion areas and geographic variation CHC expansion, MUA/P designations, and segregation. I estimated multivariate logistic and negative binomial models and compared estimates from the national and local samples.

Results: Between FYs 2010 and 2019, the number of CHCs among US metropolitan counties in the sample increased from 3,687 to 10,305. Counties with higher Black-White dissimilarity and Black isolation were more likely to gain a new CHC and had a larger number of new CHCs. MUA/P designation only mediated the association between CHC expansion and isolation. At the local level, among Cook County municipalities, the concentration of Black and White residents was not significantly associated with CHC expansion or MUA/P designation between FYs 2011 and 2019. Among Chicago neighborhoods, there was a positive association between MUA/P eligibility and MUA/P designation and the association was moderated by contemporary redlining.

Conclusion: The Patient Protection and Affordable Care Act of 2010 created the Community Health Center Fund, a multibillion-dollar investment in CHC expansion. Although the number of

CHCs increased drastically, the results from this study suggest racialized geographic inequities in CHC expansion and MUA/P designations existed during the first 9 years of the fund.

The dissertation of Natalie J. Bradford is approved.

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2022

DEDICATION

There are many people who I wish were still on this earth to celebrate this moment. This dissertation is dedicated to them and especially to the memory of my aunt Cynthia Denise Eadie, my grandfather Leroy Alexander, Jr., and my great-grandmother Inisha Alexander.

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ACKNOWLEDGEMENTS

Because I was raised in the church, I am going to start my acknowledgements as church folks like to do, first giving honor to God who is the head of my life. This is the Lord's doing and it is marvelous in my eyes (Psalm 118:23).

I would like to thank my dissertation committee, Drs. Ninez Ponce, Chandra Ford, Nadereh Pourat, Frederick Zimmerman, and Michael Lens for their time, insights, patience, and engagement with and contributions to this research.

A special thank you to Dr. Chandra Ford. It is difficult for me to adequately and concisely say thank you to Dr. Ford. All I know is she supported me and my work when few did. On more than one occasion she took time, when I am sure she did not have any to spare, to listen to and encourage me when I felt like quitting. I am certain I would not be getting a PhD if it was not for Dr. Ford and this dissertation would not be what it is without her introducing me to the Public Health Critical Race Praxis, teaching me to be a scholar with integrity, and constantly reminding me writing is thinking.

The UCLA Center for the Study of Racism, Social Justice & Health has been my intellectual home for the last 4 years. Thank you to the Center staff and affiliates for your support and encouragement. I have been especially inspired by Drs. Bita Amani and Kia Skrine Jeffers who have excellently modeled how to conduct critical, creative, and community-centered work. Thank you to Drs. Derek Griffith, Marino Bruce, and Keon Gilbert, co-editors, along with Dr. Chandra Ford, of the book *Racism: Science & Tools for the Public Health Professional*. I learned a lot from them during a critical time in my doctoral studies.

Also, thank you to Hala Douglas at the UCLA Center for Health Policy Research who scheduled and rescheduled so, so, so many meetings for me. In the midst of demonstrating extreme patience, Hala was always kind and sending me words of encouragement. Thank you

to all the staff at UCLA College Academic Counseling, especially Brian Latham, Jessica Amaya, and my CAM fam. Being a College Academic Mentor (CAM) and working in such a supportive and fun environment was a highlight of my time at UCLA.

My deep gratitude to Dr. Susan Nakaoka, who I first met as a student in her Critical Race Studies in Public Affairs course at UCLA. Susan believed in my scholarship, invited me to share it in her classrooms, and created safe spaces for me to think through difficult ideas. The first time I shared work under the title “This Ain’t Yo Laboratory,” was in one of Susan’s classes. I doubt I would have had the courage to make this the title of my dissertation and think through its significance without her.

A big shoutout to my students at California State University Dominguez Hills and Charles R. Drew University for inspiring and challenging me. Shoutout to the homies at Noname Book Club and Reparations Club. These spaces have felt like home. To the staff at Sip & Sonder and 310 Coffee thank you for keeping me caffeinated, sometimes for free.99, and checking on ya girl after I spent hours sitting at a table, typing, and talking to myself.

Let me tell you about friendship. Thank you to Alaina Morales (one of my favorite thinkers), Amy Bonilla (who sat next to me at orientation the first day of our PhD program and is the best person to pull an all-nighter with), Ashley “sometimes spelled Ashlee” Hamilton (who keeps me laughing and fed), Brenda Castaneda (a real one and fellow introvert), Daniela Mitchem (my fellow prayer warrior), James Huỳnh (one of the most insightful and caring people I know), Dr. Kierra Barnett (who keeps it all the way real and all the way Chicago with me in these academic streets), Dr. Margarita Lila Rosa (who shatters narrow conceptions of how to be a scholar and inspires my being), Michael Anderson (fam been hyping me up since day one and pushing me to be a better teacher and less scary writer of poems), Michele “One L Michele” Wong (who for over a year has held it down with me every Wednesday and sometimes even Thursday for group writing sessions), Dr. Mienah Sharif (whose brilliance and generosity are abounding; I owe her many thanks), Dr. Rebekah Israel Cross (my sis, my ace, my been down

with the get down since day one, we really did this), Dr. Sa Whitley (an absolute light who has pushed me out of my comfort zone especially on nature walks and hikes), and Taylor Rogers (my favorite person in the department and someone who has recommended many hilarious tv shows when I needed them to destress).

Last and the opposite least, my family. There are one too many of you to name and not enough space or time to express how grateful I am to be part of this wild group of folks we call family. You all raised me. You all ground me. You all are very loud. But there is something about how loud my family is that reminds me of my voice; that reminds me to speak up, say what I have to say, and know what I have to say is of value. So, to my family, I say thank you for cultivating my voice and challenging me to use it. But the words I am most thankful for are the ones my family lifted in prayer. I felt and needed every one of them.

A special shoutout to my Auntie Cathy and Auntie Cheryl (who are probably petitioning UCLA to change my diploma to say, “Dr. Natalie Poosy-Poo”), my Auntie Dorothy (who always checks on me just because), my Auntie Tilaya, my godmother Tommica, my “other mother” Debra, and my Uncle Hank (Mr. Arthur Thompson, who has driven all over the place from the South Side of Chicago to Bolingbrook to Champaign to show support). Thank you to my big cousin Ashton, who has been an amazing role model and constant source of light and love. Thank you to my big little cousin Adam, who has always had my back and, more than once, answered the phone at 2:00 AM and picked me up from O’Hare when my flight back to Los Angeles was canceled. Much love to my cousin Peter. Thank you to the late Mrs. Connie Hubbard (who helped take me to school as a little girl and later sent me off to LA with my first journal; I have been writing ever since). Thank you to the late Michael Plant (for many things I am just beginning to appreciate).

Thank you to my dearest friend, Chantel. She was especially supportive while I worked on my dissertation and what I appreciate most is the way she made sure we celebrated the wins. Chantel has put up with my foolishness since we were in preschool and as she once said,

more eloquently, “as far back as my memory goes, you have always been there.” Two-on-two, on or off the court, I’m taking us versus anybody. We may not always win but know I will ride with you till the wheels fall off.

I have many, many, many things to thank my Auntie Lil Ma (Mrs. Adrienne Thompson) for and I do not know where to begin or end. She is the rock, the glue, and the gavel in our family. She makes a mean pound cake. My best week of writing came after she sent me one of her pound cakes all the way from Chicago. In the process of writing my dissertation, there were times I would call her just to hear her voice, to hear home, to hear something to remind me I am loved and cared for.

Thank you to my biggest inspirations and strongest supporters, my sisters and mother. To my much cooler and clever little sisters Nicole and Mikayla, one day I hope to be half as witty and bold as you two. Our calls, virtual movie nights, and pep talks were the calm I needed to make it through this journey. To my mother Delores Alexander. Ma we did it! OUR dissertation is done! My mother and I joke that this is our doctoral degree and our dissertation. She constantly called for updates on our drafts, our presentations, and our committee meetings. No matter how early in the morning or late at night I called, she was always willing and excited to talk with me about my research, especially the parts about Chicago. She answered a lot of questions I had and told a lot of stories I did not know. She has been my greatest teacher. She has always been the person most invested in my success. So, yes, this is *our* degree. This is *our* dissertation. Big ups to us! We did that!

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1. **Bradford, N.J.**, Amani, B., Walker, V.P., Sharif, M.Z., & Ford, C.L. (in press). Barely tweeting and rarely about racism: Assessing U.S. state health department Twitter use during the COVID-19 vaccine rollout. *Ethnicity & Disease*.

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1. **Bradford, N.** (2019). Three examples of community-based antiracism projects. In C. Ford, D. Griffith, M. Bruce, and K. Gilbert (eds), Racism: Science & Tools for the Public Health Professional. Washington, DC: APHA Press.

2. **Bradford, N.** (2019). Annotated resource list. In C. Ford, D. Griffith, M. Bruce, and K. Gilbert (eds), Racism: Science & Tools for the Public Health Professional. Washington, DC: APHA Press.

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CHAPTER 1: INTRODUCTION

1.1 Problem Statement

The first community health centers (CHCs) were created to address the lack of health care services in segregated Black communities, but little research has empirically investigated the relationship between CHC access, medical underservice, and racial residential segregation. The Community Health Center Program is a direct product of the Civil Rights Movement, specifically the 1964 Mississippi Summer Project.[1,2] Also known as Freedom Summer, the Mississippi Summer Project was a voter registration campaign that in addition to spotlighting the violence Black Mississippians experienced while trying to vote,[3] illuminated the health care implications of anti-Black racism. Known as the "medical arm of the Civil Rights Movement," the Medical Committee for Human Rights (MCHR) was formed in 1964 to provide health care to Freedom Summer volunteers and help address the unmet health care needs of local Black residents.[4-6]

On December 11, 1964, MCHR members met to discuss how they could address the racial inequities in health and health care they witnessed during Freedom Summer.[1,7,8] At that meeting, Jack Geiger, a physician and MCHR member, suggested the committee create a community health center.[7,9] The nation's first two federally funded community health centers (initially named neighborhood health centers) were established over the next two years.[1,10] In 1975, the Community Health Center Program transitioned from a demonstration project to a permanent federal program.[11,12]

Today, CHCs receive funding from the federal government to provide primary care to medically underserved areas/populations (MUA/Ps). The Health Resources and Services Administration (HRSA) oversees the CHC Program and MUA/P designations. As of March 2022, HRSA funds more than 13,000 CHC sites[13] and recognizes more than 4,000 MUA/Ps.[14]

However, in previous years, many MUA/Ps lacked a single CHC. Furthermore, government reports suggest that the current MUA/P designation process is not useful for allocating CHC funds to the most underserved communities. Given CHC's origins and recent legislation under the Affordable Care Act to expand CHCs and revise the MUA/P designation process, this dissertation focused on the relationship between the racial residential segregation of Black Americans, MUA/P designation, and CHC expansion between fiscal years (FYs) 2011 and 2019.

1.2 Study Aims

This dissertation was guided by one overarching question: how is the residential segregation of Black Americans associated with medical underservice and CHC expansion between FYs 2011 and 2019? I examined this question across 3 populations: US metropolitan counties, Cook County municipalities, and Chicago neighborhoods (i.e., census tracts). The specific aim for the national and Cook County samples was to examine how segregation as a characteristic of a place affects MUA/P designation and CHC expansion. The specific aim for the Chicago sample was to examine how segregation as a process determined by institutional actors affects MUA/P designation and CHC expansion. The research questions associated with each aim are described below and in further detail at the end of Chapter 3 (Section 3.7). I also describe the distinction between segregation as a characteristic verse process in the following chapters.

AIM 1: To examine how segregation as a characteristic of a place affects MUA/P designation and CHC expansion.

The research questions for the national sample are: (1) What is the association between the residential segregation of Black Americans and the increase in CHC supply between fiscal years 2011 and 2019 among US metropolitan counties? and (2) Does MUA/P designation

mediate the association between racial residential segregation and CHC expansion between fiscal years 2011 and 2019 among US metropolitan counties? Similarly, the research questions for the Cook County sample are: (1) What is the association between the residential segregation of Black Americans and the increase in CHC supply between FYs 2011 and 2019 among Cook County municipalities? (2) Does MUA/P designation mediate the association between racial residential segregation and CHC expansion between FYs 2011 and 2019 among Cook County municipalities?

AIM 2: To examine how segregation as a <u>process</u> determined by institutional actors affects MUA/P designation and CHC expansion.

The research questions for the Chicago sample are: (1) What is the association between MUA/P eligibility and MUA/P designation between FYs 2011 and 2019 among Chicago neighborhoods (census tracts)? (2) What is the association between MUA/P designation and the increase in CHC supply between FYs 2011 and 2019 among Chicago neighborhoods (census tracts)? and (3) Does residential redlining moderate the associations between MUA/P eligibility, MUA/P designation, and CHC expansion between FYs 2011 and 2019 among Chicago neighborhoods (census tracts)?

1.3 Significance

The Patient Protection and Affordable Care Act (ACA) of 2010 established the Community Health Center Fund which allocated $11.5 billion over 5 years to the CHC Program.[15] One purpose of that funding was to increase the number of new CHC sites serving MUA/Ps.[15,16] The ACA also required the Secretary of the Department of Health and Human Services to form a committee to revise the methods used to designate medically underserved areas/populations (MUA/Ps).[17]

Few studies have examined CHC expansion under the ACA[18] and, to my knowledge, only one study has analyzed the relationship between CHC expansion and residential segregation.[19] Furthermore, the MUA/P designation process has been critiqued since its inception[20] and government reports suggests that it is not useful for allocating CHC funds.[21] However, few studies have investigated the availability of CHCs in federally designated MUA/Ps. This dissertation fills these gaps in the literature and provides evidence that can inform policy decisions about the allocation of CHC funds and the designation of MUA/Ps.

1.4 Overview

In chapter 2, I provide an overview of the literature on community health centers, medical underservice, and racial residential segregation in the US and Chicago. In chapter 3, I present the theoretical and conceptual frameworks that guide this study, namely Black feminist thought, Critical Race Theory, and the Public Health Critical Race Praxis. In chapter 4, I describe the methods including the data sources and variables used to conduct the analysis. In chapter 5, I present the results by aim, starting with the US sample, then Cook County and finally the Chicago sample. Finally, in chapter 6, I discuss the results, limitations, strengths, and implications of this research.

1.5 Terminology

The term (community) “health center” often refers to a CHC awardee (i.e., grantee) which is “a public or nonprofit non-Federal organization that carries out the federal award under the Health Center Program as a recipient.”[22] A single CHC awardee may have multiple CHC access points and can request federal funding for more than one new access point in a single grant application.[23] An access point (i.e., delivery site or service site) is the location (i.e., facility)

where a health center delivers primary and preventive health care services to patients.[22,24,25] Unless stated otherwise, I use the term CHC to refer to CHC access points (i.e., CHC sites).

1.6. Reflexive Essay #1: Centering Home

Positionality

Before I had a research question, study design, or dissertation committee I knew my dissertation would be about Chicago. I knew I wanted to write about home.

Do you know how many studies are set in Chicago? Do you know how many studies set in Chicago are not by people from Chicago? And do not get me started about research about, but not by, Black Chicagoans.

To be transparent, I am not quite a Black Chicagoan. For those who don't know, Chicagoans take saying you're from Chicago very seriously. Growing up, I experienced extreme housing insecurity, so I do not know how to answer the question *where are you from?* Chicago is usually my answer. But I'm not really from there the way most people from there say they're from there. I have lived many places. Chicago, however, is the only place I have ever considered home.

I don't want no problems, but let me talk to the real Chicago kids for a second. Yes, some kids from the burbs claim the City because it sounds cool. But some of us know and respect the difference and we are not trying to be cool. We are trying to say leaving was not our choice. We are trying to do what Black folks have done for generations. We are trying to locate home in the midst of constant movement and stay connected to that which we come from. We are trying to make sense of what it means to be part of a lineage deeply rooted in a place we have been uprooted from. We are trying to say something about the way our mother and her auntie and her

grandmother raised us to remember and carry the lessons they taught us here, at home. We are trying to name love.

when i say Chicago
after Nate Marshall

when they ask where you from
and when i say Chicago
i mean i actually lived in the city
but really grew up in the suburbs,
which means
i mean it's complicated.

& i mean we moved
& i mean we moved a lot
& i mean we moved at least once a year every year
to and from the city
all around Maywood
& Bellwood
& Broadview
& Bolingbrook

when i say Chicago
i mean that's where my family stay
i mean my family been here
i mean my family still here

when i say Chicago
i mean the house
i mean the church
i mean that's love
i mean that's blood

when i say Chicago
i mean i am holding
& honoring
contradiction
i mean i belong
to people and places
here

not there

This Ain't That

My dissertation title is inspired by the title of the book *This Ain't Chicago: Race, Class, and Regional Identity in the Post-soul South*. *This Ain't Chicago* was written by Zandria Robinson, who is a sociologist and Black woman from Memphis, TN. The book is about Black identity from the perspective of Black people who live in urban areas of the US South.[26] By focusing on the urban South, the place Robinson calls home, Robinson's research challenges dominant narratives about Black identity, which tend to focus on the lives and experiences of Black people who live in northern cities like Los Angeles, New York, and Chicago.

I try to adopt Robinson's "this ain't that" analytic approach in my dissertation. Social scientists who have conducted some of the most famous studies about neighborhoods and social life in Chicago have said, "Chicago happens to be an excellent laboratory for testing theoretically derived hypotheses."[27] For over a century, some academic communities have maintained "a research commitment to the city of Chicago as a 'social laboratory.'"[28] As a Black scholar from the Chicagoland area, I find researchers calling the city a laboratory concerning – I find myself wanting to respond with *this ain't that*.

Imperial Scholarship

In 1984, legal scholar Richard Delgado wrote an article titled "The Imperial Scholar: Reflections on a Review of Civil Rights Literature." At that time, Delgado found that work by white men dominated mainstream civil rights scholarship and excluded work by scholars of color.[29] Delgado called this academic norm imperial scholarship.

Anticipating pushback against the idea of imperial scholars/hip, Delgado posed the question, "what difference does it make if the scholarship about the rights of group A is written by members of group B?" He went on to suggest that members of group B may be ineffective advocates of group A, have a different agenda than group A, and stifle the scholarship produced by group A.

I propose we extend the concept of imperial scholarship to include the scholarly tradition of framing and examining Chicago as a social laboratory. To be clear, Chicago is not a laboratory. Black neighborhoods in Chicago are not laboratories. The places Black people live and call home are not laboratories. This ain't that.

Declarations are cool, but my goal is to do more than declare *Black Chicago ain't nobody's laboratory*. Again, I interpret Zandria Robinson's "this ain't that" assertation as an analytic approach. By using this approach my goal is to center home in my research.

Centering the Margins

Centering the margins is a key feature of critical race and Black feminist scholarship. As Ford & Airhihenbuwa (2010) describe it, "to center in the margins is to shift a discourse's starting point from a majority group's perspective, which is the usual approach, to that of the marginalized group."[30] Not only is the majority group's perspective the usual starting point, bell hooks explains that these privileged perspectives, "rarely include knowledge and awareness of the lives of [people] who live in the margin."[31] The result is research that "lacks wholeness, lacks the broad analysis that could encompass a variety of human experiences."[31]

My starting point is not Chicago is a laboratory. My starting point is Chicago is home. By shifting this dissertation's starting point, I hope to construct a more complete analysis. I hope to construct an analysis that intentionally incorporates the experiential knowledge of not just Black people, but more specifically Black people from Chicago.

The research I conducted and describe in the following chapters does not come close to fully achieving the goal of centering home. Much of what I wrote in this section is aspirational. Even the concept of centering home is not fully developed. I introduce the concept here to be explicit about my motivations and to ask: how might what we know about the places we call home change what we think we know about broader social issues?

Throughout the dissertation I include reflexive essays like this one. These are short reflections about questions I had, tensions I felt, and affirmations I received while wrestling with the contradictions between my academic training and my home training.

CHAPTER 2: LITERATURE REVIEW

2.1 Community Health Centers

According to the Public Health Service Act a community health center (CHC) is an "entity that serves a population that is medically underserved."[32] A more accurate definition of a CHC may be that it is an entity that serves a population *or area that the federal government has designated as medically underserved*. Given their legal mandate to provide health care to underserved areas/populations and that a substantial share of their patient population is uninsured, enrolled in Medicaid, or living in poverty,[33,34] CHCs are considered core health care safety net providers.

The Health Resources and Services Administration (HRSA) of the Department of Health and Human Services (HHS) oversees and manages funding for our country's Community Health Center Program. Two types of CHCs exist: federally qualified health centers (FQHCs) and FQHC look-alikes. A FQHC receives Health Center Program funding from HRSA, while look-alikes do not. However, look-alikes meet Health Center Program requirements and can apply for other federal benefits available to FQHCs.[35] Both FQHCs and look-alikes serve medically underserved areas/populations.

2.2 Medical Underservice

<u>The Concept of Medical Underservice</u>

Medical underservice is an undertheorized concept. The Public Health Service Act and the Health Maintenance Organization Act (the law that required HRSA to develop a measure of medical underservice) define a medically underserved population as "the population of an urban or rural area designated by the Secretary [of HHS] as an area with a shortage of personal health services or a population group designated by the Secretary as having a shortage of such

services."[36,37] HRSA, which is responsible for designating medically underserved areas/populations (MUA/Ps), defines MUA/Ps as "geographic areas and populations with a lack of access to primary care services."[38] HRSA, nor the Public Health Service Act or HMO Act, explicitly define the concept of medical underservice. Instead, MUA/Ps are defined. The aforementioned definitions of a MUA/P suggest that medical underservice means "a shortage of personal health services" or "a lack of access to primary care services," but this is not stated explicitly.

While *conceptualizing* medical underservice has been neglected by policymakers, *measuring* medical underservice has not. In fact, HRSA developed an index of medical underservice (IMU) without defining the concept of medical underservice. This happened for at least three reasons: 1) the HMO Act did not define medical underservice; 2) the HMO Act did not explicitly require HRSA to define medical underservice; and 3) HRSA and the research group that created the IMU found that health care experts could not agree on how to define medical underservice.[39] Instead, the IMU was constructed based on two assumptions: 1) a consensus existed among health care experts about the relative medical underservice of selected communities and 2) a mathematical model could predict experts' consensus.[39] The lack of a clear definition or conceptual framework of medical underservice suggests that the IMU is simply "a set of variables that are assumed to refer to a common construct."[20(p.129)]

Indicators of Medical Underservice

Section 330(b) of the Public Health Service Act requires the following factors to be included in the criteria for designating an area medically underserved: population health status, ability of residents to pay for health services, accessibility of health services, and the availability of health care providers.[36] HRSA partnered with the University of Wisconsin-Madison's Health Services Research Group (HSRG) to develop the IMU. Between November 1973 and October 1974, HSRG convened local, state and national health experts (e.g., practicing and teaching

physicians, academic researchers, health agency officials, consumer advocates, and public health department staff) to assess the relative scarcity of health services in selected communities and identify and rank indicators of medical underservice. HSRG used these expert assessments and rankings to determine the variables and weights used to calculate the IMU.

The mathematical model used to calculate the IMU initially included 9 variables, but was reduced to 4 variables to meet the operational needs of HRSA and address data availability concerns.[39] Currently, the IMU score is the weighted sum of an area/population's: 1) primary care provider-to-population ratio, 2) poverty rate, 3) infant mortality rate, and 4) percentage of residents age 65 and older. The IMU ranges from 0 (completely underserved) to 100 (least underserved).[40] Areas/populations with a score of 62.0 or less are eligible to receive a MUA/P designation. Despite critiques, conceptual shortcomings, and proposed revisions, the methods HRSA uses to designate MUA/Ps have barely changed since the 1970s.

HHS has considered using new indicators to calculate medical underservice at least three times. First, in 1998, HHS proposed a rule to replace the IMU with the Index of Primary Care Services (IPCS).[41] Ten years later HHS proposed another rule to replace the IMU, this time with the Index of Primary Care Underservice (IPCU). Most recently, the Patient Protection and Affordable Care Act of 2010 required HHS to develop a negotiated rulemaking committee to revise the methodologies used to designate MUA/Ps. That committee suggested HHS replace the IMU with the Index of Primary Care Needs (IPCN). Each of these new indices would have been calculated based on a wide range of indicators including, but not limited to a population's: population-to-primary care provider ratio, poverty rate, unemployment rate, infant mortality rate, standardized mortality rate, racial/ethnic composition, and proportion of residents with limited English proficiency. [20,41-43]

Two members of the 2010 negotiated rulemaking committee did not endorse the committee's proposed revisions to the MUA/P designation process. One of their concerns was the conceptualization of medical underservice. In their minority report, the two dissenting

members explain that, “given the difficulty encountered in finding an underlying framework or theory to use for setting the index, the committee [used] ‘expert opinion’ for setting the weights used in the formula for the MUA index” and “while this index is similar to current practice, that does not mean it is a conceptually valid framework for measuring medical underservice.”[19(p.xxiv)] Thus, what is needed is a conceptual framework of medical underservice.

Medically Underserved Areas Without a Community Health Center

The overwhelming majority of MUA/P designations (3,436 of 4,129 designations) are medically underserved *areas*.[44] Although CHCs must *serve* a MUA/P, they do not have to *locate* in a medically underserved *area* (MUA).[23] Few studies have examined the extent to which CHCs are available in MUAs. Those that have suggest that many MUAs do not have a CHC.[18,45]

In 2006, 47 percent of MUAs did not have a single FQHC.[45] This shortage varied by region and was highest in the Midwest and South where 62 percent and 40 percent of MUAs had no FQHC, respectively. Although federal funding for new health centers reduced the percentage of MUAs without a health center, allotment of those funds varied geographically and did not match the need for FQHCs. For example, in 2007, HRSA awarded 202 new access point grants, but only 19 percent went to organizations in the Midwest (the region with the highest proportion of MUAs lacking a FQHC) while 50 percent went to organizations in the South.[45] Similarly, a recent study of CHC expansion in three southern states showed that between 2008 and 2016, the number of census tracts with no CHC decreased, but the increase in CHC supply was not associated with indicators of need like high poverty, low health insurance coverage rates, and primary care provider shortages.[46]

The reason why some MUAs lack a CHC, despite high need, is unknown. Racial residential segregation, which has been called a fundamental cause of racial disparities in health[47] and health care,[48] may be one explanation.

2.3 Racial Residential Segregation

Conceptualizing Racial Residential Segregation

Residential segregation is often defined as the degree to which two or more groups live in different parts of an urban area.[49] This definition hides the complexity of racial residential segregation and its relationship to racism. As Williams and Collins (2001) describe, racial residential segregation "was imposed by legislation, supported by major economic institutions, enshrined in the housing policies of the federal government, enforced by the judicial system, and legitimized by the ideology of white supremacy that was advocated by churches and other cultural instituions."[47(p.405)]

Scholars have conceptualized racial residential segregation as a *product* of structural racism[50] and as a *form* of structural racism.[51] These conceptualizations of segregation seem to present a paradox:[50] How can segregation be both a *product* and a *form* of racism? Addressing this issue, Kramer and Hogue (2009) explain that "one challenge in conceptualizing segregation is that its social and health-relevant effects are often described in terms of the process of segregation... as opposed to the condition or state of segregation."[52(p.180)] Most studies that examine segregation's effect on health and health care outcomes employ Massey and Denton's (1988)[49] definition and, using indices that measure one or more dimensions of segregation, measure segregation as an attribute of a place or what Kramer and Hogue (2009) call the *condition*/*state* of segregation (i.e., the extent to which two racial/ethnic groups live in separate neighborhoods of an urban area).

According to Massey and Denton (1988) segregation has five dimensions: *evenness* which examines the differential distribution of two groups across neighborhoods in a municipality; *exposure* which refers to the degree to which two groups live in the same neighborhood and therefore are assumed to interact or come in contact with each other; *concentration* which indicates the relative amount of physical space a group occupies;

centralization which refers to the degree to which a group resides in the center of a municipality; and *clustering* which refers to the extent to which the neighborhoods where members of a racial/ethnic minority group live are located next to each other (i.e., cluster in the same space).[49,53]

Measures that capture the condition/state of segregation say nothing about the *processes* of segregation (i.e., the series of forces that cause different racial/ethnic groups to reside in separate neighborhoods)[52] and, as Sewell (2016) suggests, leave the "specification of the institutional processes, policies, and practices that undergird the health [and health care] effects of residential segregation to the imagination, as well as their white supremacist assumptions."[50(p.403)] Thus, for the purposes of this study, racial residential segregation is conceptualized as the degree to which two or more racial/ethnic groups live in separate neighborhoods of a municipality (e.g., city or county) and the processes that create and reinforce that separation. To this end, the process of segregation can be viewed as a form of structural racism and the condition/state of segregation is a product of that racism.

Residential Redlining

Redlining is one example of the process of racial residential segregation. Broad definitions of redlining refer to it as a discriminatory practice whereby financial institutions deny mortgages or provide mortgages with unfavorable terms in certain neighborhoods, even if an applicant is eligible for the loan.[54-56] However, racism is central to the practice of redlining as it occurs when lending decisions are based on the actual or perceived racial composition of a neighborhood.[50,57,58] As a result, redlining systematically undervalues and channels financial investments away from Black neighborhoods.[59,60]

In 1933, the federal government created the Home Owners' Loan Corporation (HOLC) to reduce the rate of mortgage foreclosures in urban areas.[55,61] In addition to refinancing mortgages at risk of foreclosure, the HOLC institutionalized redlining.[59,61] The HOLC created

color-coded “residential security maps” based on the demographic and housing characteristics of an area in order to rate the level of perceived risk associated with making long-term real estate investments in a particular area.[58] The HOLC gave the first grade (an “A”) to the “best” and most desirable neighborhoods, which were colored green; the second grade (a “B”) to “still desirable” neighborhoods, which were colored blue; the third grade (a “C”) to “definitely declining” neighborhoods, which were colored yellow; and the fourth and lowest grade (a “D”) to “hazardous” or the least desirable neighborhoods, which were colored red.[58,62,63]

Segregation, Redlining, Health and Health Care

Residential segregation between Black and White populations has been linked to various physical and mental health outcomes. Prior studies have found that increased or high segregation is associated with increased risk of adverse birth outcomes,[64] higher breast and lung cancer mortality rates,[65] a greater likelihood of reporting poor overall health,[66] a higher prevalence of obesity and overweight,[67] and higher adult all-cause mortality.[68] While findings such as these typically show that racial residential segregation negatively affects the health of Black people and not White people,[52] findings vary by study design, health outcome, measure of segregation, and unit of anlsysis.[52,67,68]

Less research has examined how redlining affects health and health care outcomes.[69,70] Studies on redlining and health have focused on birth and cancer outcomes and specific metropolitan areas like Philadelphia,[71] New York,[72] and Chicago[73] rather than the entire US or multiple cities simultaneously. One reason for the focus on specific cities may be that the HOLC only made redlining maps for the 239 cities with a population of at least 40,000 people at the time of the organization’s neighborhood appraisals.[58]

Evidence of a statistically significant relationship between redlining and health is mixed. For example, Mendez, Hogan and Culhane (2014) found that living in a redlined area was associated with a decreased risk of preterm birth among Black women in Philadelphia[74] while

Matoba et al.[73] found that living in a redlined area was associated with an increased risk of preterm birth among Black women in Chicago. Both studies used data from the Home Mortgage Disclosure Act (HMDA) to calculate a redlining index that estimated the odds of mortgage loan denial among Black applicants compared to White applicants, for each census tract in the study and controlling for applicants' income, gender and loan amont.[71] This measure of redlining – developed by Mendez et al. [71] – captures racial bias against individual loan applicants in a neighborhood[75] and therefore differs from redlining measures based on HOLC grades,[74] which capture racial bias against an entire neighborhood.

While the measures and methods studies use to estimate the association between health and segregation vary, prior systematic reviews of this literature consistently identify access to health care services as a mechanism that mediates the relationship between segregation and health.[47,52,76,77] Research on segregation and health care access has focused on utilization and availability outcomes. Health care utilization reflects realized access or the actual use of health care services[78] (e.g., a visit to a doctor's office or emergency department). Health care availability measures potential access or the presence of resources that provide the means for or enable health care use.[79]

Like the relationship between segregation and health, the relationship between segregation and health care access depends on the measure of segregation. Health services research tends to measure segregation using segregation indices (e.g., the dissimilarity or isolation index), racial composition (e.g., the proportion of Black residents in an area) and/or the interaction between segregation indices and racial composition. To my knowledge, only one published study has examined the association between redlining and health care access.

In general, prior research suggest that the segregation of Black Americans has a negative effect on health care access. Gaskin et al.[80] found that African Americans living in majority (more than 50 percent) African American zip codes were less likely to have visited a physician's office for primary or specialty care compared to African Americans living in majority

White zip codes. Li et al.[81] found that census blocks with a higher proportion of African American residents had a higher rate of emergency department visits. Similarly, Nardone et al.[70] found that the present day rate of emergency department visits due to asthma was significantly higher in census tracts that had been redlined in the past. Together these results suggest that segregated Black neighborhoods have a lower propensity to use primary care. However, supply could be the binding constraint as research shows that majority Black neighborhoods are more likely to have a shortage of primary care physicians.[82] Furthermore, majority Black neighborhoods located in racially segregated areas are more likely to have a primary care provider shortage while non-majority Black neighborhoods located in racially segregated neighborhoods are less likely to have a primary care provider shortage.[82]

Segregation and Community Health Centers

Although the first CHCs were established to mitigate primary care shortages in Black communites,[8,9] health services and policy research has almost completely neglected to study the relationship between racial residential segregation and the availability of community health centers. To my knowledge, only one published study has examined the effect of residential segregation on health center supply. Ko and Ponce (2013) found that racial/ethnic residential segregation was positively associated with the supply of CHCs in 2000 and the growth in CHC supply between 2000 and 2007, among urban counties.[83] As the authors note, these findings do not tell us about the distribution of CHCs within counties. In addition, the study examines residential segregation between non-White and White populations, which may not affect health care access in the same way as residential segregation between Black and White or non-Black populations. Prior research shows that the association between racial residential segregation[84] and health and health care varies depending on the racial/ethnic groups and dimension of segregation[85] examined. Furthermore, segregation and its effect on health care may vary by place.

Segregation and Medical Underservice in Chicago

For nearly a century, Chicago has been one of the most racially segregated cities in the US. From 1930 to 2010, the black-white dissimilarity index for the city of Chicago never dropped below a 0.80 score[86,87] – a dissimilarity index of 0.60 or higher indicates a high level of segregation.[88] At the national level, the residential segregation of Black Americans has steadily declined since 1970.[89] However, Chicago is one of eight metropolitan areas where Black Americans have consistently been hypersegregated since 1970.[90] Chicago also has a unique history with redlining. In the 1920s and early 1930s, scholars at the University of Chicago, namely Robert Park, Ernest Burgess and Homer Hoyt, developed the theories of neighborhood change that the HOLC used to create its residential security maps.[58,61,91] Decades after these maps were created, community organizations in the Austin neighborhood of Chicago coined the term "redlining."[55,92]

In 2005, the Chicago Department of Public Health released a report about the growth in health care safety net facilities, including CHCs, in Chicago between 1990 and 2002 (Appendix A and B).[93] During this twelve year period the number of CHCs in Chicago more than doubled. Over half of the 37 new CHCs were located on the West Side of Chicago. In contrast, approximately 8 percent of new CHCs were located on the South Side of Chicago, which at the time had the highest poverty rate, infant mortality rate and proportion of residents age 65 and over. The South Side also had the worst access to primary care providers as measured by the rate of hospitalizations for ambulatory care sensitive conditions and the percentage of pregnant women who reported having received no prenatal care. These measures (poverty, infant mortality, age composition, and provider supply) are the four indicators that HRSA uses to determine if an area is medically underserved and therefore eligible to apply for CHC funding. By HRSA's own metrics, the South Side of Chicago was the most medically underserved region of Chicago in 2002. Why then was the number of new CHCs on the South Side equal to or,

more often, less than the number of new CHCs in the West, North, Northwest, and Central regions of the city? It is important to note that only Chicago's Far South and Southwest regions had fewer new CHCs than the South region – longtime residents of the South Side tend to think of the "South Side" as constituting the South, Southwest, and Far South regions (Appendix C).

The South Side of Chicago is unique from other areas of Chicago because it is a predominantly Black community and has been since the 1960s (Appendix D).[94] In 2000, Black residents made up 86.7 percent of Chicago's South region.[93] The 2005 report on Chicago's health care safety net reported the racial and ethnic composition of Chicago's 7 health systems planning regions (North, Northwest, Central, West, South, Southwest, and Far South), but failed to connect the racial differences among these regions to the inequity in community health center growth. According to the report, the Chicago Department of Public Health planned to meet with the Illinois State Primary Care Office and HRSA "to encourage more deliberate targeting of community health center expansion funding"[93(p.19)] in the future.

CHAPTER 3: THEORETICAL FRAMEWORK

"You don't know a thing about our story, tell it wrong all the time. Don't know a thing about our glory, wanna steal my baby shine."

– Jamila Woods[95]

"I think about race every day. I see race every day. I see that the conditions of black neighborhoods are often the product of intentional segregation. This isn't a new topic, but it needs to be dissected and better understood…"

– Natalie Y. Moore[96]

"This is not a war among/between Black people, as the news outlets reported, but a war waged by the State against Black people... What does the State achieve from a mainstream perception of Chicago as 'Chiraq'?"

– Page May[97]

3.1 Black Feminist Thought and the Lay Race Theorist Tradition

"Much of my formal academic training has been designed to show me that I must alienate myself from my communities, my family, and even my own self in order to produce credible intellectual work. Instead of viewing the everyday as a negative on my theorizing, I tried to see how the everyday actions and ideas of the Black women in my life reflected the theoretical issues I claimed were so important to them."

– Patricia Hill Collins, Black Feminist Thought[98(p.viii)]

"For people of color have always theorized – but in forms quite different from the Western form of abstract logic... How else have we managed to survive with such spiritedness the assault on our bodies, social institutions, countries, our very humanity? And women, at least the women I grew up around, continuously speculated about the nature of life through pithy language that unmasked the power relations of their world."

– Barbara Christian[99(p.52)]

As I write this chapter, I am listening to the album *Legacy! Legacy!* by Jamila Woods, a Black woman, singer, and poet from Chicago. "Baldwin," the title of the second to last track on the album, is a meditation on James Baldwin's essay "Letter to My Nephew." The music video for "Baldwin" is set at one of the 47 Chicago public schools closed by the local government in 2012.[100] The closed schools were described as "underutilized" and local officials used this rhetoric, this dominant narrative, to justify disinvesting from these schools and their students – 88 percent of whom were Black students.[101]

As Figure 2.1 shows, in the video for "Baldwin," Jamila Woods rejects the "underutilized school" narrative and reimagines the abandoned school as a Black Hogwarts.[100] Hogwarts is a fictional school in Harry Potter books and films that exists, quite literally, on the margins of society as a secret place where children with unique magical abilities learn how to use their magic. Likewise, the Black Hogwarts in "Baldwin" is a place where the culture, interests, talents, dreams, intellect, and lives of Black youth from Chicago matter and are prioritized.

Jamila Woods opens the song with a declaration to White Americans: "You don't know a thing about our story, tell it wrong all the time." In doing so, Woods is not merely calling out whiteness, she is also speaking truth to power and challenging dominant narratives about Black Chicago(ans). This dissertation aims to do the same by drawing insight from Black feminist thought.

At its core, Black feminist thought is the knowledge Black women and girls create based on their distinctive worldview.[102] In her classic book *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment*, sociologist Patricia Hill Collins explains why Black feminist thought is necessary:

> As long as Black women's subordination within intersecting oppressions of race, class, gender, sexuality, and nation persists, Black feminism as an activist response to that oppression will remain needed. In a similar fashion, the overarching purpose of U.S. Black feminist thought is also to resist oppression, both its practices and the ideas that justify it.[98(p.22)]

In the remainder of this section, I describe how Black feminist thought inspired me to do the following: 1) speak truth to power, 2) embrace the outsider within location, 3) learn from lay race theorists, and 4) center home. I also explain why each of these practices is important for studying access to care in Chicago and a phenomenon I call racism-related medical underservice.

Speaking Truth to Power

Speaking truth to power is one way to challenge existing power hierarchies and dominant knowledge.[102] Borrowing from the Critical Race Theory concept of majoritarian stories, dominant knowledge refers to scholarship and narratives produced by people who hold power (i.e., the dominant group).[103,104] Like all knowledge, dominant knowledge is socially constructed.[105-107] Thus, it reflects the dominant group's experiences and interests[105] and carries "assumptions that persons in positions of racialized privilege bring with them to discussions of racism, sexism, classism, and other forms of subordination. In other words, [dominant knowledge] privileges Whites, men, the middle and/or upper class and heterosexuals by naming these social locations as natural or normative points of reference."[104(p.28)]

With lyrics like “it’s un-natural science, you too comfortable lying,” “you ain’t figured it out just yet,” and “all my friends been reading them books, reading them books you ain’t read,” Jamila Woods exposes the limitations of relying on dominant knowledge to understand Black people’s lived experiences. Lies are told. Experiences are distorted. Problems are not figured out. Entire bodies of knowledge are ignored. For these reasons, some Black women scholars use their academic writing to speak truth to power in an effort to establish alternative analyses about social injustices.[102]

To be clear, the choice to speak truth to power, to confront dominant knowledge and center Black feminist thought, is about more than critique. As Gloria Ladson-Billings states, “the two traditions are not merely matters of ‘alternatives’ or ‘preferences,’ but rather represent a deliberate choice between hegemony and liberation.”[108(p.257)] Black feminist thought is committed to justice in ways that dominant knowledge may never be, despite its best efforts. Consider, “what does it mean when the tools of a racist patriarchy are used to examine the fruits of that same [racist] patriarchy?”[109(p.110-111)] According to Audre Lorde (2007), “It means that only the most narrow perimeters of change are possible and allowable.”[109(p.111)]

As oppositional knowledge and critical social theory, Black feminist thought challenges the status quo, seeks to dismantle unjust structures, and creates new ways of thinking that contribute to justice for Black women and other marginalized groups.[98,110] Speaking truth to power is important for this dissertation for at least three reasons: 1) dominant knowledge about community health centers tends to ignore the program’s civil rights and anti-racist roots, 2) dominant narratives about Chicago tend to ignore structural violence, and 3) landmark studies and prominent researchers have used and literally referred to Chicago as a “laboratory.”[28] Each of these conventional ways of thinking and doing research may limit our ability to understand and address medical underservice. Even worse, they may reinforce existing power relations and perpetuate harm against Black communities.

Embracing the Outsider Within Location

The politics of Black feminist thought refers to the tension between the suppression of Black women's ideas and Black women's resistance against that suppression (i.e., creation of knowledge anyway).[98] This tension is more than theory, it is the lived, daily reality for many Black women scholars and students who work, write, conduct research, and produce scholarship in academic institutions and do so as outsiders within. In academia, outsiders within are people who are members of an academic discipline, but are marginalized within that discipline because of their social identities.[107] For example, a Black woman sociologists may be part of the sociology field, but marginalized because she is a Black woman.

It would be a mistake to reduce the outsider-within construct to a personal identity category and consider Black feminist thought nothing more than an attempt to acknowledge and advance Black women's ideas.[102] Collins (2013) reminds us that "[m]esmerized by the multiple identities of each individual Black woman that celebrates her unique differences, we fail to see how racism, sexism, class exploitation, and heterosexism shape her experiences as well as her analyses of her lived reality."[102] The analyses part is key. In her original conceptualization of the outsider within construct Collins (1986) suggests:

> At its best, outsiders within status seems to offer its occupants a powerful balance between the strengths of their [academic] training and the offerings of their personal and cultural experiences. Neither is subordinated to the other. Rather, experienced reality is used as a valid source of knowledge for critiquing sociological facts and theories, while sociological thought offers new ways of seeing that experienced reality.[111(p.S29-S30)]

Box 2.1 Strengths of the Outsider Within Location

- The potential of outsiders within to notice patterns and relations not apparent to persons socially located in the mainstream.
- Creativity and resilience that arise from the experiences of marginalization
- Potential to draw on strategies of resistance originating within the margins.

Adapted by author (NJB) from Ford and Airhihenbuwa, 2010[107]

Learning from Lay Race Theorists

The lay race theorist tradition, like Black feminist thought, acknowledges that all intellectuals are not academics. As Hunter and Robinson (2018) explain, "the wisdom of everyday Black folk is knowledge, scientific, and underutilized"[112(p.xiii)] and "Black musicians [are] some of the greatest philosophers and sociologists."[112(p.xi)] Lay race theorists are "writers [and] cultural workers whose mastery in another arena, such as journalism or fiction, lends credence to their insights on race or activists whose organizing work give them the same authority."[113(p.30)] They do not have terminal academic degrees, but their work has appeared in scientific literature. For example, a review of sociology literature suggests that researchers tend to use the work of James Baldwin (a lay race theorist) in three ways: 1) as a source of quotes by including his words as an epigraph or in the main text, 2) as a source of data by treating his essays as ethnographies, and 3) as a source of social theory by identifying theoretical claims in his writing and testing those claims with data.[113] It is the last use of Baldwin's work that I am interested in for this project. As the next section describes, this dissertation is guided by the critical social theory and oppositional knowledge that lies in the words of Black women from Chicago (i.e., lay race theorists).

Learning from "lay race theorists" is particularly important for this project because dominant knowledge about neighborhoods and social life in Chicago has been dominated by the thoughts of academics, especially men, at elite universities. Of particular concern is the problematic notion put forth by social scientists that "Chicago happens to be an excellent laboratory for testing theoretically derived hypotheses."[27(p.viii)] Equally disturbing is the practice of "taking as [one's] laboratory the social landscape and continued vitality of Chicago"[27(p.31)] to conduct social science research.

Centering Home

At the core of this dissertation is a love for Chicago, my homeplace. Chicago does not make sense to me without the ideas of Black women from Chicago. I cannot write a dissertation about Chicago without not only considering their ideas, but centering them. To do otherwise would be to reinforce the suppression of Black women's ideas and majoritarian stories about Black Chicago. For this reason, I kept Chicago in my ear and let my "unscholarly" activities become part of my theorizing.

The lyrics and video for "Baldwin" encourage me to draw on Black women's words as oppositional knowledge and critical social theory. Specifically, I draw on the work of three Black women who are from and/or committed to community organizing and Black liberation in Chicago to focus on three features of Critical Race Theory (CRT) and the Public Health Critical Race Praxis that are central to understanding how racial residential segregation influences medical underservice and community health center availability, especially in Chicago (Table 2.1). I discuss these CRT themes in the next section.

Table 2.1. Black Feminist Thought and Related CRT and PHCRP Themes

Author	Quote	Related CRT/PHCRP themes
Jamila Woods	"You don't know a thing about our story, tell it wrong all the time. Don't know a thing about our glory, wanna still my baby shine."[95]	Voice Counterstorytelling

Natalie Moore	"I think about race every day. I see race every day. I see that the conditions of black neighborhoods are often the product of intentional segregation. This isn't a new topic, but it needs to be dissected and better understood…"[96(p.7)]	Primacy of racialization
Page May	"This is not a war among/between Black people, as the news outlets reported, but a war waged by the State against Black people... What does the State achieve from a mainstream perception of Chicago as 'Chiraq'?"[97(p.21)]	Structural determinism
Jamila Woods	"It's a casual violence in your speech and your silence"[95]	Structural determinism
Note: CRT = Critical Race Theory; PHCRP = Public Health Critical Race Praxis		

3.2 Critical Race Theory

Critical Race Theory (CRT) is an intellectual movement that began in legal studies with scholars and activists who were interested in studying and transforming the relationship among race, racism, and power.[106,114] These scholar activists, most scholars of color, recognized and were discontent with the contradiction between the liberal ideals US society and law claim to uphold, and, on the other hand, the maintenance of white supremacy and the subordination of people of color.[115] Despite the passage of civil rights laws in the 1960s, racism still existed and new theories, methods and strategies were needed to combat contemporary, seemingly subtler, forms of racism.[106,116] Thus, CRT was created.

CRT is not a theory in the way public health researchers may think of theory.[30] CRT is not an explanation for a social phenomenon; it does not describe the key variables and mechanisms that cause variation in some outcome of interest. In fact, CRT did not start as an abstract idea at all, but as a struggle between students and scholars of color and their academic institutions and disciplines.[117,118]

CRT considers racism to be a central component of laws and policies in the United States.[119] This makes CRT particularly useful for health services and policy research that

examines racism. Furthermore, the roll back of civil rights gains also motivated the development of CRT. Given its roots in the Mississippi Summer Project of 1964 (Freedom Summer), it can be argued that the absence of community health centers in predominantly Black neighborhoods is part of the roll back of civil rights gains. This makes CRT especially useful for examining the relationship between contemporary (i.e., post-civil rights) racism and access to community health centers.

This dissertation will use CRT concepts and methods to examine how racism operates in health care policies relevant to the Community Health Center Program. Key tenets of CRT are described in Table 2.2. Those that are particularly relevant for this dissertation and at odds with conventional health services research methods are described below.

The Myth of Objectivity

According to CRT, objectivity does not exist; scholarship and the production of knowledge are not and can never be objective or neutral.[106,115] Indeed they are inevitably political.[115,120] People who conduct research, the way we conduct our research, and the products of our research cannot be removed from the social and political contexts we live and work in, no matter how systematic and rigorous our methods are. Opponents often criticize CRT's rejection of objectivity[106] and cite it as a reason why CRT should not be used in social science, especially in academic disciplines that privilege quantitative data and statistical analysis.[121,122]

The term objective has been used to describe research that is not influenced by a researcher's prejudice, bias, or personal feelings and interests.[123,124] Critical Race theorists argue that these claims of "'neutral' research or 'objective' researchers... act as a camouflage for the self-interest, power, and privilege of dominant groups in US society."[125(p.74)] Speaking about CRT and public health methodology, specifically, Cross (2018) explains that "although

they are seemingly unbiased, statistics can promote White supremacist ideologies because they rely on human data collection, analysis and, most importantly, interpretation."[126]

QuantCrit Counterstorytelling

Counter-storytelling is "both a method of telling the story of those experiences that are not often told (i.e., those on the margins of society) and a tool for analyzing and challenging the stories of those in power and whose story is a natural part of the dominant discourse."[103(p.475)] Recently, Critical Race scholars in education proposed a new type of counterstory, a QuantCrit counterstory. This type of story is a methodological counterstory. Specifically, a QuantCrit counterstory documents how researchers use CRT to conduct quantitative research and reimagine how quantitative approaches are used to study people of color.[127] In a QuantCrit counterstory, researchers share their methodological journey of integrating CRT into their empirical work.

Pérez-Huber et al.[127] present their QuantCrit counterstory as a six-step process that involves: 1) asking initial questions about quantitative data, 2) reflecting on the role of theory and epistemology, 3) unpacking dominant narratives about their research topic, 4) explaining how the relationship between key variables would be examined in a way that challenged the dominant narratives unpacked in the previous step, 5) engaging in a race-conscious analysis of quantitative data, and 6) recommending a new CRT-based measure of their outcome of interest.

Table 2.2. Key Critical Race Theory Themes, Concepts and Definitions

Theme/Concept	Definition
Ordinariness of racism	"Racism is ordinary, not aberrational – 'normal science,' the usual way society does business, the common, everyday experience of most people of color in this country."[106(p.7)]
Critique of Liberalism	CRT "rejects the basic premises of American legal liberalism. Critical race theorists have not placed their faith in neutral procedures and the substantive doctrines of formal equality; rather, critical race theorists assert that both the procedures and the substance of American law,

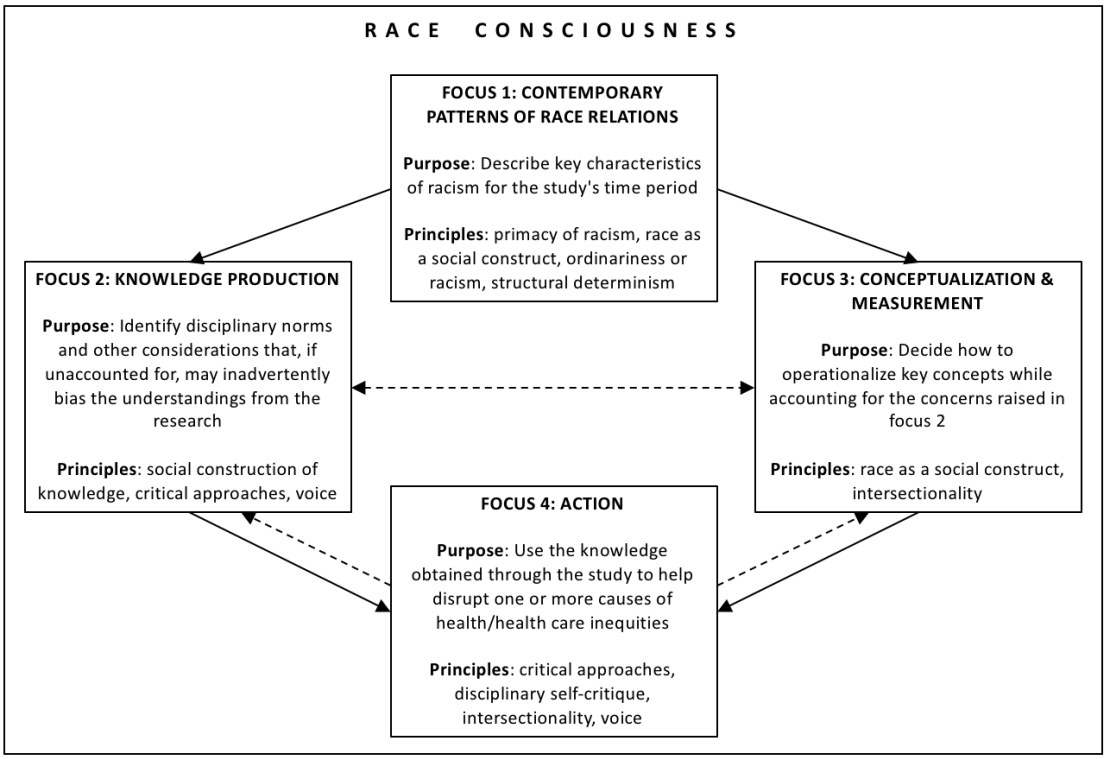
	including American antidiscrimination law, are structured to maintain white privilege."[128(p.1)]
Interest convergence	"Interest convergence [is the] thesis pioneered by Derrick Bell that the [dominant] group tolerates advances for racial justice only when it suits its interest to do so;"[106(p.165)] "This principle of 'interest convergence' provides: The interest of blacks in achieving racial equality will be accommodated only when it converges with the interests of whites."[129(p.523)]
Social construction of race	"The 'social construction' thesis, holds that race and races are products of social thought and relations. Not objective, inherent, or fixed, they correspond to no biological or genetic reality; rather, races are categories that society invents, manipulates, or retires when convenient."[106(p.8)]
Differential racialization	"Differential racialization calls attention to the ways in which the dominant society racializes different minority groups in different ways at different times in response to shifting needs… with our system of laws following suit."[130(p.137)]
Intersectionality	"Intersectionality is a theoretical framework for understanding how multiple social identities such as race, gender, sexual orientation, SES, and disability intersect at the micro level of individual experience to reflect interlocking systems of privilege and oppression (i.e., racism, sexism, heterosexism, classism) at the macro social-structural level."[131(p.1267)]
Voice	"Ability of a group, such as African Americans or women, to articulate experience in ways unique to [them]"[106(p.174)] "because of their different histories and experiences with oppression;"[106(p.10)]
Revisionist History	"Revisionist history reexamines America's historical record, replacing comforting majoritarian interpretations of events with ones that square more accurately with minorities' experiences."[106(p.24)]

3.3 Public Health Critical Race Praxis

If CRT concepts and methods are tools that can be used to better understand and address structural racism, the Public Health Critical Race Praxis is a guidebook that helps public health researchers understand how to use those tools to conduct health equity research. Specifically, the Public Health Critical Race Praxis (PHCRP) is an iterative research methodology that helps public health scholars use CRT to conduct empirical research on racism and health.[107] It consists of 4 focus areas and 10 principles (Figure 2.1) that guide scholars

through a research process that "maintains public health's high standards for scientific rigor" while drawing on CRT.[107] The PHCRP begins with race consciousness and then considers relevant issues related to contemporary race relations (Focus 1), knowledge production (Focus 2), conceptualization and measurement (Focus 3), and action (Focus 4).[116]

Figure 2.1. The Public Health Critical Race Praxis Focus Areas



Adapted by the author (NJB) from Ford and Airhihenbuwa, 2010[107]

PHCRP Principles

The CRT principles included in the PHCRP are defined in Table 2.3 along with examples of conventional research and PHCRP approaches to addressing each principle. To the extent possible, this dissertation takes a PHCRP approach to studying racial residential segregation and CHC availability.

Table 2.3. Public Health Critical Race Praxis Principles and Approaches to Research

Principle	Definition	Conventional Approach	PHCRP Approach

Race consciousness	A deep awareness of one's racial position; awareness of racial stratification processes operating in colorblind contexts	• Research and researchers are assumed to be objective and racially neutral • Colorblindness – belief in the irrelevance of racism characterized by the tendency to attribute medical underservice and racial inequities in health care access to non-racial factors (e.g., socioeconomic status) • Research and policy frame the CHC Program as a War on Poverty program and ignore its civil rights roots	• Researchers clarify their racial biases before collecting and analyzing data and develop methods that are not based on negative racial perceptions • Researchers acknowledge the civil rights and social justice roots of the CHC Program and its relevance to the study
Primacy of racialization and racism	The fundamental contribution of racialization and racism to societal problems and central focus of CRT scholarship	• Tendency to attribute effects to race rather than to racialization or racism • A neighborhood's racial composition is treated as a predictor of racial inequities in health care access instead of racialization or racism	• A study includes factors hypothesized to reflect structural racism • A study seeks to understand the contexts and structures that lead to racial residential segregation (e.g., residential redlining) and racial inequities in health care access (e.g., racialized spatial stigma)
Race as a social construct	Significance that derives from social, political, and historical forces	• Biological determinism – the belief that race is meaningful because it provides insights about people's biology and propensities • Race is treated as a predisposing factor or cause of racial inequities	• A study assesses race not as a risk factor but to identify a population at risk for specific racism exposures • A study clearly states that race and racial composition are not causes of racial inequities • A study explicitly measures racism rather than race
Ordinariness of racism	Racism is embedded in the social fabric of society	• Racial exceptionalism-defines racism as rare, discrete and overtly egregious incidents	• A study examines how racism operates in health care policies and in the routine processes and practices of health care institutions
Structural determinism	The fundamental role of macro-level forces in driving and sustaining inequities across time and contexts; the tendency of dominant group members and institutions to make decisions or take actions that preserve existing power hierarchies	• Emphasizing individual or interpersonal factors • Emphasizing compositional attributes of a neighborhood (e.g., a neighborhood's racial composition or crime rate) rather than the structural factors that shape a neighborhood's make-up	• A multilevel study considers policy factors that may contribute to racial residential segregation and racial inequities in health care access • A study on contextual determinants of access emphasizes structural factors
Social construction of knowledge	The claim that established knowledge within a discipline can be re-evaluated using antiracism modes of analysis	• The belief that empirical research carried out properly is impermeable to social influences	• A disparities-related literature review compares articles published in minority vs. majority journals • A study uses Black feminist thought as critical social theory and oppositional knowledge

Critical approaches	To dig beneath the surface; to develop a comprehensive understanding of one's biases	• To accept phenomena or explanations at face value	• A researcher considers alternative explanations for findings than those previously posited
Intersectionality	The interlocking nature of co-occurring social categories (e.g., race and gender) and the forms of social stratification that maintain them	• Additive model of co-occurring social categories (e.g., race and gender)	• A study examines how interlocking structures of oppression (e.g., the intersection of racism and sexism) affect health care access • Efforts to reduce medical underservice in Black neighborhoods address the unique experiences and needs of all Black people
Disciplinary self-critique	The systematic examination by members of a discipline of its conventions and impacts on the broader society	• Limited, if any, critical examination of how a discipline's norms might influence the knowledge on a topic	• Researchers examine implications for research of using 'health inequities' vs. 'health disparities' vs. 'health inequalities'
Voice	Prioritizing the perspectives of marginalized persons; Privileging the experiential knowledge of outsiders within	• Routine privileging of majority perspectives	• Outsiders within speak truth to power • A study centers the voice and experiential knowledge of outsiders within and people of color (e.g., Black people from Chicago)
Notes: CHC = Community Health Center; Public Health Critical Race Praxis (PHCRP) principles and definitions remain in their original form,[107] conventional and PHCRP approaches are adapted from Ford and Airhihenbuwa (2010),[107] Gilbert and Ray[132] and Doll, Snyder and Ford (2017)[133] to reference research on racial inequities in health care access. The dissertation may not adequately address each principle.			

PHCRP Focus Areas

This dissertation applies the first three foci of the PHCRP (contemporary race relations, knowledge production, and conceptualization and measurement) and thus sets the foundation for exploring the fourth focus area (action) in subsequent projects. Table 2.4 describes the questions that are considered during each of these phases and how each phase (i.e., focus area) guides different parts of the research process (e.g., theory, conceptual models, and methods).

Contemporary race relations (Focus 1) will primarily inform the dissertation's conceptual models. This focus area will be used to conceptualize racism as it operates during the 21st century, specifically in Chicago between 2008 and 2015, and in ways that impact health care

access. The methods will focus on knowledge production (Focus 2) by addressing: 1) how racialization may shape research about CHCs and Chicago; and 2) how conventional health services research methods may reinforce existing power hierarchies and beliefs about CHCs, medical underservice and Black neighborhoods in Chicago. Also key to the methods is conceptualization and measurement (Focus 3), especially identifying the best ways to define and operationalize the dissertation's race and racism related constructs (e.g., racial residential segregation). Future projects will focus on action (Focus 4) and the dissemination of the research findings by exploring ways to use the results to help disrupt one or more causes of inequities in the designation of medically underserved areas and the availability of CHCs.

Table 2.4. Public Health Critical Race Praxis focus areas, guiding questions, and application to the research process

PHCRP focus	**Questions to consider**	**Application to research**
Contemporary race relations	How does racism operate during the time period and in the places of interest to the study? For the following places and time periods: a) the US in 2008 b) the US between 2011 and 2015 c) Cook County and Chicago, IL between 2011 and 2015 d) the US in the post-civil rights era What is the state of racial residential segregation? Which dimensions and processes of racial residential segregation are salient? What are the mechanisms that produce and reinforce racialized spatial stigma?	**Theory, Conceptual Models, Background, and Discussion:** Place CHC expansion in the context of the social construction of racially stigmatized places and the persistence of racial residential segregation; Describe this context and how it is relevant to the study aims and findings **Conceptual Models and Methods:** Identify contemporary forms of racism and contextual factors to consider as predictors of interest and covariates
Knowledge production	How might conventional social science and HSR methods reinforce existing power relations? How might this study further marginalize or stigmatize communities, specifically Black neighborhoods and potentially MUA/Ps?	**Theory:** Center the voice of Black women from Chicago **Theory, Conceptual Models, and Methods:** Draw on multiple sources of knowledge and modes of knowledge production

	How has racialization informed existing knowledge about Chicago neighborhoods, medical underservice, and the Community Health Center Program?	**Reflexive essays:** Describe my methodological journey (e.g., how I applied CRT, addressed my own personal subjectivities, and disciplinary norms) in a QuantCrit counterstory
Conceptualization & measurement	How is racial residential segregation defined? What is the best way to operationalize racial residential segregation given the places, populations, and timeframes of interest?	**Methods:** Explore context-specific measures of racial residential segregation
Notes: PHCRP = Public Health Critical Race Praxis; CHC = Community Health Center; HSR = health services research; MUA/P = Medically Underserved Area/Population		

3.4 Behavioral Model of Health Services Use

The Behavioral Model of Health Services Use (hereafter: Behavioral Model) will be used to understand how contextual determinants of health care access may affect medically underserved area (MUA) designation and CHC supply. According to the Behavioral Model, an individual's access to care is determined by their predisposition to use services (predisposing factors), resources that enable or impede their access (enabling factors), and their need for health care (need factors).[79] Predisposing, enabling and need factors may exist at the individual or contextual level. Given the ecological nature of this dissertation, the dissertation conceptual models focus on contextual factors. Under the Behavioral Model, contextual refers to the circumstances and environment in which health care access occurs.[134] At the contextual level, predisposing factors include a community's demographic characteristics, social characteristics, and norms; enabling factors include health care policy and infrastructure; and need factors include characteristics of the physical environment and indicators of population health.[78]

The dissertation conceptual models are also informed by two adaptations of the Behavioral Model: the Behavioral Model for Vulnerable Populations[135] and a conceptual framework for evaluating safety net and other community-level factors on access.[136] In addition to the traditional predisposing, enabling, and need domains, the Behavioral Model for

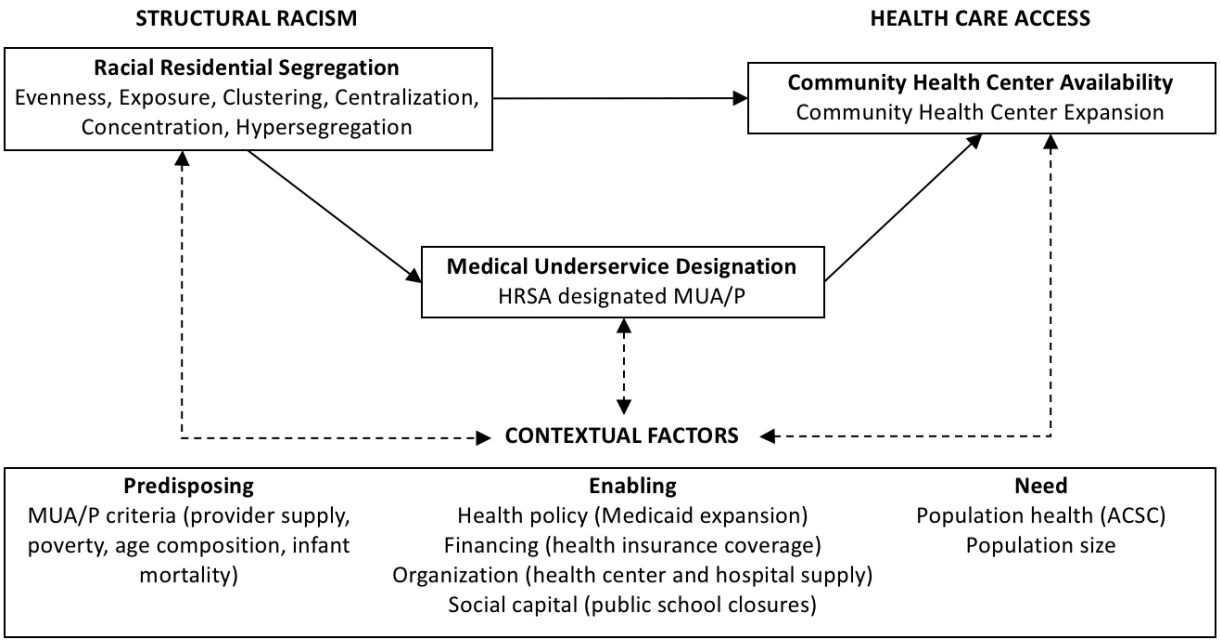
Vulnerable Populations includes determinants of health care access that are relevant to vulnerable populations. These vulnerable domains focus on social structure and enabling resources like living conditions, crime rates, and social services resources.[135] The conceptual model for evaluating safety net and other community-level factors was developed by Davidson et al.[136] and delineates a more comprehensive list of contextual determinants of health care access. The contextual factors in that model focus on community characteristics that "capture the characteristics of the low-income and safety-net populations, the structure of the health care market and safety-net services in a geographic area, and public policy support for providing services" to insured and uninsured low-income populations.[136]

3.5 Dissertation Conceptual Models

This dissertation is guided by two conceptual models. The first model (Figure 3.1) examines racism-related medical underservice and is described in Section 3.6.1. The second model (Figure 3.2) examines health care redlining and is described in Section 3.6.2.

Conceptual Model #1: Racism-Related Medical Underservice

Figure 3.1. Conceptual Model of Racism-Related Medical Underservice



Notes: MUA/P = medically underserved area/population; ACSCs = ambulatory care sensitive conditions

This dissertation focuses on a phenomenon I refer to as racism-related medical underservice, which has three main components: 1) racism, 2) medical underservice, and 3) the relationship between racism and medical underservice, which affects the availability of community health centers (CHCs). The conceptual model of racism-related medical underservice (Figure 3.1) illustrates how racial residential segregation, a form of structural racism, directly and indirectly through its impact on medical underservice and contextual determinants of health care access affects CHC availability. The primary outcome of interest is CHC availability.

Segregation and Health Center Availability

Racial residential segregation may have a positive or negative effect on community health center availability. Historically, health care safety net facilities intentionally located in segregated areas to combat racial segregation. For example, historically Black hospitals, "that is, facilities that had a traditional mandate to serve black people,"[137(p.xiv)] intentionally served and located in Black communities because White hospitals refused to serve Black patients or

employ Black health care providers. For similar reasons, the Black Panther Party added a demand for "completely free health care for all Black and oppressed people" to their ten-point platform.[138] In 1970, all chapters of the Black Party Panther were instructed to establish health care clinics (called the People's Free Medical Clinics) to delivery community-based care in Black communities that were neglected and mistreated by both private and public health care institutions.[138,139] The first federally-funded community health center was created to address inadequate access to health services in the racially segregated South[2,8] where predominantly Black communities experienced "the worst of the problems and the worst of the racism and the worst of the need."[9(p.44)]

The historical relationship between segregation and the availability of safety net facilities, specifically community health centers, may remain intact today. For example, clinics that explicitly served Black communities in the past may still exist today and some may now be CHCs. It is also possible that health center grantees prioritize historically disadvantaged areas when deciding where to build new sites. Alternatively, the marginalization of predominantly Black neighborhoods in segregated areas may persist. In this case, the availability of CHCs in a highly segregated county or city may be high compared to a less segregated county or city, but those CHCs may be clustered in non-Black neighborhoods. Consequently, Black neighborhoods may have fewer health centers than non-Black neighborhoods and experience chronic medical underservice.

Segregation and Medical Underservice Designation

Medical underservice designation may mediate the relationship between racial residential segregation and CHC availability. The relationship between a medically underserved area/population (MUA/P) designation and CHC availability is likely positive. That is, federally designated MUA/Ps are probably more likely to have a CHC and a larger supply of CHCs than areas that do not have a MUA/P designation. This is because CHCs are required by law to

serve medically underserved populations and to receive CHC funding, an organization must show that its service area is a designated MUA/P. The relationship between racial residential segregation and medical underservice is less clear and may function like segregation's relationship with CHC availability. For example, a highly segregated county or city may be more likely to be designated medically underserved or have more neighborhoods designated medically underserved than a less segregated county or city, but those designations may be clustered in non-Black neighborhoods.

Contextual Determinants of Health Care Access

In addition to racial residential segregation, various contextual factors may affect CHC availability. These contextual determinants of health care access may also affect and be affected by racial residential segregation.

Contextual predisposing factors include sociodemographic characteristics that predispose a community to receive a MUA designation and CHC grants. An area's primary care provider-to-population ratio, poverty rate, percentage of residents age 65 and over, and infant mortality rate are considered predisposing factors because they are the demographic and health indicators the federal government uses to determine MUA designation and therefore CHC eligibility. For example, an area with a low provider-to-population ratio, high poverty rate, high percentage of residents age 65 and over, and high infant mortality rate is more likely to (be eligible to) receive a MUA designation and CHC grant.

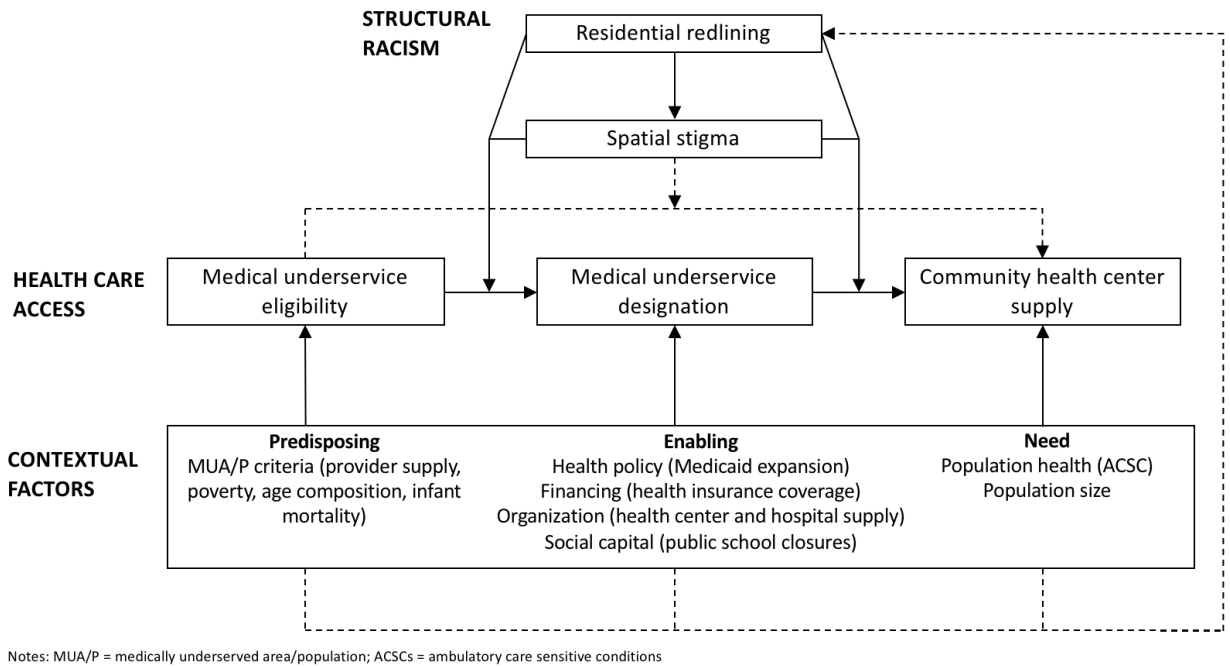
Regardless of whether an area is eligible for a MUA designation or CHC grant, contextual enabling characteristics, including public policy and social capital, may facilitate or impede a community's ability to receive a MUA designation or CHC grant. For example, a federal policy that provides increased funding for CHCs or a local policy that aims to increase CHC supply in previously neglected areas may improve an organization's ability to secure a grant to establish a CHC in its service area. However, an organization may lack the social

capital and organizational capacity necessary to complete and submit a MUA/P designation or CHC grant application. This may impede the organization's ability to get their service area designated medically underserved and establish a CHC delivery site.

Lastly, contextual need factors include community characteristics that residents, health care providers, or policymakers recognize as requiring medical treatment. Most of these are population health measures like mortality and morbidity rates. More specifically, and for the purpose of this study, contextual need factors also include community characteristics that suggest a community needs more primary care services. This could include an area's total population size or hospital admissions and emergency department visits for ambulatory care sensitive conditions. For example, areas with more residents may need (and receive) more health centers to meet the demand for health services. An area may also need (and receive) more CHCs if it has a high rate of hospitalizations or ED visits for ambulatory care sensitive conditions (ACSCs). ACSCs are health conditions (e.g., diabetes, asthma, and hypertension) for which adequate access to primary care could prevent hospitalization or an emergency department visit. Previous research shows that Medicaid patients who rely on federally qualified health centers for care have significantly fewer hospitalizations and ED visits for ACSC compared to Medicaid patients who rely on other sources of ambulatory care.[140]

Conceptual Model #2: Health Care Redlining

Figure 3.2. Conceptual Model of Health Care Redlining



Notes: MUA/P = medically underserved area/population; ACSCs = ambulatory care sensitive conditions

Medical Underservice

Medical underservice can mean many things. This model conceptualizes medical underservice in two ways. First, an area can be an eligible MUA/P. An eligible MUA/P is medically underserved by definition only; it meets the federal government's MUA/P eligibility criteria, but is not a federally designated MUA/P. Second, an area can be a federally designated MUA/P. A federally designated MUA/P is an area that meets HRSA's MUA/P eligibility criteria and is designated a MUA/P by HRSA. Both definitions of medical underservice are based on HRSA's definition and measurement of medical underservice. Although HRSA's MUA/P designation criteria have several limitations, it is the current criteria used to determine access to CHC grant and has been since the creation of the CHC Program. Thus, conceptualizing medical underservice in this way has policy relevance.

Medically Underserved Area Designation

Neighborhoods that meet HRSA's MUA eligibility criteria may be more likely to be part of a designated MUA. MUA eligibility is based on the index of medical underservice (IMU), which is based on a service area's provider-to-population ratio, infant mortality rate, poverty rate, and percentage of residents age 65 and over. Service areas with an IMU score of 63.0 or lower are eligible to apply for an MUA designation. A service area can be a whole county or a group of neighboring counties, census tracts, or civil divisions. Most MUAs (over 80 percent)[44] are a group of census tracts, a common proxy for neighborhood boundaries. Although MUA eligibility is based on the IMU score for the service area as a whole, an individual neighborhood with an IMU less than 63.0 may be more likely to be part of an MUA designation application. For example, calculating the IMU for individual neighborhoods (e.g., census tracts) may help organizations identify areas to include in a MUA application. Inclusion in a MUA designation application is the only way for a neighborhood to become part of a MUA designation.

Community Health Center Expansion

A neighborhood that is part of a designated MUA may be more likely to have a CHC or gain a CHC. An organization applying for CHC funding must demonstrate that their proposed service area is in whole or in part a federally designated MUA/P. Organizations located in a MUA may be more likely to apply for and be awarded a CHC grant. For one, the purpose of the CHC program is to improve access to underserved communities, and most federally designated MUA/P are a collection of neighborhoods. Second, federal and local health agencies and CHC advocates have complained about the maldistribution of CHCs and the number of MUAs without a single CHC. Third, research shows that increased funding for CHCs has helped decrease the number of MUAs without a CHC. For these reasons, HRSA may be more inclined to approve a CHC grant application for an organization located in a neighborhood that is part of a designated MUA, especially if that area currently lacks a CHC.

Structural Determinism and the Ordinariness of Racism

The submission and approval of MUA designation and CHC grant applications are determined by institutional actors. For example, a MUA designation application can only be submitted by a state Primary Care Office (PCO). A PCO is a state or territorial public or non-profit entity approved and funded by HRSA to assess and address its state's need for primary care services and coordinate shortage designations in the state. An organization within the state can submit a request for a MUA designation, but PCOs determine what applications are submitted. Similarly, for a CHC to be built or designated in a particular neighborhood, a local organization has to decide to apply for a Health Center program grant. Ultimately, HRSA determines whether a MUA designation or CHC grant is approved or denied.

The MUA designation and CHC grant application processes highlight the structural determinism of MUA designations and access to CHCs. Structural determinism posits that macro-level forces play a fundamental role in driving and sustaining inequities.[107] It also suggests that dominant institutions (e.g., HRSA and PCOs) may make decisions that reinforce existing power hierarchies and preserve the interests of dominant groups.[107,116] For these reasons, the conceptual model focuses on how macro-level forces (i.e., institutional decisions) affect a neighborhood's MUA designation status and supply of CHCs. To capture the ordinariness of racism, the conceptual model considers how the routine process of designating MUAs and awarding CHC grants may be influenced by residential redlining.

Residential Redlining

Despite meeting MUA eligibility criteria, redlined neighborhoods may be less likely to be part of a designated MUA and less likely to have or gain a CHC. As structural determinism highlights, MUA designation and CHC funding are determined by institutional actors. Institutional actors may, knowingly or unknowingly, carry negative views about redlined neighborhoods, consider redlined neighborhoods unworthy of investment, and, as a result, be

less likely to grant redlined neighborhoods MUA designation and CHC funding. Thus, the conceptual model suggests that HRSA's MUA designation and CHC funding application processes are not objective or race neutral. Instead, these processes, specifically the decisions of institutional actors, may be influenced by historical or contemporary residential redlining and the racialized spatial stigma it creates. In other words, institutional actors may stigmatize redlined neighborhoods and this stigmatization may cost redlined neighborhoods MUA designation and access to CHCs.

Residential redlining refers to the practice of financial institutions systematically denying housing loans or providing housing loans with less favorable terms based on the racial composition of the neighborhood where the property to be financed is located.[54] The practice was based on a color-coded system that evaluated the perceived risk of lending money in a particular neighborhood. Financial institutions consistently assigned Black neighborhoods the lowest rating which was colored red and indicated where lenders would not loan money.[59,141] Redlined neighborhoods were labeled hazardous, undesirable, and unworthy of investment.[55]

Negative representations of marginalized communities have been referred to as spatial stigma.[142] Spatial stigma is produced by the symbolic and material degradation associated with structural inequities.[142] For example, residential redlining steers money away from Black neighborhoods (material degradation) and labels Black neighborhoods as high-risk areas (symbolic degradation).

3.6 Research Questions and Hypotheses

This dissertation examines the association between CHC expansion, MUA/P designations, and racial residential segregation in 3 settings: nationally, among US metropolitan counties and locally among: a) Cook County, IL municipalities and b) Chicago, IL neighborhoods. The research questions and hypotheses associated with each study aim are described below.

AIM 1: To examine how racial residential segregation and MUA/P designation as characteristics of a place affect CHC expansion.

There were 2 research questions associated with the first:

1. What is the association between Black-White residential segregation and CHC expansion between FYs 2011 and 2019 among: a) metropolitan counties in the United States and b) municipalities in Cook County, IL?
2. Does MUA/P designation mediate the association between segregation and CHC expansion?

I hypothesized that Black-White residential segregation and CHC expansion would be positively associated among US metropolitan counties, such that counties with higher segregation would, on average, be more likely to gain a new CHC during the study period. In addition, I hypothesized that among counties with at least one new CHC (expansion counties) counties with higher segregation would, on average, have a greater number of new CHCs.

Because county-level analyses may mask inequities within counties, I hypothesized that Black-White residential segregation and CHC expansion would be negatively associated among Cook County municipalities, such that municipalities with the highest concentration of Black residents would be less likely to gain a new CHC compared to municipalities with the highest concentration of White residents. Likewise, I hypothesized that the number of new CHCs among expansion areas would be lower for municipalities with a higher concentration of Black residents.

As for the second research question, I hypothesized that having a MUA/P designation during the study period would mediate the association between Black-White segregation and CHC expansion among metropolitan counties. Specifically, I hypothesized that metropolitan counties with higher Black-White segregation would be more likely to have at least one MUA/P designation and that metropolitan counties with a MUA/P designation would be more likely to

have a new CHC. Among expansion counties, I hypothesized that segregation and MUA/P designation would maintain a positive association and that expansion counties with a MUA/P would have a greater number of new CHCs. I hypothesized that MUA/P designation would also mediate the association between segregation and CHC expansion among Cook County municipalities, but that segregation would be negatively associated with both CHC expansion and MUA/P designation.

AIM 2: To examine how racial residential segregation and MUA/P designation as processes determined by institutional actors affect CHC supply.

There were 3 research questions associated with the second aim:

1. What is the association between MUA/P eligibility and MUA/P designation between FYs 2011 and 2019 among Chicago neighborhoods?
2. What is the association between MUA/P designation and the increase in CHC supply between FYs 2011 and 2019 among Chicago neighborhoods?
3. Does residential redlining moderate the associations between MUA/P eligibility, MUA/P designation, and CHC expansion between FYs 2011 and 2019 among Chicago neighborhoods?

I hypothesized MUA/P eligibility would be positively associated with MUA/P designation and CHC expansion among Chicago neighborhoods, such that neighborhoods eligible for an MUA/P designation would be more likely to both have an MUA/P designation and a new CHC between FYs 2011 and 2019. I also hypothesized MUA/P designation would be positively associated with CHC expansion.

In terms of moderation, I hypothesized redlining would moderate the associations between MUA/P eligibility, MUA/P designation, and CHC expansion. Specifically, I expected redlining would reduce the magnitude of the association between MUA/P

eligibility and designation, as well as the effect of MUA/P designation on CHC expansion.

CHAPTER 4: METHODS

4.1 Study Design

An ecological study design was used to assess the association between segregation, medical underservice and the expansion of CHCs between FY 2011 and 2019 (October 1, 2010 and September 30, 2019) among: a) US metropolitan counties, b) Cook County municipalities, and c) Chicago neighborhoods. The study period was selected to match the initial 5-year authorization of the CHCF from FY 2011 to FY 2015 (October 1, 2010 – September 30, 2015) and the two, 2-year extensions of the CHCF spanning FY 2016 to FY 2019 (October 1, 2015 – September 30, 2019) that occurred prior to the COVID-19 pandemic.

In 2015, the Medicare Access and CHIP Reauthorization Act (MACRA) extended the CHCF for FY 2016 and FY 2017.[143] In 2017, the Bipartisan Budget Act (BBA) extended the CHCF for FY 2018 and FY 2019.[143] Despite these two, 2-year extensions, CHCF funds were not used for new access point grants (i.e., grants used to increase the number of new CHC sites) in fiscal years 2016, 2018, and 2019.[143,144] I observed health center expansion during the CHCF extension period (FYs 2016 – 2019) because new access point grants were still awarded during this time, even if the funding source was not the CHCF.

4.2 Sample

There are three study samples: a US sample, a Cook County sample, and a Chicago sample. The US sample consists of metropolitan counties with at least 100 Black residents, the Cook County sample consists of Chicago community areas and suburban municipalities, and the Chicago sample consists of census tracts in the city. In the following sections, I describe each sample below.

US Sample

The population of interest was US metropolitan counties. Consistent with Ko and Ponce[83] a metropolitan county was defined as a county located in a metropolitan or micropolitan statistical area. The Office of Management and Budget (OMB) defines a metropolitan statistical area as an area containing at least one urbanized area of 50,000 or more residents and a micropolitan statistical area as an area containing at least one urban cluster of 10,000 or more residents but less than 50,000 residents.[145] Metropolitan and micropolitan areas both consist of one or more counties or county equivalents.[146]

I do not use the terms metropolitan and non-metropolitan counties to mean urban and rural counties. The OMB warns policymakers to avoid conflating metropolitan and micropolitan statistical areas with urban and non-rural areas, as a metropolitan or micropolitan area may contain a predominantly rural county.[147] However, HRSA considers rural counties to be all counties located outside of a metropolitan statistical area, including counties located in a micropolitan statistical area.[148] The study results were interpreted with these definitions in mind.

The sample excluded areas located in US commonwealths, territories, or freely associated states (i.e., Puerto Rico, the Virgin Islands, Guam, American Samoa, the Northern Mariana Islands, Palau, the Republic of the Marshall Islands, and the Federated States of Micronesia). Although HRSA provides CHC funding and designates MUA/Ps in these areas, the provision of health care and the history and conceptualization of race and racism in these areas and the US differ. In addition, counties that contain only one census tract were excluded because two or more census tracts per county were required to calculate the study's segregation measures.

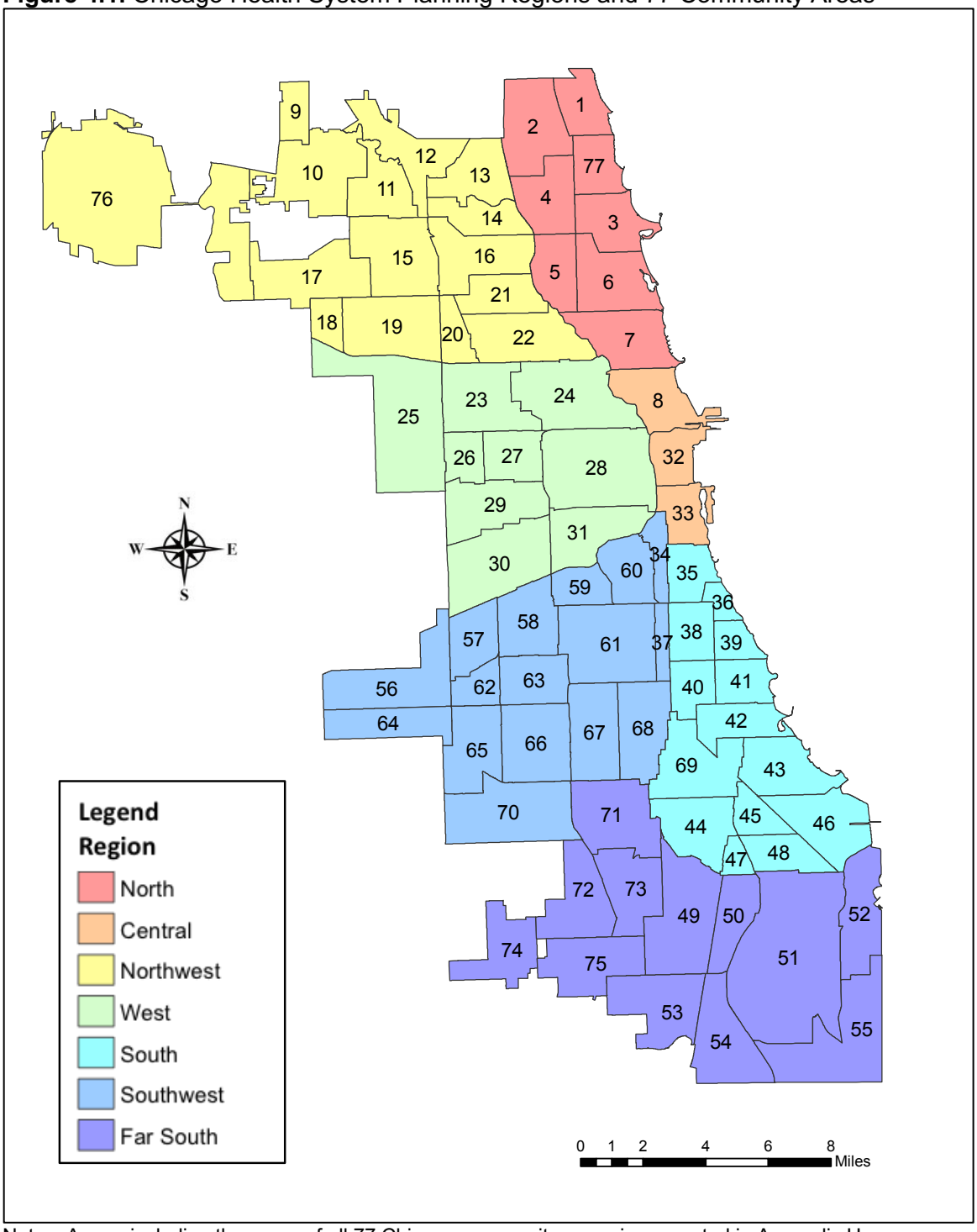
Prior studies that measures racial residential segregation exclude areas with a small Black population[88,149] because segregation measures like the dissimilarity index are less reliable when the Black population is small.[85,150,151] Conceptually, however, it is unclear what the appropriate cut point is. Most studies on segregation and health are conducted at the MSA level

and restrict the sample to areas with at least a 3% Black population. County-level analyses have restricted samples to areas with at least 100 to 1,000 Black residents.[150,151] Consistent with recent research,[150,152] the sample for this study was restricted to metropolitan counties with at least 100 Black residents.

Cook County Sample

The population of interest for Cook County consisted of the county's suburban municipalities and Chicago's community areas (Figure 4.1). Cook County suburban municipalities are cities, villages, and incorporated towns located in Cook County and outside of the city of Chicago. In 1920, the Chicago Department of Public Health and the University of Chicago's Local Community Research Committee divided the city's then 935 census tracts into 75 community areas in order to track local variations in census data and vital statistics based on "real," not arbitrary, community boundaries.[153] With the exception of O'Hare (community area 76) and Edgewater (community area 77), Chicago community areas (CCAs) have remained the same since their inception.[154] Although CCAs were developed a century ago and for the purpose of data collection and social science research,[28] local residents, politicians, media outlets, and institutions recognize and regularly reference areas by their community area name.[27,28] The exclusion and inclusion criteria for the Cook County sample are detailed below and based on the purpose of this study, which is to document disparities in the distribution of CHCs within a county.

Figure 4.1. Chicago Health System Planning Regions and 77 Community Areas



Notes: A map including the name of all 77 Chicago community areas is presented in Appendix H.
Source: Image created by the author (NJB) using shapefile for Chicago Community Areas available on the Chicago Data Portal website

The number of municipalities considered to be part of Cook County, Illinois varies by organization, document, and year. For example, the "about" page on the Cook County government website currently states that Cook County contains 128 municipalities including the City of Chicago,[155] the County's 2016 Comprehensive Annual Financial Report (prepared by the Office of the County Comptroller) states that 132 municipalities lie within Cook County,[156] and the 2013 Economic Growth Action Agenda for Cook County (prepared by the Cook County Council of Economic Advisors) states that Cook County contains 121 municipalities.[157]

Two sources were used to identify the suburban municipalities included in the study sample: 1) The Cook County Department of Public Health (CCDPH)'s Suburban Cook County District Map; and 2) the Chicago Metropolitan Agency for Planning (CMAP)'s Suburban Cook County Community Data Snapshots. CCDPH is a core safety net provider and its community profiles (which include the Suburban Cook County District Map) list all municipalities entirely or partially located in Cook County and indicates which are under CCDPH's jurisdiction. CMAP, an Illinois state government organization, was created in 2005 and authorized by the Regional Planning Act (Public Act 095-0677) to consolidate regional planning for public and private investments, land use, and transportation in northeastern Illinois.[158,159] The organization's Community Data Snapshots provide data for municipalities located in Cook, DuPage, Kane, Kendall, Lake McHenry, and Will counties. Municipalities located in multiple counties are assigned to the county containing the largest geographic portion of the municipality.[160]

From the Suburban Cook County District Map, 129 municipalities were identified. Based on CMAP's community snapshots, municipalities were excluded if the largest geographic portion of the municipality is not located in Cook County. Eight suburban municipalities (Bartlett, Bensenville, Buffalo Grove, Burr Ridge, Elgin, Hanover Park, Hinsdale, and Roselle) were excluded for this reason, leaving 121 suburban municipalities to be included in the sample. Six of the eligible municipalities (Burbank, Evanston, Forest View, Oak Park, Skokie, and Stickney)

are not served by CCDPH, but included in the sample because the entire geographic area of each is located in Cook County.

Chicago Sample

The population of interest for the Chicago sample was Chicago neighborhoods. For this study, census tracts were used as a proxy for neighborhoods. Initially, neighborhood clusters were intended to be the proxy for Chicago neighborhoods. Neighborhood clusters contain two to three geographically contiguous census tracts that, based on US Census data, are relatively similar in terms of racial and ethnic composition, socioeconomic status, housing density, and family structure.[27,161] The Project on Human Development in Chicago Neighborhoods (PHDCN) research team designated neighborhood clusters in the 1990s for research purposes, but used major geographic boundaries (e.g., railroad tracks, parks, and expressways) and the team's knowledge of local neighborhoods to help guide the construction of neighborhood clusters. While census tracts in Chicago have changed little since the 1920s,[162] the city currently has more census tracts than it did in the 1990s when neighborhood clusters were initially constructed – there are currently 866 census tracts in Chicago and neighborhood clusters consist of the 847 populated tracts in Chicago in the 1990s. However, neighborhood cluster data, including which census tracts make up each cluster, is not publicly available and was not able to be obtained for this study.

4.3 Data Sources

Several publicly available datasets were used to create the study datasets. A separate dataset was created for each sample. Data on CHCs was obtained from HRSA's Health Care Service Delivery Site (HCSDS) database. The HCSDS contains a list of all federally qualified health center delivery sites, look-alike delivery sites, and administrative sites. The database also contains geographic information (e.g., site and grantee county, zip code, street address and

geocoding coordinates) and organizational information (e.g., ownership type, health center type, and grant number) for each site. HRSA also maintains a Medically Underserved Areas/Population database which was used to obtain information about each MUA/P's service area location (e.g., county name or census tracts), designation type (e.g., MUA, MUP, governor's exception MUP), and designation status (e.g., designated, proposed for withdrawal, withdrawn). HRSA updates both databases daily.[163] The CHC data for this study were downloaded on January 8, 2021, and the MUA/P data on April 8, 2021.

I aggregated HRSA CHC data, which is available at the site (clinic) level, and MUA/P data, which is available at the census tract level, to the county level. Similarly, I aggregated HRSA CHC and MUA/P data to the municipality level for the Cook County sample, and CHC data to the census tract level for the Chicago sample. I then merged these data with county-level, municipality-level, and census tract-level population health, physician supply, and demographic data from multiple sources.

Population health data (e.g., 5-year infant mortality rates) were obtained from HRSA's 2017-2018 Area Health Resource File, which includes 5-year infant mortality rates from the National Center for Health Statistics Detail Mortality and Natality data files. Infant mortality rates for Cook County and Chicago were obtained from the Illinois Department of Public Health (IDPH) Vital Statistics. The Cook County Department of Public Health has aggregated IDPH infant mortality data for suburban Cook County municipalities and it is publicly available on the Cook County Government's open data portal website.[164] Similarly, the Chicago Department of Public Health has aggregated IDPH infant mortality data for Chicago community areas and it is publicly available on the Chicago Health Atlas website.[165]

Physician supply data for all samples was obtained from the 2010 American Medical Association (AMA) Physician Masterfile via the Primary Care Service Area Project Version 3.1 database. Developed by Dartmouth College and Virginia Commonwealth University, the Primary Care Service Area Project is a national dataset that provides information about the availability of

health care resources in the US.[166,167] I aggregated the census tract-level PCSA data to the county level for the US sample and to the municipality level for the Cook County sample before merging it with the other datasets.

Data on the social, economic, and demographic characteristics of US counties, Cook County municipalities, and Chicago census tracts was obtained from the 2015 American Community Survey (ACS) 5-Year (2011-2015) estimates, which includes pooled data collected between January 1, 2011 and December 31, 2015. The ACS is a national survey published by the US Census Bureau and contains demographic (e.g., age), social (e.g., race, education, marital status), economic (e.g., income and employment), health (e.g., health insurance coverage), and housing (e.g., occupancy and housing value) data at multiple geographic levels (e.g., state, county, and census tract). The ACS 5-year estimates were used instead of the 1-year or 3-year estimates because the data is more reliable and includes a larger sample size.[168]

Lastly, for the Chicago sample, housing discrimination data was obtained from the Home Owners' Loan Corporation (HOLC) and Home Mortgage Disclosure Act (HMDA). Specifically, data on historical redlining was obtained from the HOLC security maps through the Mapping Inequality website. Mapping Inequality - a product of a collaboration among the University of Richmond, Virginia Tech University, and the University of Maryland – provides public access to HOLC maps and neighborhood assessments.[169]

Contemporary redlining data was obtained from the Housing Mortgage Disclosure Act (HMDA) data. HMDA data has been collected annually since 1976. Financial institutions that must report HMDA data include banks, savings associations, credit unions, and other financial institutions that meet certain criteria. In 2017 these criteria included having over $44 million in assets, an office or more than 5 home loan applications/purchases in an MSA, and at least 1 home loan or home refinancing loan that originated from the institution. The data collected from these institutions is considered the most comprehensive information on home lending practices in the US and includes: the loan amount, loan type, property type, race and ethnicity of the

applicant, and property location among other variables. In 2017, 6,762 institutions reported HMDA data. This data included 16.3 million home loan records.

Geographic data

I used geographic data from the US Census to identify metropolitan counties for the US sample and the census tract of each CHC site for the Cook County and Chicago samples. The US Census Bureau's Delineation File for Core Based Statistical Areas (CBSAs) and Combined Statistical Areas (CSAs) provides a list of the counties and county equivalents that make up metropolitan and micropolitan statistical areas, as defined by the Office of Management and Budget (OMB). This data was used to identify metropolitan counties and determine the US sample.

I used the US Census Bureau's Census Geocoder[170,171] to identify the census tract of each CHC site. HRSA's health center delivery site database provides each site's address (e.g., street name and number, city, and zip code). I uploaded this information to the Census Geocoder using the batch address processing feature and the find geographies option to match the most current data on the addresses to the geographies (e.g., census tracts) that were in place at the time of the 2010 US Census. The 2010 Census was selected as the vintage point because it aligns with the study's baseline (FY 2010).

4.4 Measures

4.4.1 Community Health Center Expansion

The primary outcome variable for this study was community health center expansion between FYs 2011 and 2019. CHC expansion was operationalized in the following two ways: 1) as a binary indicator of whether an area (e.g., county, municipality, or census tract) gained at least one new CHC site between FYs 2011 and 2019 and 2) as the number of new CHC sites

an area gained between FYs 2011 and 2019, if the area gained at least one new CHC site. For both measures, FY 2010 was the baseline. CHCs included HRSA-funded health center sites and look-alike health center sites. Administrative sites where health care services are not delivered were excluded.

CHC expansion is measured as the addition of a new CHC site instead of the change in CHC supply for three reasons. First, measuring the change in CHC supply makes it difficult to know how many new CHCs were created. This is because the change in supply would account for both the number of new CHC sites *and* the number of closed CHC sites. For example, a county with 10 CHCs in FY 2011, 2 new CHCs in FY 2012, and 2 closed CHCs in FY 2013, would have a change score of 0. The number of new CHCs is masked by the number of closed CHCs.

4.4.2 Medically Underserved Area/Population Designation

Medically underserved area/population designation was measured as a binary indicator of whether an area (e.g., county, municipality, or census tract) had at least one MUA/P designation at any point between FYs 2011 and FY 2019. HRSA grants MUA/P designations to whole counties, groups of neighboring counties, groups of urban census tracts, and groups of minor civil divisions (also known as county subdivisions).[172] The majority of MUA/P designations have been assigned to geographic areas and are known as medically underserved areas (MUAs). MUAs tend to be a group of census tracts or a county subdivision rather than an entire county (i.e., a single county designation). The primary measure of MUA/P designation includes designations of any geographic type as well as medically underserved populations. This was done to account for the full scope of medical underservice in the US as measured by the federal government.

A medically underserved population (MUP) is a population group within a geographic area that lacks access to primary care health services and includes populations that

experiences economic, cultural, and linguistic barriers to care. HRSA grants MUP designations to low income, Medicaid eligible, low income homeless, low income migrant farmworker, low income migrant seasonal worker, and Native American populations.[172]

4.4.3 County-level Racial Residential Segregation

The predictor of interest for this study was the level of racial residential segregation in a county. The dissimilarity index was the primary segregation measure. I measured dissimilarity between residents who identify as Black alone or in combination with another race and residents who identify as non-Hispanic White. Dissimilarity, a measure of evenness, can be interpreted as the percentage of Black or non-Hispanic White residents who would have to move to different neighborhoods for each neighborhood (i.e., census tract) to have the same composition of the two groups as the county overall. The index ranges from 0 to 1.0 and is calculated as:

$$D = \frac{1}{2}\sum_{i=1}^{n}\left|\frac{w_i}{W} - \frac{b_i}{B}\right|$$

where b_i is the number of Black residents in census tract i, w_i is the number of non-Hispanic White residents in census tract i, B is the total number of Black residents in county n, and W is the total number of non-Hispanic White residents in county n. Dissimilarity scores between 0 and 0.3 are considered low, scores between 0.31 and 0.6 are considered moderate, and scores above 0.6 are considered high. In other words, higher values represent more segregation (dissimilarity). For ease of interpretation and consistency with how other variables were measured, I multiplied the dissimilarity by 100, making the variable a percent rather than a proportion.

The dissimilarity index is the most widely used measure of segregation[53,173] and was used in a prior study that examined the relationship between segregation and CHC expansion.[83] Despite its conceptual shortcomings, the dissimilarity index will be used to measure racial

residential segregation because it allows for comparison across studies. Specifically, it allows us to address the question of whether Ko and Ponce's findings of a positive relationship between segregation, as measured by the dissimilarity index, and CHC expansion hold under the most recent federally funded initiative to expand CHCs. Furthermore, Ko and Ponce (2013) measured dissimilarity among counties' non-White and White residents. In contrast, the present study measured dissimilarity among counties' Black and non-Hispanic White residents, allowing us to address whether the positive association between segregation and CHC expansion holds for residential segregation between Black and White populations.

The isolation index is another common measure of segregation and was used to measure segregation in sensitivity analyses. I examined the isolation index because exploratory data analysis revealed that a county's total population size impacted CHC expansion but was significantly correlated with all other independent variables. Unlike the dissimilarity index, the isolation index accounts for population size, specifically the size the racial/ethnic groups being compared.[49] Interpreted as the likelihood that a Black resident will come in contact with another Black resident in their neighborhood, the isolation index is a measure of exposure and calculated as:

$$\sum_{i=1}^{n}\left[\left(\frac{b_i}{B}\right)\left(\frac{b_i}{t_i}\right)\right]$$

where b_i is the number of Black residents in census tract i, B is the total number of Black residents in county n, and t_i is the total number of residents in census tract i. Like the dissimilarity index, the isolation index ranges from 0 to 1.0 and higher values indicate greater segregation (isolation). Isolation was also multiplied by 100 to create a percent.

4.4.4 Local-level Racial Residential Segregation

The **Index of Concentration at the extremes** (ICE) was used to measure racial and racialized economic segregation in Cook County municipalities and Chicago census tracts. ICE measures the extent to which an area's residents are concentrated at the top or bottom of a social hierarchy and is calculated as:[174,175]

$$ICE_i = \frac{A_i - P_i}{T_i}$$

where A_i is the number of residents in area i who are members of the most privileged social group; P_i is the number of residents in area i who are members of the least privileged (most deprived) group; and T_i is the total population of area i (for which data on the social category of interest is available). The ICE ranges from -1 (100% of residents are members of the least privileged group) to 1 (100% of residents are members of the most privileged group).[176] The ICE is zero if none of the residents are in the least or most privileged group or if an equal number of residents is in the least and most privileged groups.[177] Initially developed by Massey (2001) to measure neighborhood-level concentration at the extremes of affluence and poverty, the ICE has been extended and employed in public health research to measure racial segregation and racialized economic segregation at the census tract and city/town levels.[178] The specific measures used for this study are described in Table 4.1.

Table 4.1. Selected Measures of the Index of Concentration at the Extremes

Measure	Formula	Interpretation
Local Racial Segregation (ICE for race)	$\frac{W_i - B_i}{T_i}$	Ranges from -1 to 1; Negative values indicate that an area has a higher concentration of Black residents (as compared to White residents); Positive values indicate that an area has a higher concentration of White residents (as compared to Black residents)
Local Racialized Economic Segregation (ICE for race and income)	$\frac{H_i - L_i}{T_i}$	Ranges from -1 to 1; Negative values indicate that an area has a higher concentration of Black residents with low incomes (as compared to White residents with high incomes; Positive values indicate that an area has a higher concentration of White residents with high incomes (as compared to Black residents with low incomes)

Notations:
W_i = the number of White residents in area i

B_i = the number of Black residents in area i
T_i = the total number of residents in area i
H_i = the number of White residents with high incomes in area i
L_i = the number of Black residents with low incomes in area i

ICE for race was measured using the racial categories non-Hispanic Black (alone) as the least privileged group and non-Hispanic White (alone) as the most privileged group. ICE for race and income was measured using non-Hispanic Black residents with a household income less than $25,000 (as the least privileged group) and non-Hispanic White residents with a household income of $100,000 or more (as the most privileged group). Consistent with previous research and data availability both ICE measures only count residents who identified a single race (e.g., non-Hispanic Black alone, non-Hispanic White alone). Most studies,[179] including research set in Chicago,[180,181] group ICE scores into quantiles (e.g., quintiles) and assess differences between the highest and lowest quantile. For this reason, the ICE was operationalized as a categorical variable. ICE quintiles were observed in the descriptive analyses. Due to the small sample size, a binary indicator of whether an area had a negative ICE score was the primary predictor in the regression analyses.

4.4.5 Residential Redlining

Historical redlining

Historical redlining was measured at the neighborhood (census tract) level as a neighborhood's level of credit "worthiness" and "risk" between 1935 and 1940, according to residential security maps created by the Home Owners' Loan Corporation and digitized by the Mapping Inequality Project. This variable (**HOLC grade**) was operationalized as a categorical variable with the following categories: grade A ("best/most desirable"), grade B ("still desirable"), grade C ("declining"), grade D ("hazardous"), and no grade. Due to the small number of grade A and B census tracts, these two groups were combined.

Contemporary redlining

Contemporary redlining was also measured at the neighborhood (census tract) level and only for the Chicago sample. It was operationalized as a binary indicator of whether a census tract had a majority (>50%) non-Hispanic Black population and high neighborhood credit refusal (i.e., a high proportion of denied mortgage loan applications) in 2010.

I constructed 3 separate variables (Table 4.2) to develop the measure of contemporary redlining. These variables were adapted from Sewell's (2013) "distinct measures of racist relational structures"[(p125)] which include: neighborhood credit refusal, high neighborhood credit refusal, and racialized credit refusal.

First, I calculated **neighborhood credit refusal** as the number of denied mortgage loan applications divided by the total number of mortgage loan applications submitted for residential properties in the specified census tract. This variable measured the rate of mortgage loan denials in a census tract.

Second, I created a binary indicator of whether a census tract had a **high neighborhood credit refusal rate**. This variable equaled 1 (yes) if the census tract's neighborhood credit refusal rate was higher than the city median. This variable equaled 0 (no) if the census tract's neighborhood credit refusal rate was equal to or less than the city median.

Third, I created a **racialized neighborhood credit refusal** variable, which indicated whether a census tract had a high neighborhood credit refusal rate and a high percentage of Black residents. Census tracts that had a neighborhood credit refusal rate above the city median and a majority (>50%) Black population were classified as having high racialized neighborhood credit refusal. Census tracts were classified as having low racialized neighborhood credit refusal if the tract: 1) had a low neighborhood credit refusal rate and was majority Black; 2) had a high neighborhood credit refusal rate and was not majority Black; or 3) had a low neighborhood credit refusal rate and was not majority Black. Census tracts with high racialized neighborhood credit refusal were considered redlined at baseline.

Table 4.2. Variables calculated to measure contemporary redlining

Measure	Formula	Interpretation
Neighborhood credit refusal (NCR)	$NCR_i = \frac{number\ of\ denied\ loan\ applications_i}{total\ number\ of\ loan\ applications_i}$	The proportion of all loan applications submitted for homes located in census tract i that were denied
High neighborhood credit refusal	High NCR_i = 1 (high) if census tract i has NCR rate > the median NCR rate for census tracts in the city Low NCR_i = 0 (low) if census tract i has NCR rate ≤ the median NCR rate for census tracts in the city	An indicator of whether census tract i has a high rate of loan denials (NCR)
Racialized neighborhood credit refusal	Racialized NCR_i = 1 (high) if census tract i has high NCR and a majority Black population Racialized NCR = 0 (low) if census tract i has: a) low NCR and a majority Black population; b) low NCR and a majority non-Black population; or c) high NCR and a majority non-Black population	An indicator of whether census tract i has a high rate of loan denials (NCR) and a majority (>50%) Black population

One key difference between the racialized *neighborhood* credit refusal variable I created and the racialized credit refusal variable Sewell (2013) created is that the measure for this study focuses on the racial composition of neighborhoods, while Sewell's (2013) measure focuses on the race/ethnicity of individual loan applicants. Sewell (2013) measured racialized credit refusal as a risk ratio comparing the rate of loan denial among applications submitted by racial/ethnic minorities to the rate of loan denial among all applications in a neighborhood.

By definition, redlining occurs when loans are denied because of the actual or perceived racial composition of a *neighborhood*,[50] not because of the race/ethnicity of the applicant. This focus on neighborhood racial composition and spatial stigma distinguishes redlining from lending discrimination which is based on an applicant's race/ethnicity, regardless of the neighborhood where the residential property is located (i.e., rracial biasin mortgage lending).[75]

All contemporary redlining related variables were calculated using 2010 HMDA data. In 2010, 266,068 mortgage loan applications were submitted to HMDA-reporting institutions in Chicago. Consistent with previous studies that used HMDA data to calculate redlining and

housing discrimination measures,[71,75,182] I excluded: incomplete or withdrawn applications (n= 26,609) and applications for non-owner-occupied units (e.g., properties for business purposes) (n=18,332), multifamily units (n= 54), and home improvement & refinancing (n=164,651). The redlining variables were calculated using data on the remaining 56,422 loans.

Initially, I planned to create two additional measures of contemporary redlining: neighborhood subprime approval and racialized neighborhood subprime approval. Previous studies using HMDA data have classified mortgage loans as high-cost if the loan's annual percentage rate (APR) exceeded designated thresholds by a certain percentage.[183-186] Some studies suggest using a loan's Home Ownership and Equity Protection Act (HOEPA) status as a proxy for predatory lending.[187,188] HOEPA, passed in 1994, addresses abusive lending practices by imposing limitations on the terms of mortgage loans that have rates or fees above a certain threshold.[189] HOEPA loans are also referred to as "high-cost mortgages"[190] and most are flagged in HMDA data.[189] I planned to use the rate spread and HOEPA status variables in the HMDA dataset to determine if a loan was high-cost. However, there were only 4 HOEPA loans in the 2010 HMDA dataset for Chicago. Thus, the rate of subprime mortgage approvals in majority Black census tracts was not calculated.

The measure of contemporary redlining (racialized neighborhood credit refusal) does not measure redlining directly. Instead, it captures geographic disparities in loan denial. The measure does not indicate whether loans were denied *because* of the racial composition of the property's location (i.e., redlining). Loans may be denied for various reasons having nothing to do with race or racism – some loans may be denied for legitimate economic reasons. However, this is unlikely the case for the study sample (Chicago neighborhoods), as previous research has shown that neighborhood credit refusal is significantly higher in Chicago neighborhoods with a higher proportion of Black residents[50] and lower family income.[191] While this study's contemporary redlining measure does not tell us if the racial composition of an area was the

cause of the loan decision, it does indicate which neighborhoods have a majority Black population and a high level of loan denials.

Lastly, although the proposed measure of contemporary redlining measures residential redlining indirectly, it is nevertheless a measure of structural racism. Sewell[50] conceptualizes racial and geographic disparities in lending as measures of racist relational structures, which are: a) "institutionalized sources of treatment bias that develop out of the actions and inactions of institutional gatekeepers."[50(p411)] and b) explicit measures of institutional racism,[50] where institutional racism refers to "differential access to the goods, services, and opportunities of society by race."[192(p1212)]

4.4.6 Covariates

Covariates included contextual predisposing factors (the poverty rate, the number of primary care physicians per 1000 residents, the percentage of residents age 65 and older, and the infant mortality rate) and a contextual enabling factor (the baseline supply of CHCs in 2010). Initially, I also intended to include state Medicaid expansion status, the percentage of residents without health insurance, and the total population as covariates. However, state Medicaid expansion status is a state-level variable that was dropped from the fixed effects models and the main regression models failed to converge when percent uninsured and total population were included in the model. Preliminary analysis suggested that multicollinearity explained the latter.

4.5 Statistical Analysis

Descriptive statistics (frequencies and summary statistics) were calculated to examine sample characteristics overall and stratified by CHC expansion status. Areas with at least one new CHC during the study period were categorized as *expansion areas* while areas with no new

CHCs were categorized as *nonexpansion areas*. To test whether expansion and nonexpansion areas had statistically significant differences in residential segregation, MUA/P designations, and MUA/P criteria, I used Wilcoxon rank sum tests for continuous variables and chi-square tests for categorical variables. I used Tableau to map the primary outcome and predictor variables. Maps were created to illustrate geographic variations in CHC expansion, residential segregation, and MUA/P designations among each sample. Correlation analysis was also performed – the results for which are in the appendix.

To test the hypotheses that residential segregation and MUA/P designation were associated with CHC expansion between FYs 2011 and 2019, I used logistic regression models to estimate odds ratios for the binary outcome (whether an area had at least one new CHC) and negative binomial regression models to estimate incidence rate ratios for the count outcome (the *number* of new CHCs). Logistic regression models were performed for the full sample while the sample for the negative binomial regression models was restricted to expansion areas (e.g., US counties, Cook County municipalities, and Chicago census tracts with at least one new CHC). This method is consistent with Ko and Ponce[83] and allows us to assess the contextual characteristics that effect the volume of CHC expansion.

All models for the US sample included state-level fixed effects to account for unobserved state-specific characteristics that may influence CHC expansion (e.g., a state's investment in and commitment to expanding the health care safety net).

Based on the conceptual model, sets of predictor variables were sequentially added such that: model 1, the base model, included only the primary predictor; model 2 included the primary predictor and mediator or moderator variable; model 3 included all variables in model 2 and contextual predisposing characteristics (MUA/P criteria); and model 4 included all variables in model 3 and contextual enabling characteristics (baseline CHC supply). Initially, I ran a fifth model including all variables in model 4 and contextual need characteristics (total population and percent uninsured). However, the addition of total population and percent uninsured

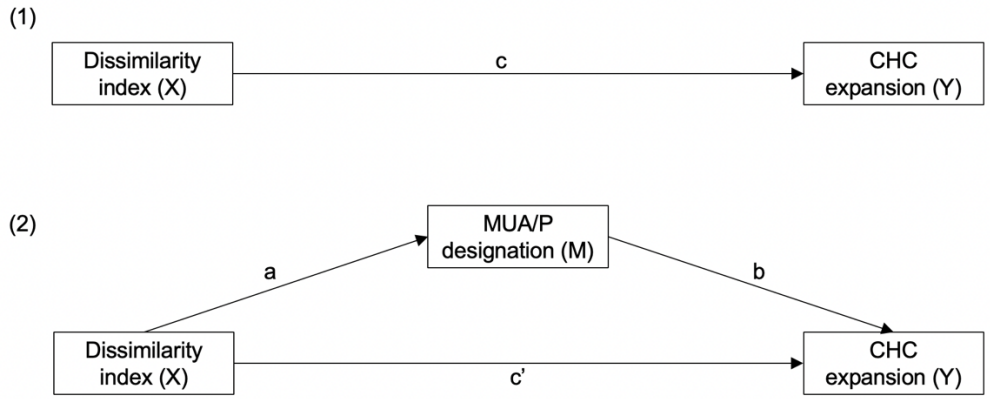
introduced multicollinearity problems. For this reason, Model 4 was the final model and used for the mediation and moderation analyses.

For each sample I tested the hypothesis that MUA/P designation *mediated* the association between residential segregation and CHC expansion. For the Chicago sample I also tested the hypothesis that residential redlining *moderated* the association between MUA/P designation and CHC expansion at the neighborhood level. In the next sections I describe the mediation and moderation analyses in detail.

Mediation Analysis

Figure 4.2 shows the path diagrams and Table 4.3 presents the regression equations that were used to test for mediation. Both depict reduced-form models. Paths a – c' (Figure 4.2) represent the adjusted effects estimated from Models 1 – 3 (Table 4.3). Specifically, c is the effect of the independent variable (Black-White dissimilarity) on the outcome (CHC expansion); c' is the effect of the independent variable (Black-White dissimilarity) on the outcome (CHC expansion) controlling for the mediating variable (MUA/P designation); b is the effect of the mediating variable (MUA/P designation) on the outcome (CHC expansion); and a is the effect of the independent variable (Black-White dissimilarity) on the mediating variable (MUA/P designation). In other words, Model 1 tests if Black-White dissimilarity (X) predicts CHC expansion (Y). Model 2 tests if Black-White dissimilarity (X) predicts MUA/P designation (M). Model 3 tests whether MUA/P designation (M) affects CHC expansion, controlling for Black-White dissimilarity; and whether Black-White dissimilarity (X) still predicts CHC expansion (Y), controlling for MUA/P designation (M). Each regression model in Table 3.3 was rerun for each measure of CHC expansion (e.g., CHC expansion as a binary indicator and as a count variable).

Figure 4.2. Path diagram for the mediation models



Notes: These models are reduced-form models. All models controlled for physician to population ratio, poverty rate, infant mortality rate, percentage of the population age 65 and over, and baseline (FY 2010) CHC supply. CHC expansion was measured as *any* increase in CHC supply between FYs 2011 and 2019 and as the *number* of new CHCs between FYs 2011 and 2019. Each path was run twice, once for each measure of CHC expansion. Paths a – c' represent the adjusted effect of the independent variable on the dependent variable as estimated by logistic and negative binomial regression models. CHC = community health center; MUA/P = medically underserved area/population; X = primary predictor; Y = primary outcome; M = mediator

Table 4.3. Regression Equations for mediation analysis and paths tested

Model	Generic Model	Study-specific Model
1	$Y = i_1 + cX + e_1$	$CHC_{county} = i_1 + c(dissimilarity)_{county} + e_1$
2	$M = i_2 + aX + e_2$	$MUA/P_{county} = i_2 + a(dissimilarity)_{county} + e_2$
3	$Y = i_3 + c'X + bM + e_3$	$CHC_{county} = i_3 + c'(dissimilarity)_{county} + b(MUA/P)_{county} + e_3$

Notes: These models are reduced-form models. The full models included state fixed effects and controlled for county physician to population ratio, poverty rate, infant mortality rate, percentage of residents age 65 and over, and baseline (FY 2010) CHC supply. The outcome CHC expansion was measured as *any* increase in CHC supply between FYs 2011 and 2019 and as the *number* of new CHCs between FYs 2011 and 2019. Each model was run twice, once for each measure of CHC expansion. CHC = community health center expansion; MUA/P = medically underserved area/population designation; Dissimilarity = Black-White dissimilarity index; i_1, i_2, and i_3 = the intercepts for each equation; e_1, e_2, and e_3 = the residuals for each equation

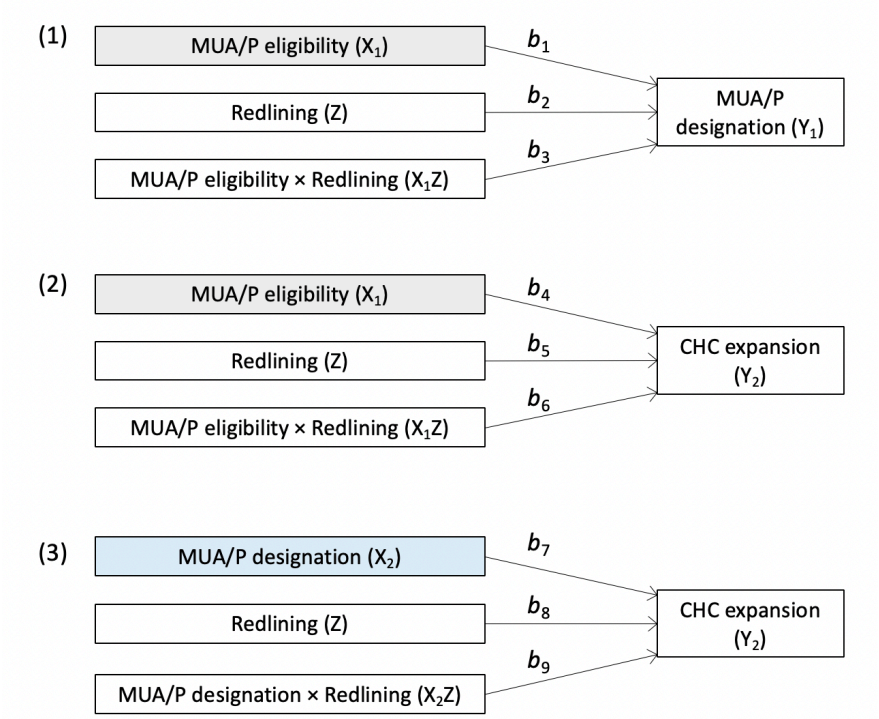
Structural equation modeling (SEM) can be used to conduct mediation analysis. One advantage to this approach is SEM can test the direct and indirect effects simultaneously, rather than with a series of regression models. However, at least two disadvantages of SEM limit its utility for conducting the mediation analysis for this study. For one, the most commonly used methods in SEM assume both the dependent variable and mediator are continuous,[193,194] but both the dependent variable (i.e., CHC expansion) and mediator variable (i.e., MUA designation) for this study are dichotomous. The second disadvantage of using SEM for

mediation analysis is the difficulty in adjusting for clustering.[194] As noted in the previous section, all regression models in this study adjusted for the clustering of counties in states.

Moderation Analysis

The path diagrams in Figure 4.3 and regression equations in Table 4.4 are presented to show the focal relationships that were tested in the moderation analyses. Coefficient b_3 tested if redlining (Z) moderated the relationship between medical underservice *eligibility* (X_1) and medical underservice *designation* (Y_1); coefficient b_6 tested if redlining (Z) moderated the relationship between medical underservice *eligibility* (X_1) and CHC expansion (Y_2); and coefficient b_9 tested if redlining (Z) moderated the relationship between medical underservice *designation* (X_2) and CHC expansion (Y_2). Separate models were run for each measure of redlining. All models controlled for census tract-level covariates (e.g., the poverty rate, the number of primary care physicians per 1000 residents, the percentage of residents age 65 and over, the infant mortality rate, and the 2010 supply of CHCs).

Figure 4.3. Path diagrams for the moderation analysis



Note: These models are reduced-form conceptual models. All models will control for other contextual determinants of access including: MUA/P criteria (i.e., poverty rate, the number of primary care physicians per 1000 residents, the percentage of residents age 65 and older, and the infant mortality rate) and baseline CHC supply.

Table 4.4. Regression equations for moderation analysis

Model	Generic Model	Study-specific Model
1	$Y_1 = b_0 + b_1X_1 + b_2Z + b_3X_1Z + e_1$	$MUAP_{CT} = b_0 + b_1(IMU)_{CT} + b_2(RNCR)_{CT} + b_3(IMU)_{CT} *(RNCR)_{CT} + e_1$
2	$Y_2 = b_0 + b_1X_1 + b_2Z + b_3X_1Z + e_1$	$CHC_{CT} = b_0 + b_1(IMU)_{CT} + b_2(RNCR)_{CT} + b_3(IMU)_{CT} *(RNCR)_{CT} + e_1$
3	$Y_2 = b_0 + b_4X_2 + b_5Z + b_6X_2Z + e_2$	$CHC_{CT} = b_0 + b_4(MUA)_{CT} + b_5(RNCR)_{CT} + b_6(MUA)_{CT} *(RNCR)_{CT} + e_1$

Notes: CT = census tract; CHC = CHC expansion; MUA = MUA designation status; RNCR = high racialized neighborhood credit refusal (i.e., a majority Black census tract with a high rate of mortgage loan denial)

Stratified and Sensitivity Analysis

US Sample

I performed several sensitivity analyses. First, I stratified the main model (Model 4) by county total population size using an indicator of whether a county was a big or small county. According to the US Census Bureau's analysis of 2016 Population Estimates, a big county is a county with 485,846 or more residents and over half of all US residents lived in one of these 143 big counties in 2016.[195] It was important to examine differences in the association between CHC expansion, segregation, and MUA/P designations by county total population size because previous studies[83] indicate that total population is a significant predictor of CHC expansion. Furthermore, descriptive statistics from this study showed that the average total population of expansion counties was significantly larger than nonexpansion counties but including total population as a covariate in the regression models caused multicollinearity problems.

Second, I stratified the data by US Census designated region (e.g., Midwest, Northeast, South, and West). This was done because previous government reports[45] and descriptive statistics from this study showed that CHC expansion varied significantly by region. Third, I repeated the main regression analysis with different measures of CHC expansion, racial residential segregation, and MUA/P designation. These regression analyses were done using the final model (Model 4) which includes MUA/P criteria and baseline CHC supply as covariates. Table 3.4 provides a description of each regression model that was part of the sensitivity analysis. In addition to the 20 regression models described in Table 4.5, the mediation analysis was repeated with the isolation index as the primary predictor instead of the dissimilarity index.

Table 4.5. List of the outcome, predictor, and mediator variables in the regression models estimated as part of the sensitivity analyses

Model	Outcome	Predictor	Mediator
	Main models		
--	New CHCs (yes/no)	Dissimilarity index	Any MUA/P
--	New CHCs (count)	Dissimilarity index	Any MUA/P
	Models with an alternative CHC measure		

1	New CHCs (yes/no), **CY 2011-2019**	Dissimilarity index	Any MUA/P[a]
2	New CHCs (count), **CY 2011-2019**	Dissimilarity index	Any MUA/P[a]
3	New **HRSA-funded CHCs** (yes/no)	Dissimilarity index	Any MUA/P
4	New **HRSA-funded CHCs** (count)	Dissimilarity index	Any MUA/P
	Models with an alternative segregation measure		
5	New CHCs (yes/no)	Dissimilarity index (**Black alone**)	Any MUA/P
6	New CHCs (count)	Dissimilarity index (**Black alone**)	Any MUA/P
7	New CHCs (yes/no)	Dissimilarity index **tertiles**	Any MUA/P
8	New CHCs (count)	Dissimilarity index **tertiles**	Any MUA/P
9	New CHCs (yes/no)	**Isolation** index	Any MUA/P
10	New CHCs (count)	**Isolation** index	Any MUA/P
11	New CHCs (yes/no)	**Isolation index (Black alone)**	Any MUA/P
12	New CHCs (count)	**Isolation index (Black alone)**	Any MUA/P
	Models with an alternative MUA/P measure		
13	New CHCs (yes/no)	Dissimilarity index	Any MUA/P, **FY 2010**
14	New CHCs (count)	Dissimilarity index	Any MUA/P, **FY 2010**
15	New CHCs (yes/no)	Dissimilarity index	Any **new** MUA/P
16	New CHCs (count)	Dissimilarity index	Any **new** MUA/P
17	New CHCs (yes/no)	Dissimilarity index	Any **Single County** MUA/P
18	New CHCs (count)	Dissimilarity index	Any **Single County** MUA/P
19	New CHCs (yes/no)	Dissimilarity index	Any **MUA**
20	New CHCs (count)	Dissimilarity index	Any **MUA**

Notes: Unless stated otherwise new CHCs (yes/no) is a binary indicator of whether a county had at least one new CHC between FYs 2011 and 2019; New CHCs (count) is the number of new CHCs a county had between FYs 2011 and 2019; Any MUA/P is a binary (yes/no) indicator of whether a county had at least one MUA/P designation at some point between FYs 2011 and 2019; and the racial categories used to calculate the dissimilarity and isolation indices were Black alone or in combination with another race and non-Hispanic White alone. CHCs include HRSA-funded health centers and health center look-alikes, unless stated otherwise. CHC = community health center; CY = calendar year; FY = fiscal year; HRSA = Health Resources and Services Administration; MUA/P = medically underserved area/population; [a]There was no difference in MUA/P designation among the sample when calendar years was used instead of fiscal years.

CHAPTER 5: RESULTS

5.1 National (US) Sample

5.1.1 Descriptive Statistics

All Counties

The sample consisted of 1,693 metropolitan counties across all 50 states and the District of Columbia. These counties represented 52.58 percent of all counties and 90.97 percent of all metropolitan counties in the US in 2010. Between FYs 2010 and 2019, the number of CHCs among the study sample increased from 3,687 to 10,305. However, CHC expansion was minimal in most counties.

Most counties gained no more than 3 new CHCs between FYs 2011 and 2019, with 33.57 percent gaining 0 new CHCs, 22.56% gaining 1 new CHC, and 19.49 percent gaining 2 to 3 new CHCs (Figure 5.1.1). Large increases in CHC supply were concentrated on the West coast. Of the 51 counties that gained more than 20 new CHCs during the FY 2011 – 2019 expansion period, 45.10 percent were in western states and 27.45 percent were in California. Among these outliers were 3 counties with more than 100 new CHCs during the study period: Cook County, IL (with 125 new CHCs); Miami-Dade County, FL (with 150 new CHCs); and Los Angeles County, CA (with 336 new CHCs).

Despite geographic inequities in CHC expansion, most counties (87.36 percent) had at least 1 MUA/P designation at some time between FYs 2011 and 2019 (Figure 5.1.2). However, 54.21 percent of the 214 counties with no MUA/P were in midwestern states and 73.55 percent of the 692 counties with a single county MUA/P were in southern states (Figure 5.1.2, panel 1 and 2 respectively). Counties in the Midwest and South also represented a disproportionate share of counties that had no CHC or no new CHC despite having at least 1 MUA/P. For example, midwestern counties accounted for 28.17 percent of all counties, but 34.92 percent of

counties with at least 1 MUA/P and not a single CHC. Similarly, southern counties accounted for 48.97 percent of all counties, but 60.97 percent of counties with at least 1 MUA/P and no *new* CHC between FYs 2011 and 2019 (Figure 5.1.3).

CHC expansion also varied by segregation level and funding period. Dissimilarity scores ranged from 2.51 to 80.64 and were categorized by tertile: least segregated (scores 2.51 to 35.63), moderately segregated (scores 35.64 to 45.87), and highly segregated (scores 45.88 to 80.64) (Figure 5.1.4). Most new CHCs were located in highly segregated counties during both the initial 5-year authorization of the CHCF (FY 2011 – 2015) and the two, 2-year funding extension periods (FY 2016 – 2019). However, CHC expansion overall and for each segregation level was higher during the funding extension periods than during the initial authorization – overall, CHC supply increased by 2,801 during the first 5 years of the CHCF and by 3,817 during its last 4 years.

Expansion versus Nonexpansion Counties

Two thirds (66.63 percent) of counties in the sample gained at least one new CHC between FYs 2011 and 2019. On average, these expansion counties were more likely to have at least 1 MUA/P at baseline and at some time between FYs 2011 and 2019 compared to nonexpansion counties (Table 5.1.1). Although the number of CHCs among nonexpansion counties did not grow during this period, the number of MUA/P designations did. In fact, the percentage of nonexpansion counties that gained at least 1 new MUA/P designation (11.86 percent) was not statistically different from the percentage of expansion counties that gained at least 1 new MUA/P designation (13.56 percent). Furthermore, the majority of both nonexpansion (64.18 percent) and expansion (56.86 percent) counties that gained a new MUA/P gained a medically underserved *population* designation rather than a medically underserved *area* designation. This difference was also nonsignificant.

There were significant differences in segregation, MUA/P criteria, and baseline CHC supply. Racial residential segregation between Black and White residents was higher among expansion counties than nonexpansion counties, both in terms of dissimilarity and isolation. Compared to nonexpansion counties, expansion counties on average had a higher PCP to population ratio, poverty rate, infant mortality rate, and total population, but a slightly smaller percentage of residents age 65 and over or uninsured. In addition to demographic differences, expansion and nonexpansion counties had significant differences in baseline CHC supply. For example, in FY 2010, 38.03 percent of expansion counties and 9.2 percent of nonexpansion counties had two or more CHCs.

5.1.2 Main Regression Analyses

Effects of Dissimilarity and MUA/P designation on CHC Expansion

Table 5.1.2 presents unadjusted and adjusted odds ratios from logistic regression models that estimated the effect of county characteristics on whether a county gained at least one new CHC between FYs 2011 and 2019. In all models, the dissimilarity index and having a MUA/P designation were positively associated with CHC expansion. For example, among US metropolitan counties, the odds of gaining at least 1 new CHC between FYs 2011 and 2019 was 1.03 times (or 3 percent) higher for everyone one point increase in the Black-White dissimilarity index, after adjusted for MUA/P designations, MUA/P criteria, and baseline (FY 2010) CHC supply (Model 4). The effect of MUA/P designations on the odds of gaining a CHC was even greater. Specifically, among metropolitan counties, the odds of gaining at least 1 new CHC was 3.03 times higher for counties with at least 1 MUA/P designation compared to counties with no MUA/P, after accounting for dissimilarity, MUA/P criteria, and baseline CHC supply (Model 4).

Table 5.1.3 presents unadjusted and adjusted incidence rate ratios from negative binomial regression models that estimated the effect of county characteristics on the *number* of new CHCs expansion counties gained between FYs 2011 and 2019. While dissimilarity was

significantly associated with the number of new CHCs among expansion counties in all models, MUA/P designation was not. On average and after adjusting for MUA/P designation, MUA/P criteria and baseline CHC supply (Model 8), every 1 percentage point increase in the Black-White dissimilarity index was associated with a 2 percent increase in the expected number of new CHCs among expansion counties. When dissimilarity and MUA/P criteria were accounted for (Model 7), having at least 1 MUA/P relative to none was associated with a 38 percent increase in the expected number of new CHCs among expansion counties. This effect was no longer statistically significant (at the 0.05 level) after baseline CHC supply was also accounted for in the model (Model 8).

Effects of MUA/P Criteria and Baseline CHC Supply on CHC Expansion

The effect of MUA/P criteria and baseline CHC supply on CHC expansion was mixed. The PCP to population ratio and proportion of residents age 65 and over were the only MUA/P criteria significantly associated with both measures of CHC expansion. The PCP to population ratio was positively associated with CHC expansion, whereas the proportion of residents age 65 and over was negatively associated with CHC expansion. Among all counties, having 2 or more CHCs in FY 2010 relative to none increased the odds of gaining at least one new CHC, and among expansion counties, increased the expected number of new CHCs. In contrast, there was no significant difference in CHC expansion between counties with 1 CHC in FY 2010 and those with none.

5.1.3 Mediation Analyses

Figure 5.1.6 shows the results of the regression models that tested whether MUA/P designation mediated the association between dissimilarity and (1) gaining at least 1 new CHC among all counties in the sample (panel 1) and (2) the number of new CHCs among expansion counties (panel 2). In both sets of models, the Black-White dissimilarity index did not have a

statistically significant effect on the likelihood of a county having at least 1 MUA/P designation between FYs 2011 and 2019 (path a). Additionally, among expansion counties, having at least 1 MUA/P designation between FYs 2011 and 2019 had no statistically significant effect on the number of new CHCs a county gained during that time (panel 2, path b). Although Black-White dissimilarity was a significant predictor of CHC expansion with and without MUA/P designation in the model (paths c' and c, respectively), the absence of a significant association between dissimilarity and MUA/P designation indicates that having at least 1 MUA/P designation between FYs 2011 and 2019 did not mediate the association between Black-White dissimilarity and CHC expansion during that period.

5.1.4 Sensitivity Analyses

Stratified Analyses

Negative binomial regression models stratified by county total population and US Census designated region reveal that the effect of the dissimilarity index and MUA/P designation on the number of new CHCs among expansion counties varies by population size and geographic location (Table 5.1.4). Specifically, the magnitude of the effect of Black-White dissimilarity on the number of CHCs was highest among big counties (aIRR=1.03, $p<0.01$) and counties in the Midwest (aIRR=1.02; $p<0.001$) and Northeast (aIRR=1.02; $p<0.001$). On the contrary, Black-White dissimilarity had no significant effect on the number of new CHCs among expansion counties in the West. Unlike dissimilarity, having at least 1 MUA/P had no significant effect on the number of new CHCs among expansion counties in big counties when the data were stratified by population size and Census region.

Other Sensitivity Analyses

The first set of estimates in Table 5.1.5 show the effect of dissimilarity levels and the isolation index on CHC expansion and MUA/P designations. Among US metropolitan counties

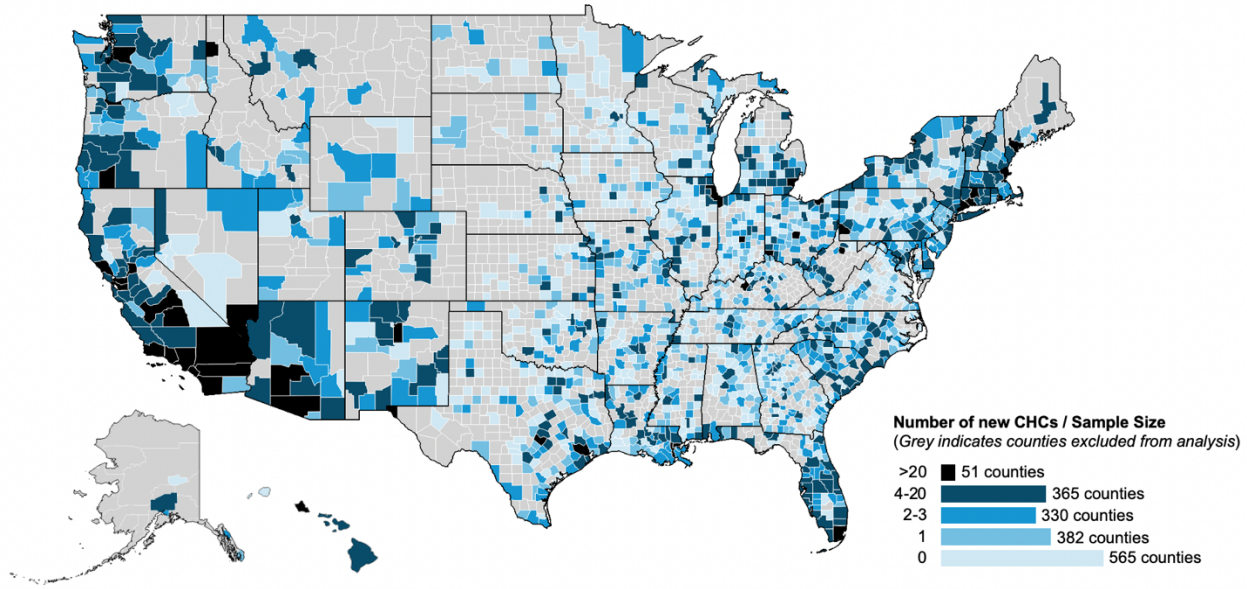
(i.e., the full sample), the odds of gaining at least one new CHC was 1.77 times higher for moderately dissimilar counties and 2.07 times higher for highly dissimilar counties compared to the least dissimilar counties, after adjusting for MUA/P designation, MUA/P criteria, and baseline CHC supply. Furthermore, among expansion counties, the expected number of new CHCs was significantly higher among highly dissimilar but not moderately dissimilar counties compared to the least dissimilar counties. There was no difference in the effects of the dissimilarity index and isolation index on CHC expansion. However, unlike Black-White dissimilarity, higher isolation of Black residents was positively associated with the odds of having at least 1 MUA/P designation. This effect was statistically significant and – given the significant effect of MUA/P designation (path b) and isolation on CHC expansion (paths c and c') (not shown) – indicates that having at least 1 MUA/P during the expansion period mediates the relationship between the isolation of Black residents and the increase in CHC supply between FYs 2011 and 2019.

The second set of estimates in Table 5.1.5 show the effect of MUA/P designation measures on CHC expansion. Similar to having at least 1 MUA/P at during the expansion period, having at least 1 MUA/P at baseline was positively associated with gaining at least 1 new CHC among all counties in the sample, but not significantly associated with the number of new CHCs among expansion counties after adjusting for Black-White dissimilarity, MUA/P criteria, and baseline CHC supply. In contrast, having at least one *new* MUA/P designation between FYs 2011 and 2019 had a significant positive effect on both measures of CHC expansion, as did having at least 1 medically underserved *area* between FYs 2011 and 2019. Unlike any other measure of MUA/P designation, having at least 1 *single county* MUA/P was negatively associated with CHC expansion. For example, among US metropolitan counties (the full sample), the odds of gaining at least 1 new CHC was 52 percent lower for counties with at least 1 single county MUA/P compared to counties without such a designation, after adjusting for county characteristics in the model. Among expansion counties, having a single county

MUA/P was on average associated with a 19 percent reduction in the number of new CHCs, after adjusting for county characteristics in the model.

5.1.5 Tables and Figures

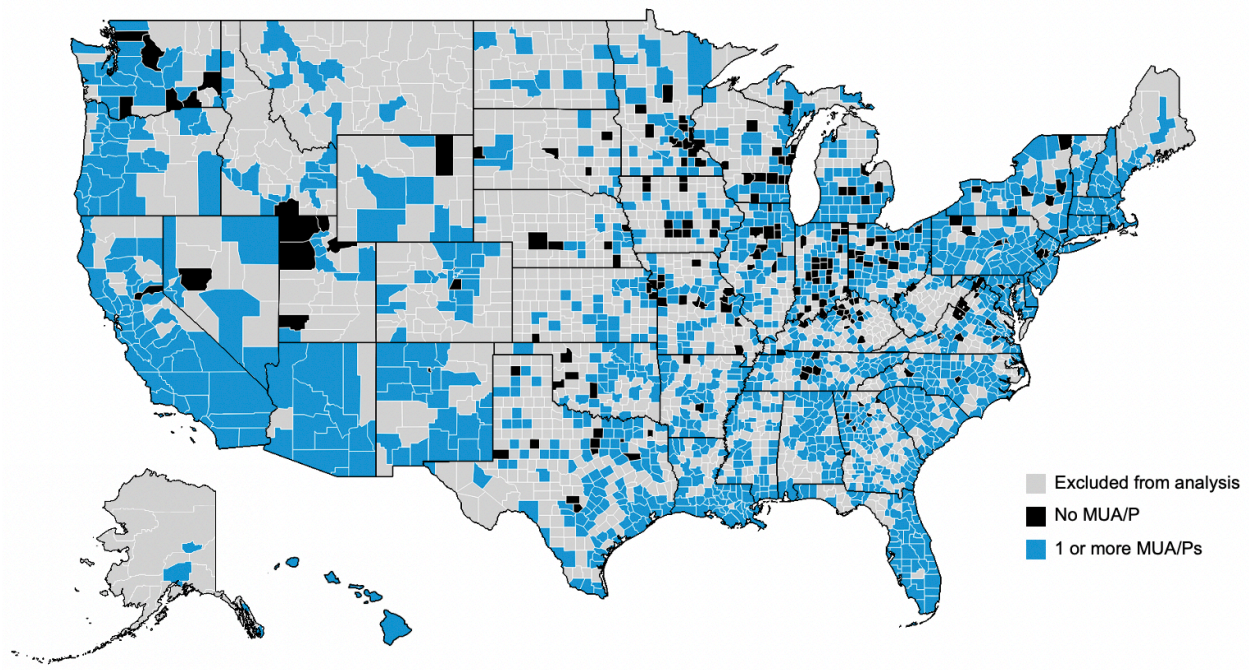
Figure 5.1.1. Community health center expansion among US metropolitan counties, FY 2011 – 2019 (N = 1,693)



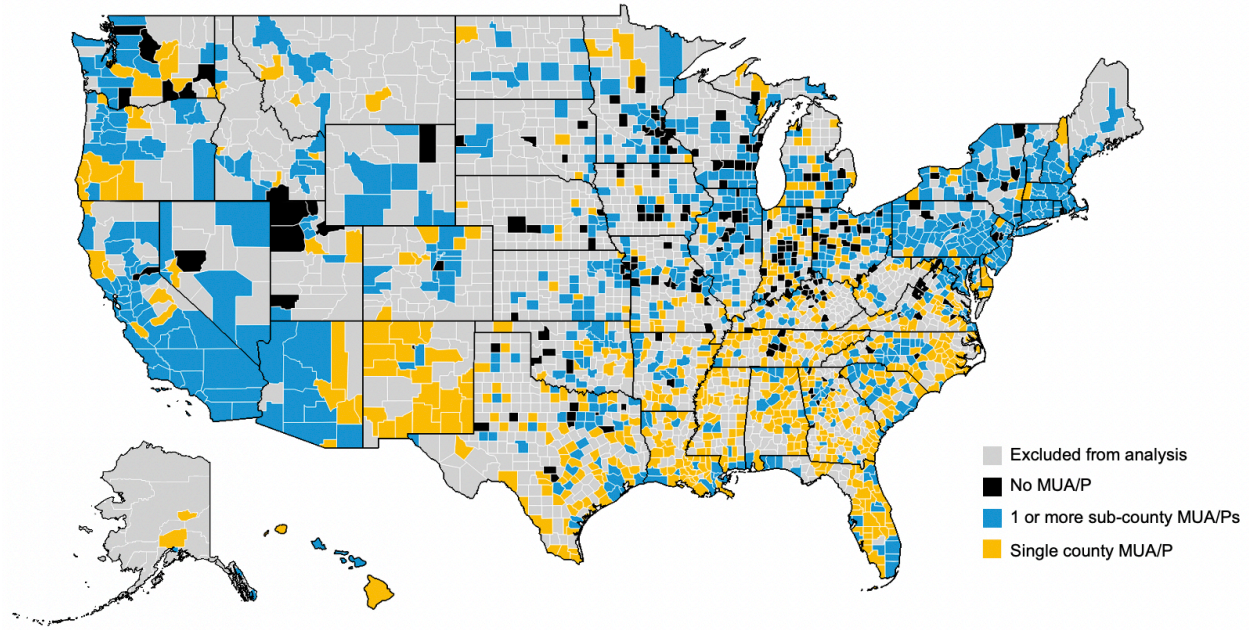
SOURCE: Author's (NJB) analysis of health center data from the Health Resources and Services Administration (HRSA). **NOTES**: The figure depicts community health center expansion among counties located in metropolitan areas (metropolitan counties). Non-metropolitan counties and metropolitan counties with fewer than 100 Black residents or composed of a single census tract were excluded from the analysis. A community health center is defined as a HRSA-funded health center site or look-alike site. Black lines represent state boundaries. White lines represent county boundaries.

Figure 5.1.2. Medically underserved area/population designations among US metropolitan counties, FY 2011 – 2019 (N = 1,693)

(1) Any MUA/P designation

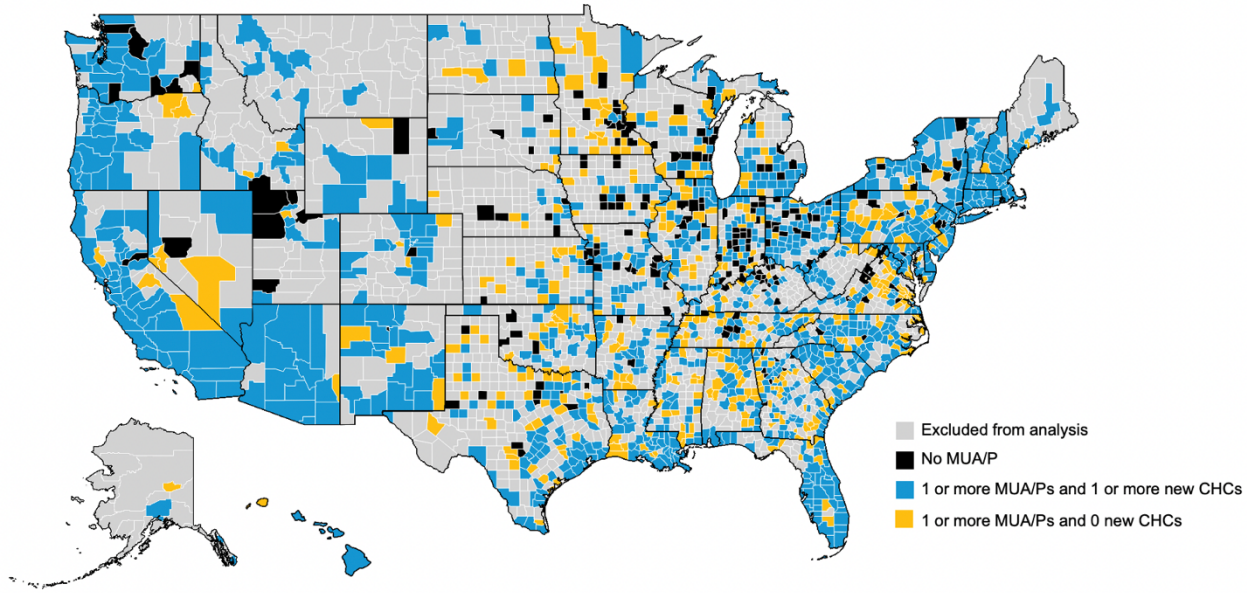


(2) Type of MUA/P designations



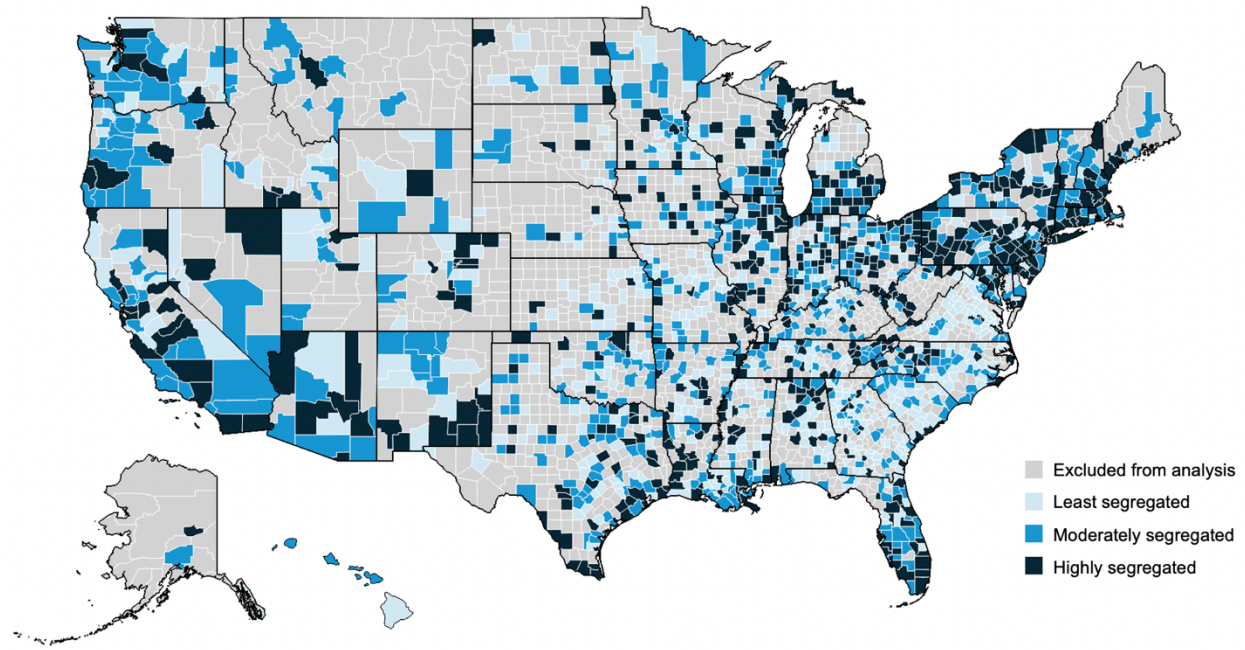
SOURCE: Author's (NJB) analysis of medically underserved area/population data from the Health Resources and Services Administration (2010-2019). **NOTES**: Non-metropolitan counties and metropolitan counties with fewer than 100 Black residents or composed of a single census tract were excluded from the analysis. A community health center is defined as a HRSA-funded health center site or look-alike site. Black lines represent state boundaries. White lines represent county boundaries.

Figure 5.1.3. Community health center expansion among US metropolitan counties with at least 1 medically underserved area/population designation, FY 2011 – 2019 (N = 1,693)



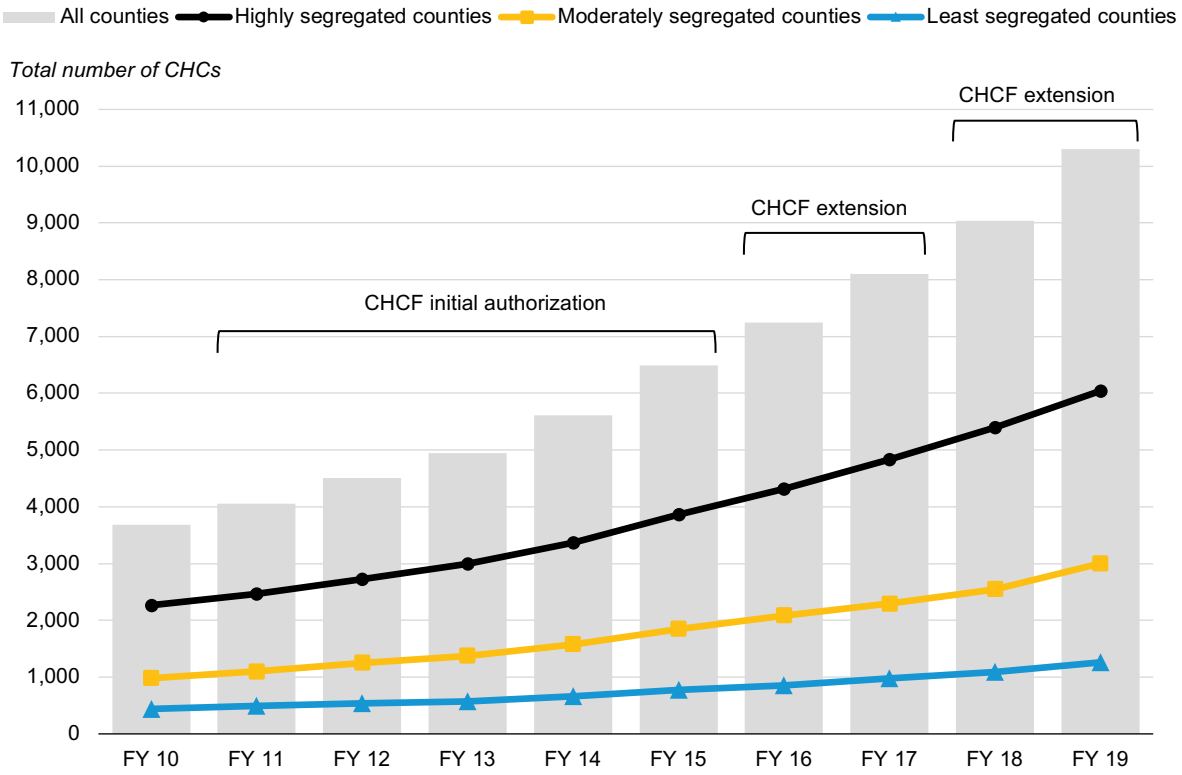
SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019). **NOTES**: Non-metropolitan counties and metropolitan counties with fewer than 100 Black residents or composed of a single census tract were excluded from the analysis. A community health center is defined as a HRSA-funded health center site or look-alike site. Black lines represent state boundaries. White lines represent county boundaries.

Figure 5.1.4. Residential segregation (dissimilarity) between Black and White residents in US metropolitan counties, 2011 – 2015 (N = 1,693)



SOURCE: Author's (NJB) analysis of American Community Survey 5-Year Estimates (2011-2015). **NOTES**: The segregation categories (high, moderate, and low) are based on the distribution of the analytic sample and represent tertiles of the dissimilarity index. Least segregated DI scores range from 0.03-0.36 (n = 565 counties). Moderately segregated DI scores range from 0.36-0.46 (n = 564 counties). Highly segregated DI scores range from 0.46-0.81 (n = 564 counties). The dissimilarity index (DI) was calculated using the racial categories non-Hispanic Black (alone or in combination) and non-Hispanic White (alone). Non-metropolitan counties and metropolitan counties with fewer than 100 Black residents or composed of a single census tract were excluded from the analysis. Black lines represent state boundaries. White lines represent county boundaries.

Figure 5.1.5. Number of community health centers among US metropolitan counties by level of racial residential segregation (Black-White dissimilarity index), FY 2010-2019 (N=1,693)



SOURCE: Author's (NJB) analysis of health center data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), and health center funding data from the National Association of Community Health Centers (2010-2021). **NOTES**: The figure depicts the number of community health centers (i.e., HRSA-funded health center and look-alike sites) in all metropolitan counties, except counties with fewer than 100 Black residents and counties composed of a single census tract. The segregation categories (high, moderate, and low) are based on the distribution of the analytic sample and represent tertiles of the dissimilarity index. Least segregated DI scores range from 0.03-0.36 (n = 565 counties). Moderately segregated DI scores range from 0.36-0.46 (n = 564 counties). Highly segregated DI scores range from 0.46-0.81 (n = 564 counties). The dissimilarity index (DI) was calculated using the racial categories non-Hispanic Black (alone or in combination) and non-Hispanic White (alone). FY = fiscal year; CHCF = Community Health Center Fund

Table 5.1.1. Sample characteristics of metropolitan counties with no new community health center (nonexpansion counties) compared to counties with at least one new community health center (expansion counties) between fiscal years 2011 and 2019, (N=1693)

County Characteristics	All counties (N=1,693)	Nonexpansion counties (N=565)	Expansion counties (N=1,128)	p-value
Racial residential segregation[a]				
Dissimilarity index (Black in combination)	40.56 (12.90)	36.35 (13.19)	42.66 (12.21)	0.000
Dissimilarity index (Black alone)	44.70 (13.95)	40.73 (14.93)	46.70 (13.00)	0.000
Isolation index (Black in combination)	18.72 (18.64)	14.28 (15.86)	20.95 (19.52)	0.000
Isolation index (Black alone)	17.56 (18.55)	13.33 (15.75)	19.68 (19.46)	0.000
MUA/P designation				
At least 1 MUA/P in FY 2010, n (col %)	1342 (79.27)	376 (66.55)	966 (85.64)	0.000
At least 1 MUA/P FY 2011-2019, n (col %)[b]	1479 (87.36)	433 (76.64)	1046 (92.73)	0.000
At least 1 *new* MUA/P FY 2011-2019, n (col %)	220 (12.99)	67 (11.86)	153 (13.56)	0.325
At least 1 *single county* MUA/P FY 2011-2019, n (col %)	906 (53.51)	390 (69.03)	516 (45.74)	0.000
MUA/P criteria[a]				
Number of PCPs per 1000 residents	0.62 (0.34)	0.55 (0.38)	0.66 (0.32)	0.000
Poverty rate	16.20 (6.05)	15.02 (6.12)	16.78 (5.94)	0.000
Percentage of population age 65 and over	15.40 (3.67)	15.81 (3.37)	15.20 (3.80)	0.000
Infant mortality rate (2006-2010)	6.84 (2.50)	6.76 (2.82)	6.89 (2.33)	0.031
Baseline CHC supply				
Number of CHCs (FY 2010), n (col %)				0.000
0 CHCs	859 (50.74)	374 (66.19)	485 (43)	
1 CHC	353 (20.85)	139 (24.60)	214 (18.97)	
2 or more CHCs	481 (28.41)	52 (9.20)	429 (38.03)	
Other county characteristics[a]				
Total population (in thousands)	175.05 (426.17)	53.00 (57.27)	236.18 (509.73)	0.000
Uninsured (% of total population)	12.65 (4.72)	12.10 (5.00)	12.93 (4.54)	0.000

SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the Dartmouth Health Atlas Primary Care Service Area Project (2010), and mortality data from the National Center for Health Statistics (2006-2010). **NOTES:** Values represent mean (standard deviation) for continuous variables and the number of observations (column percent) for categorical variables. P-values were calculated using Wilcoxon rank sum tests for continuous variables and chi-square tests for categorical variables. The sample excludes counties with fewer than 100 Black residents and counties composed of a single census tract. A community health center is defined as a HRSA-funded health center site or look-alike site. The comparison group for all segregation measures is non-Hispanic White (alone). [a]Segregation, MUA/P criteria, and other county characteristics are based on calendar year 2011-2015 data from the American Community Survey, unless stated otherwise. [b]At least one MUA/P at any point between FY 2011 and FY 2019. CHC = community health center; CY = calendar year; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician

Table 5.1.2. Association of racial residential segregation with gaining at least 1 new community health center among US metropolitan counties, FYs 2011-2019 (N=1,650)

	Model 1	Model 2	Model 3	Model 4
Independent variables	**OR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
Black-White dissimilarity index	1.04***	1.04***	1.04***	1.03***
	(1.03, 1.05)	(1.03, 1.05)	(1.03, 1.05)	(1.02, 1.04)
At least 1 MUA/P (FY 2011-2019) (ref is no)	--	3.31***	3.40***	3.03***
		(2.35, 4.66)	(2.37, 4.88)	(2.10, 4.37)
PCPs per 1,000 residents (2010)	--	--	2.51***	2.24***
			(1.69, 3.74)	(1.52, 3.32)
Infant mortality rate (2006-2010)	--	--	0.99	0.98
			(0.94, 1.04)	(0.93, 1.04)
Poverty rate	--	--	1.03*	1.03*
			(1.00, 1.05)	(1.00, 1.05)
Percentage of population age 65 and over	--	--	0.93***	0.94***
			(0.90, 0.96)	(0.91, 0.97)
Baseline CHC supply (ref is 0)				
1 CHC in FY 2010	--	--	--	0.79
				(0.59, 1.06)
2 or more CHCs in FY 2010	--	--	--	2.52***
				(1.75, 3.65)

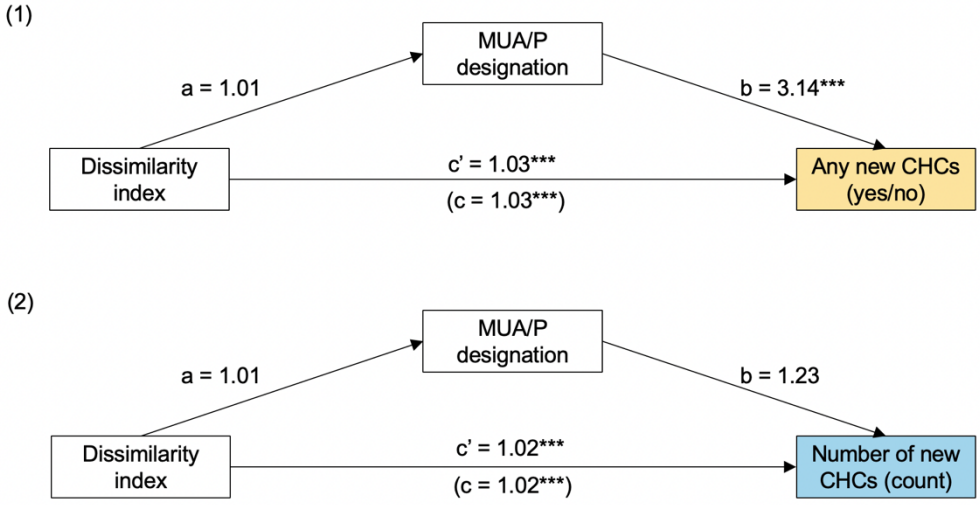
SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the American Medical Association (2010), and mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: The table shows results (odds ratios (OR) or adjusted odds ratios (aOR) and 95% confidence intervals) from logistic regression models. All models exclude counties in VT, RI, MT, MA, DE, DC, and CT where all counties in the state had at least one new CHC (i.e., no variation in the outcome variable). All models account for state fixed effects and exclude counties with fewer than 100 Black residents and counties composed of a single census tract. A community health center is defined as a HRSA-funded health center site or look-alike site. CHC = community health center; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician; ref = reference group; * p<0.05, ** p<0.01, *** p<0.001

Table 5.1.3. Association of racial residential segregation with the number of new community health centers among US metropolitan counties, FYs 2011-2019 (N=1,127)

	Model 5	Model 6	Model 7	Model 8
Independent variables	**IRR (95% CI)**	**aIRR (95% CI)**	**aIRR (95% CI)**	**aIRR (95% CI)**
Black-White dissimilarity index	1.02***	1.02***	1.02***	1.02***
	(1.01, 1.02)	(1.01, 1.02)	(1.01, 1.02)	(1.01, 1.02)
At least 1 MUA/P (FY 2011-2019) (ref is no)	--	1.34**	1.38**	1.21
		(1.08, 1.66)	(1.11, 1.72)	(0.97, 1.50)
PCPs per 1,000 residents (2010)	--	--	1.68***	1.55***
			(1.45, 1.95)	(1.33, 1.81)
Infant mortality rate (2006-2010)	--	--	1.02	1.03*
			(1.00, 1.05)	(1.00, 1.05)
Poverty rate	--	--	1.00	1.00
			(0.99, 1.01)	(0.99, 1.01)
Percentage of population age 65 and over	--	--	0.95***	0.95***
			(0.94, 0.96)	(0.94, 0.97)
Baseline CHC supply (ref is 0)				
1 CHC in FY 2010	--	--	--	1.08
				(0.94, 1.25)
2 or more CHCs in FY 2010	--	--	--	1.55***
				(1.37, 1.74)
Constant	0.64***	0.50***	0.63*	0.71
	(0.51, 0.79)	(0.37, 0.66)	(0.42, 0.94)	(0.47, 1.05)

SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the American Medical Association (2010), and mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: The table shows results (incidence rate ratios and 95% confidence intervals) from negative binomial regression models. All models exclude counties with no new community health centers between fiscal years 2011 and 2019 and DC. All models account for state fixed effects and exclude counties with fewer than 100 Black residents and counties composed of a single census tract. A community health center is defined as a HRSA-funded health center site or look-alike site. CHC = community health center; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician; ref = reference group; * p<0.05, ** p<0.01, *** p<0.001

Figure 5.1.6. Mediation effect of MUA/P designation on the association between racial residential segregation (dissimilarity) and community health center expansion among US metropolitan counties, fiscal years 2011-2019



SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the Dartmouth Health Atlas Primary Care Service Area Project (2010), and mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: A community health center is defined as a HRSA-funded health center site or look-alike site. All models exclude counties with fewer than 100 Black residents and counties composed of a single census tract. **In panel 1**, values represent adjusted odds ratios from logistic regression models; the sample for paths b, c and c' (N=1,650 counties) excludes counties in VT, RI, MT, MA, DE, DC, and CT where all counties in the state had at least one new CHC (i.e., no variation in the outcome variable); and the sample for path a (N=1,301 counties) excludes counties in AK, AL, AZ, CT, DC, DE, FL, HI, LA, MA, ME, MS, MT, ND, NH, OR, RI, SC, TN, and VT where all counties in the state had at least one MUA/P (i.e., no variation in the outcome variable). **In panel 2**, values for path a represent adjusted odds ratios from logistic regression models and values for path b, c, and c' represent adjusted incident rate ratios from negative binomial models; the sample for paths b, c and c' (N=1,127 counties) excludes counties with no new CHCs and DC; and the sample for path a (N=783 counties) excludes counties with no new CHCs and counties in AK, AL, AZ, CT, DC, DE, FL, HI, LA, MA, ME, MS, MT, ND, NE, NH, NM, NV, OK, OR, RI, SC, TN, VT, and WY where all counties in the state had at least one MUA/P (i.e., no variation in the outcome variable). All models include state fixed effects and control for physician to population ratio, poverty rate, infant mortality rate, percentage of the population age 65 and over, and baseline (fiscal year 2010) CHC supply. The dissimilarity index was calculated using the racial categories Black (alone or in combination with other races) and non-Hispanic White (alone). CHC = community health center; MUA/P = medically underserved area/population; PCP = primary care physician; * p<0.05, ** p<0.01, *** p<0.001

Table 5.1.4. Stratified Analyses: Association of racial residential segregation (dissimilarity) and MUA/P designation with the number of community health centers among metropolitan counties by total population and region, fiscal years 2011-2019

	Stratified by Total Population		Stratified by US Census Designated Region			
Independent variables	**Small Counties**	**Big Counties**	**Midwest**	**Northeast**	**South**	**West**
Dissimilarity index	1.01**	1.03**	1.02***	1.02***	1.01***	1.01
At least 1 MUA/P (yes; ref is no)	1.2	0.50	1.26	0.84	1.22	1.22
PCPs per 1,000 residents (2010)	1.41***	1.91**	1.57**	1.51	1.47***	2.03*
Infant mortality rate (2006-2010)	1.01	1.01	1.00	0.93	1.03*	0.98
Poverty rate	1.00	1.04*	1.01	1.06***	0.99	0.99
Age 65 and over (% of total population)	0.98**	0.96	0.93***	0.93*	0.96***	0.96*
1 CHC in FY 2010 (ref is 0)	1.15*	1.20	1.17	1.42	1.06	1.00
2 or more CHCs in FY 2010 (ref is 0)	1.59***	1.25	1.89***	2.12***	1.51***	1.33
Constant	1.52*	0.39	0.77	0.68	1.05	0.89
Number of observations (N)	991	127	276	139	529	183

SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the Dartmouth Health Atlas Primary Care Service Area Project (2010), and mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: Values represent incident rate ratios (IRRs) estimated from negative binomial regression models. All models exclude counties with no new health centers between fiscal years 2011 and 2019, counties with fewer than 100 Black residents, counties composed of a single census tract, and DC. All models account for state fixed effects. The US Census Bureau defined big counties (counties with at least 485,846 residents in 2016) and small counties based on analysis of 2016 Population Estimates. CHC = community health center; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician; ref = reference group; * p<0.05, ** p<0.01, *** p<0.001

Table 5.1.5. Sensitivity analyses: Association of segregation and MUA/P measures with community health center expansion among metropolitan counties, fiscal years 2011-2019

	Effect on gaining at least 1 new CHC (full sample)[a]		Effect on the number of new CHCs (expansion counties)[b]		Effect on having at least 1 MUA/P (full sample)[a]	
	aOR	95% CI	aIRR	95% CI	aOR	95% CI
Segregation measures						
Dissimilarity level (ref is least segregated)[a]						
Moderately segregated	1.77***	(1.33, 2.35)	1.14	(1.00, 1.30)	1.24	(0.83, 1.85)
Highly segregated	2.07***	(1.52, 2.81)	1.30***	(1.14, 1.49)	1.56	(0.98, 2.49)
Isolation index[c]	1.03***	(1.01, 1.04)	1.02***	(1.02, 1.02)	1.05***	(1.02, 1.07)
MUA/P measures						
At least 1 MUA/P at baseline (FY 2010)	2.12***	(1.57, 2.88)	1.13	(0.96, 1.32)	--	--
At least 1 new MUA/P (FY 2011-2019)	1.48*	(1.02, 2.15)	1.41***	(1.23, 1.61)	--	--
At least 1 SCTY MUA/P (FY 2011-2019)	0.48***	(0.36, 0.63)	0.81***	(0.72, 0.91)	--	--
At least 1 MUA (FY 2011-2019)	1.74***	(1.30, 2.32)	1.21*	(1.04, 1.39)	--	--

SOURCE: Author's (NJB) analysis of data from the Health Resources and Services Administration (2010-2019), American Community Survey 5-Year Estimates (2011-2015), Dartmouth Health Atlas Primary Care Service Area Project (2010), and National Center for Health Statistics (2006-2010). **NOTES**: Values represent adjusted odds ratio (aOR) for the dichotomous (yes/no) outcome at least 1 new CHC and adjusted incident rate ratios (aIRR) for the count outcome number of new CHCs. All models exclude counties with fewer than 100 Black residents and counties composed of a single census tract and account for state fixed effects, physician to population ratio, poverty rate, infant mortality rate, percentage of the population age 65 and over, and baseline (fiscal year 2010) CHC supply. [a]N=1,650 counties; [b]N=1,127 counties; [c]The comparison group for all segregation measures is non-Hispanic White (alone). Ref = reference group

5.2 Cook County Sample

5.2.1 Descriptive Statistics

The sample consisted of 199 municipalities in Cook County, IL including 122 suburbs and 77 Chicago community areas. The number of new CHCs in Cook County increased from 89 sites in FY 2010 to 210 sites in FY 2019. Within the county, CHC expansion was highest in Chicago and concentrated on the City's West Side (Figure 5.2.1). CHC expansion ranged from 0 to 4 new CHCs among suburban Cook County municipalities and 0 to 7 new CHCs among Chicago community areas. In the suburbs, La Grange had the largest growth in CHC supply at 4 new CHCs. In the City, CHC expansion was highest in Englewood, Upton, West Town (each with 6 new CHCs), and Rogers Park (7 new CHCs). Despite this expansion, most Chicago communities (54.55%) and suburbs (84.43%) did not gain a single new CHC between FYs 2011 and 2019.

Of the 68 municipalities with at least 1 MUA/P, 55.88% had at least 1 new CHC during the study period. Suburbs with a MUA/P were significantly less likely than Chicago communities with a MUA/P to gain a new CHC ($\chi^2 = 3.88$; p=0.049). Unlike communities in any other region of Chicago, all communities on the West Side had at least 1 MUA/P and at least 1 new CHC. In contrast, 35.71% of communities on the South Side and 37.50% of communities on the Southwest Side had at least 1 MUA/P and no new CHCs.

Based on ICE values, racial residential segregation (Figure 5.2.3) in Cook County was more pronounced than racialized economic segregation (Figure 5.2.4). For example, the ICE for race ranged from -1.00 to 0.95, while the ICE for race and income ranged from -0.239 to 0.250. The South Side of Chicago and South suburbs had the highest concentrations of non-Hispanic Black residents, overall and with low income. In contrast, the North Side of Chicago and Northwest and Southwest suburbs had the highest concentrations of non-Hispanic White residents, overall and with high income.

At baseline and throughout the first 9 years of the Community Health Center Fund (CHCF), CHC supply was highest among areas with a higher concentration of non-Hispanic Black residents (Figure 5.2.5) and non-Hispanic Black residents with low-income (Figure 5.2.6). However, the South Side of Chicago, the area with the highest racial and racialized economic segregation in Cook County was the only region in the county without a single new CHC during the initial 5-year authorization of the CHCF (FYs 2011 – 2015).

Despite the initial lack of CHC expansion on Chicago's South Side, on average, expansion municipalities had a higher concentration of both Black and low-income Black residents than nonexpansion municipalities (Table 5.2.1). In addition, expansion municipalities were more likely than nonexpansion municipalities to have 1 or more MUA/Ps during the study period and 1 or more CHCs at baseline. All MUA/P indicators (physician supply, poverty, and infant mortality) were higher for expansion municipalities, except for the percentage of residents age 65 and over.

5.2.2 Main Regression Analyses

Few expansion municipalities had ICE scores in the highest quintile or tertile (Table 5.2.2). For this reason, the primary predictor in the following regression models is the binary indicator of whether a municipality had a negative or positive ICE score. Descriptive statistics also revealed that few Cook County municipalities (n=54) had at least 1 new CHC between FYs 2011 and 2019. For this reason, I did not test the association between municipality characteristics and the *number* of new CHCs among expansion municipalities.

Tables 5.2.3 and 5.2.4 present unadjusted and adjusted odds ratios from logistic regression models that estimated the effect of municipality characteristics on whether a municipality gained at least 1 new CHC between FYs 2011 and 2019. The primary predictor was negative ICE for race in Models 1 – 4 (Table 5.2.3) and negative ICE for race and income in Models 5 – 8 (Table 5.2.4).

Effect of ICE & MUA/P designation on CHC Expansion

In unadjusted models, municipalities with a higher proportion of non-Hispanic Black residents were 2.61 times more likely than municipalities with a higher proportion of non-Hispanic White residents to have at least 1 new CHC between FYs 2011 and 2019. Similarly, municipalities with a higher proportion of low-income non-Hispanic Black residents were 2.52 times more likely than municipalities with a higher proportion of high-income non-Hispanic White residents to have a new CHC.

The significance and direction of these effects changed when covariates were added to the models. For example, the proportion of Black (versus White) residents and low-income Black (versus high-income White) residents had no significant effect on gaining a new CHC when MUA/P designation, MUA/P criteria, and baseline CHC supply were controlled for. In particular, the association between gaining a new ICE for race and income and CHC expansion was negative, though statistically insignificant, after adjusting for MUA/P criteria and baseline CHC supply.

In all adjusted models, MUA/P designation had a stronger association with CHC expansion than ICE scores did. Compared to municipalities without a MUA/P, municipalities with at least one MUA/P were nearly 2.9 times more likely to have at least one new CHC between FYs 2011 and 2019 after adjusting for ICE values and MUA/P criteria. The effect of MUA/P designation on gaining a CHC remained positive when baseline CHC supply was accounted for (Models X and X), but was no longer statistically significant. The mediating effect of MUA/P designation on the relationship between CHC expansion and segregation (as measured by the ICE) was not tested because segregation had no significant effect on gaining a new CHC in the adjusted models.

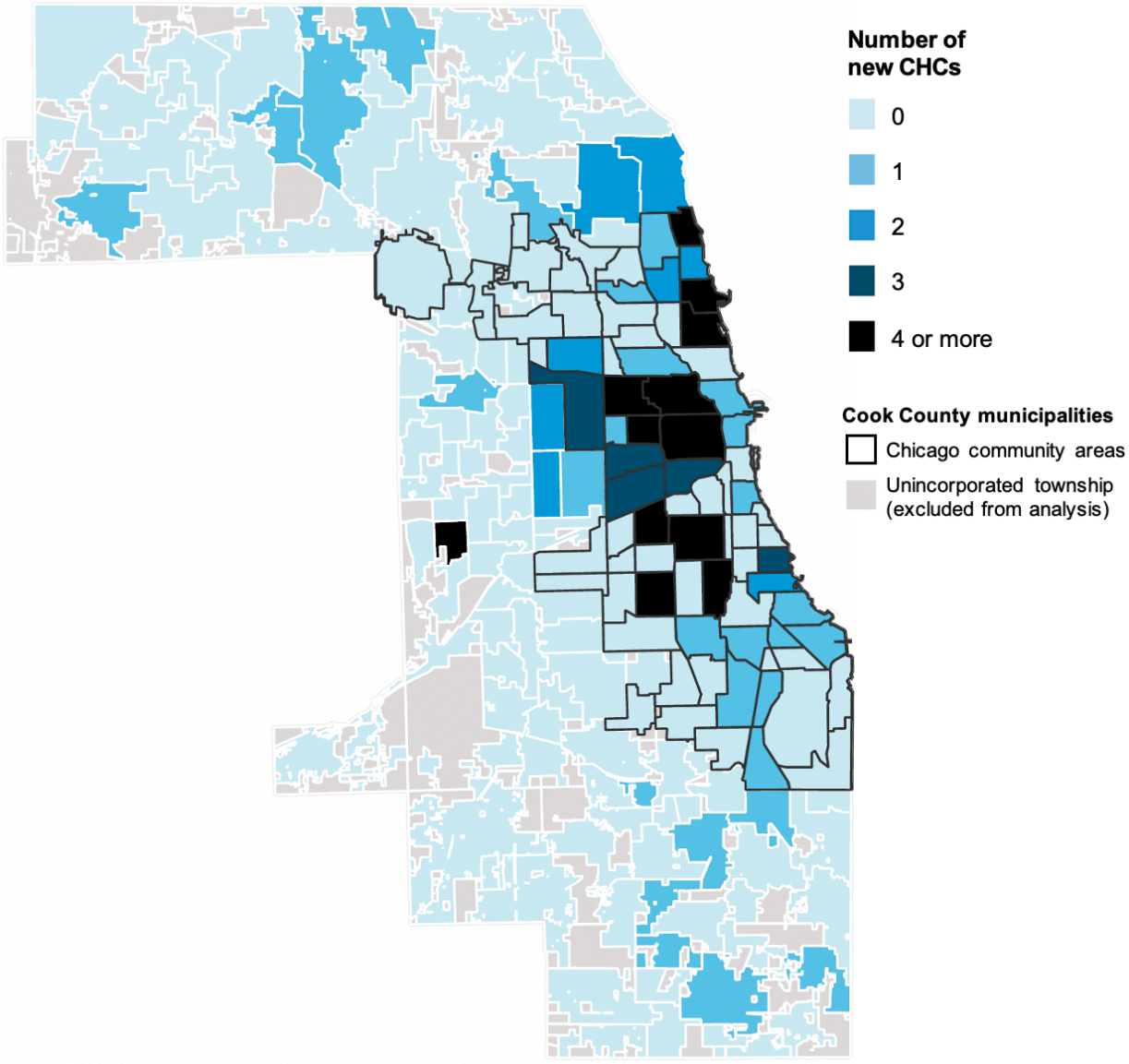
Effects of MUA/P Criteria and Baseline CHC Supply on CHC Expansion

The effect of MUA/P criteria on CHC expansion between FYs 2011 and 2019 was mixed. For example, the number of primary care physicians per 1,000 residents and poverty rate were both positively associated with gaining a new CHC during the study period, but the infant mortality rate and percent of residents age 65 and over were both negatively associated with gaining a new CHC. The poverty rate was the only MUA/P criterion with a statistically significant effect when baseline CHC supply was added to the model. A one percentage point increase in the poverty rate was associated with an 8% increase in the odds of gaining at least 1 new CHC between FYs 2011 and 2019 among Cook County municipalities, controlling for ICE for race, MUA/P designation, other MUA/P criteria and baseline CHC supply.

Of all predictors, baseline CHC supply had the largest effect on gaining a new CHC among Cook County municipalities. Specifically, the odds of gaining a new CHC between FYs 2011 and 2019 was 3.06 times higher for every one unit increase in baseline CHC supply, controlling for ICE for race and MUA/P designation and criteria. This effect remained the same when ICE for race and income was the primary predictor instead of ICE for race.

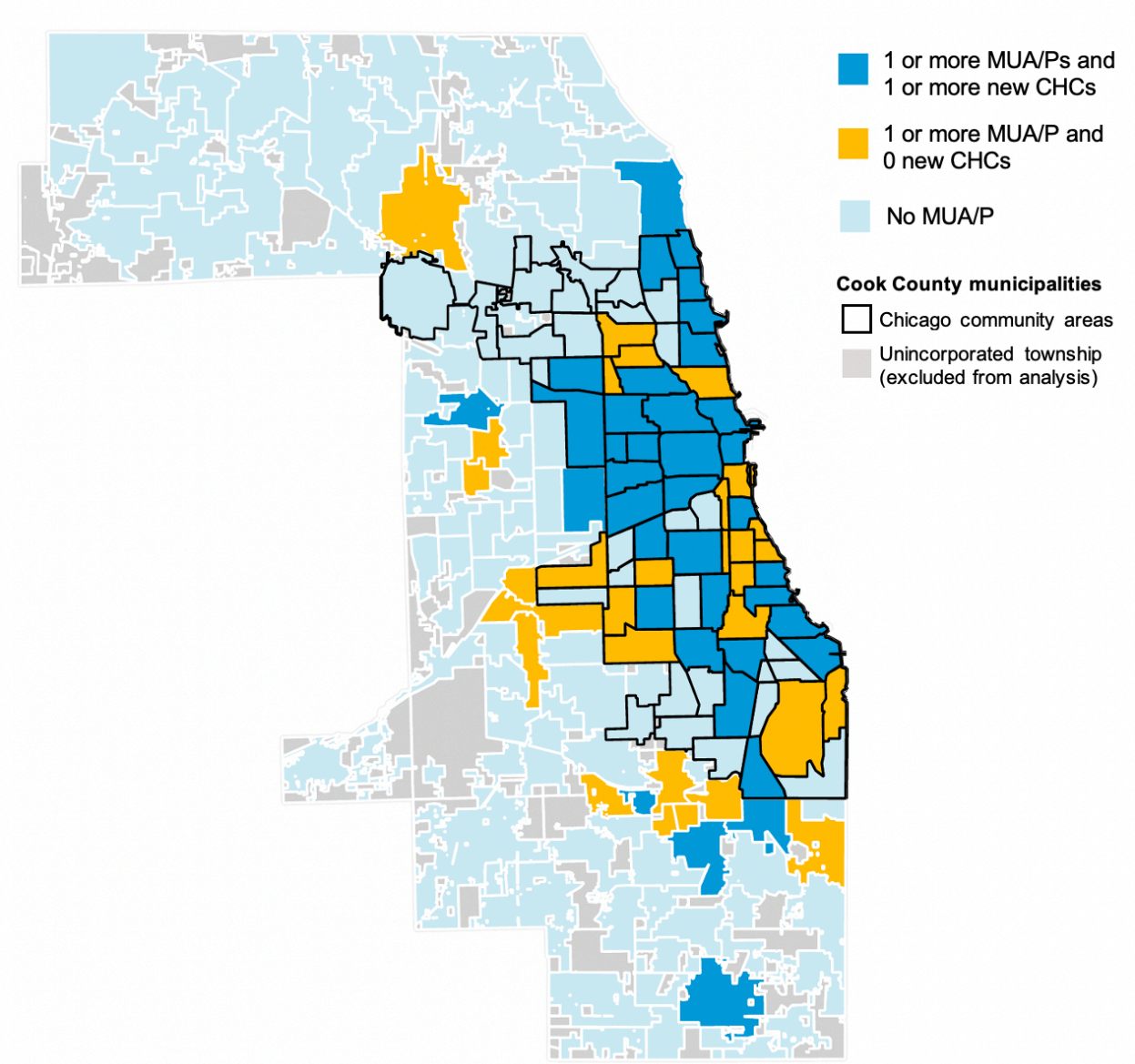
5.2.3 Tables and Figures

Figure 5.2.1. Community health center expansion among Cook County municipalities (N=199), FY 2011 – 2019



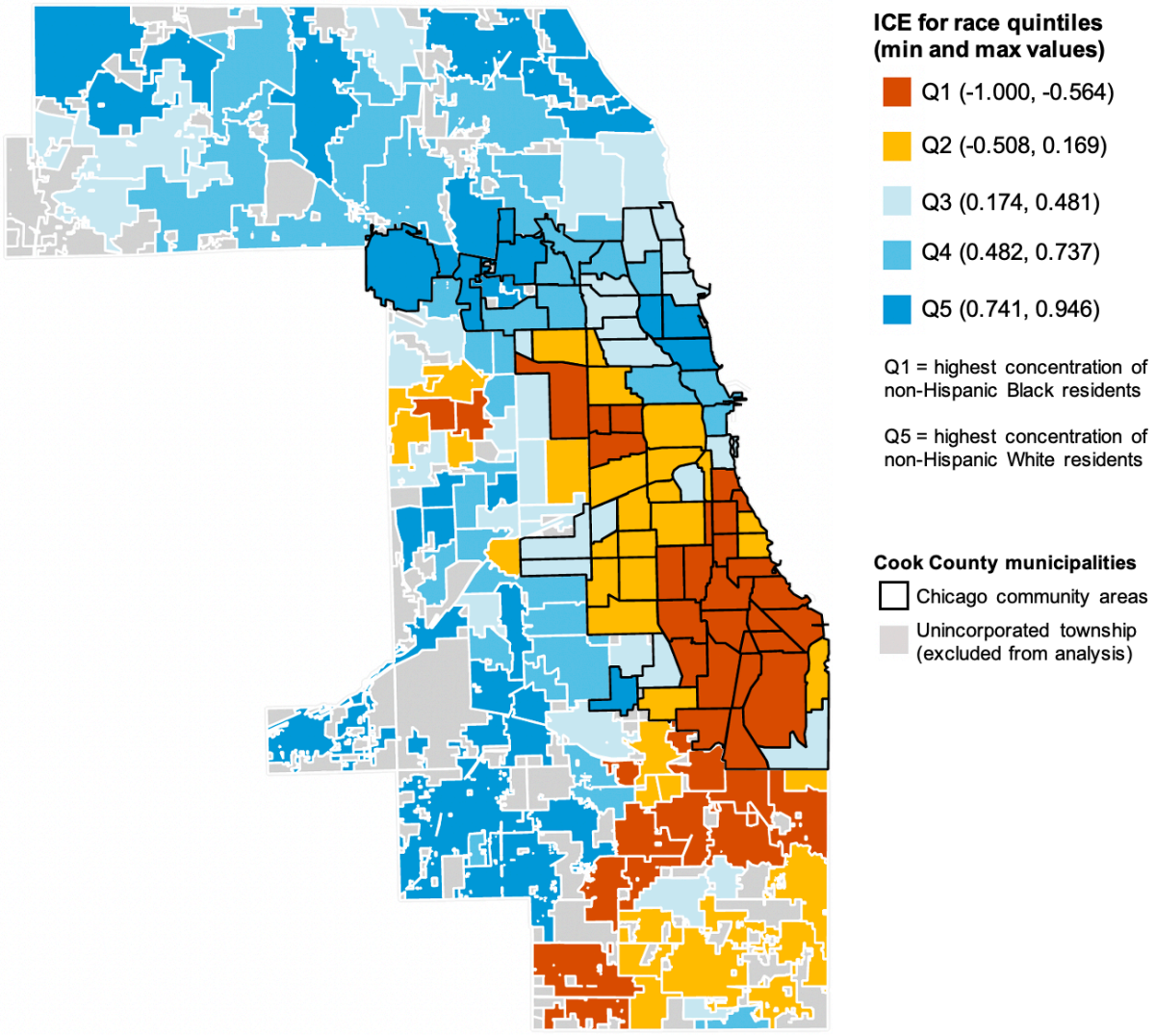
SOURCE: Author's (NJB) analysis of community health center (CHC) data from the Health Resources and Services Administration (HRSA). **NOTES**: A CHC is a HRSA-funded health center site or look-alike site. Black lines represent state boundaries. White lines represent suburban municipality boundaries.

Figure 5.2.2. Community health center (CHC) expansion by medically underserved area/population (MUA/P) designation among municipalities in Cook County (N=199), FY 2011 – 2019



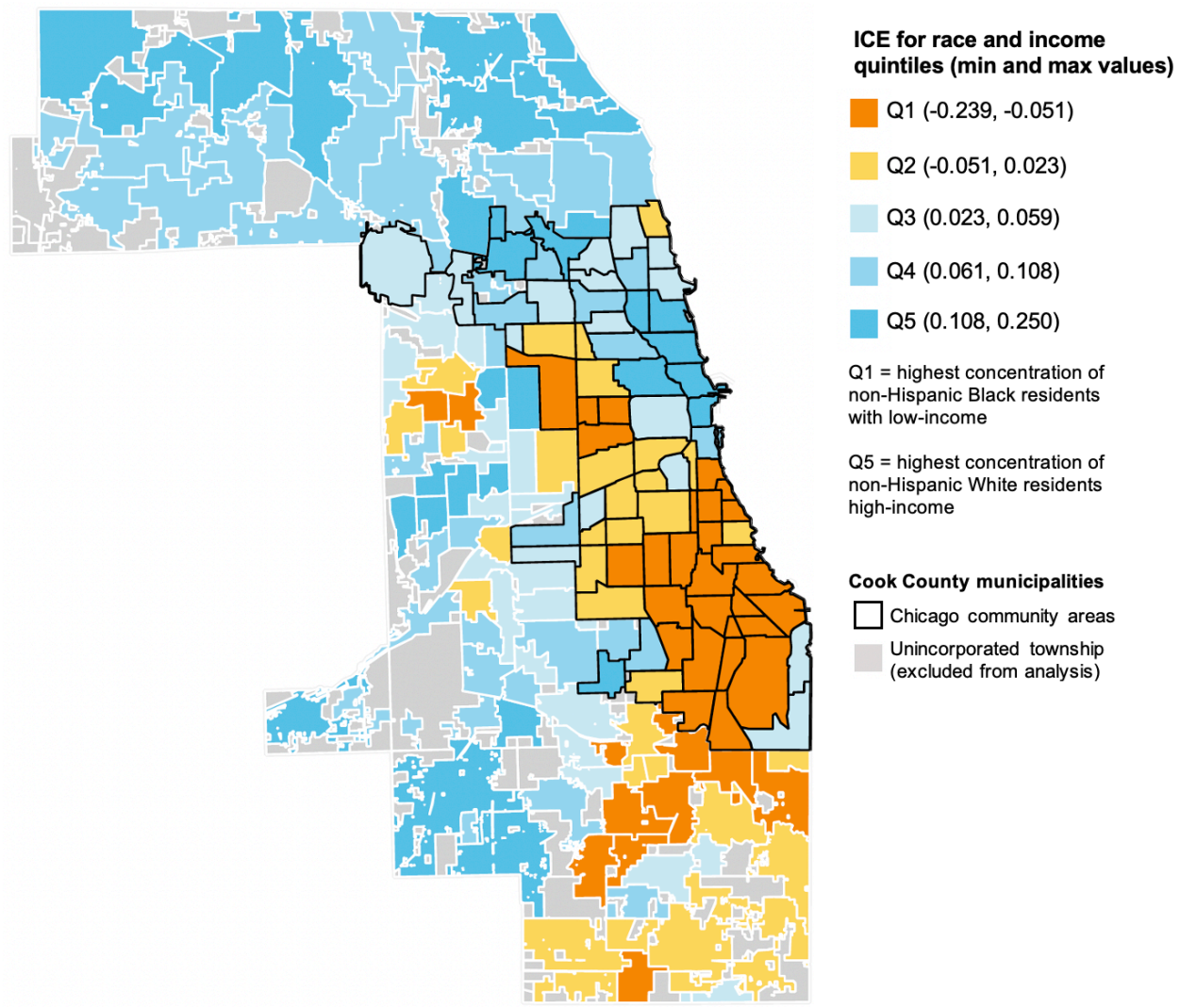
SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019). **NOTES**: A community health center (CHC) is defined as a HRSA-funded health center site or look-alike site. White lines represent suburban municipality boundaries.

Figure 5.2.3. Racial segregation among Cook County municipalities, 2011 – 2015 (N = 199)



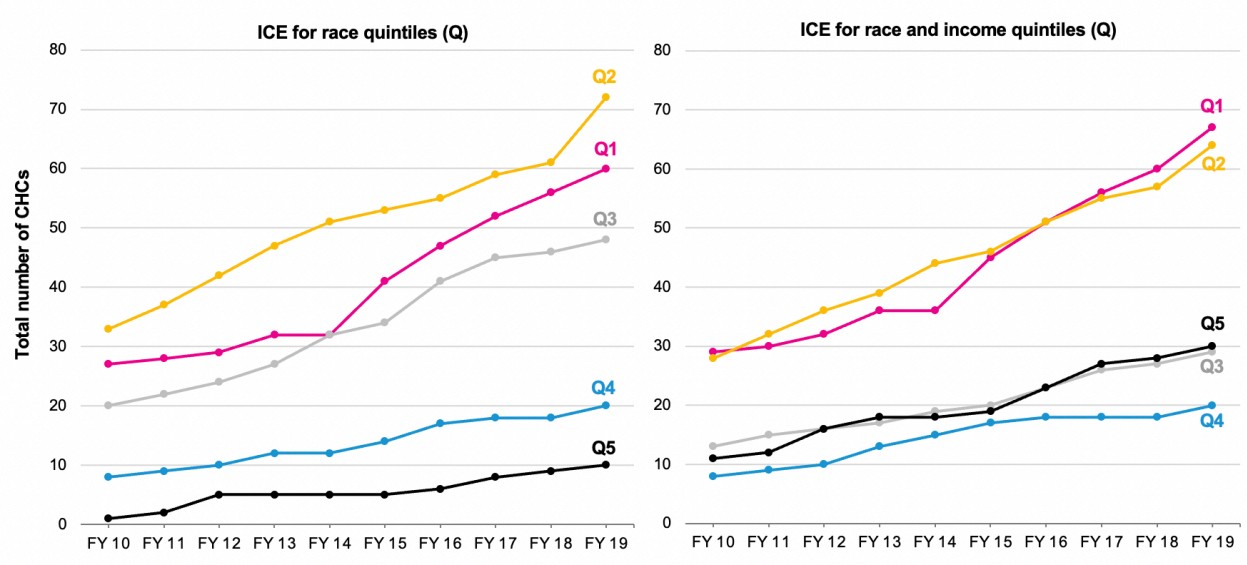
SOURCE: Author's (NJB) analysis of American Community Survey 5-Year Estimates (2011-2015). **NOTES**: Racial residential segregation was measured using the index of concentration at the extremes (ICE) for race which ranges from -1 to 1.

Figure 5.2.4. Racialized economic segregation among Cook County municipalities, 2011 – 2015 (N=199)



SOURCE: Author's (NJB) analysis of American Community Survey 5-Year Estimates (2011-2015). **NOTES**: Racialized economic segregation was measured using the index of concentration at the extremes (ICE) for race and income which ranges from -1 to 1.

Figure 5.2.5. Number of CHCs among Cook County municipalities by level of residential segregation (ICE quintiles), FY 2010-2019 (N=199)



SOURCE: Author's (NJB) analysis of health center data from the Health Resources and Services Administration (2010-2019) and demographic data from the American Community Survey 5-Year Estimates (2011-2015). **NOTES**: Community health centers include HRSA-funded health center and look-alike sites. CHCF = Community Health Center Fund; ICE = index of concentration at the extremes; FY = fiscal year

Table 5.2.1. Sample characteristics of Cook County municipalities with no new community health center (nonexpansion) compared to counties with at least one new community health center (expansion) between fiscal years 2011 and 2019, (N=199)

Variable	All municipalities (N=199)	Nonexpansion municipalities (N = 145)	Expansion municipalities (N= 54)	p-value
Residential segregation				
ICE for race	0.27 (0.60)	0.28 (0.57)	-0.12 (0.60)	0.000
ICE for race and income	0.03 (0.10)	0.04 (0.09)	-0.02 (0.12)	0.001
MUA/P Designation				
At least 1 *MUA*, n (col %)	55 (27.64%)	22 (15.17%)	33 (61.11%)	0.000
At least 1 *MUA/P*, n (col %)	68 (34.17%)	30 (20.69%)	38 (70.37%)	0.000
MUA/P Criteria				
PCPs per 1000 residents	0.86 (1.20)	0.78 (1.20)	1.06 (1.20)	0.010
Poverty rate	16.53% (11.24%)	13.59% (9.00%)	24.42% (12.83%)	0.000
% age 65 and over	13.82% (4.65%)	14.64% (4.60%)	11.62% (4.10%)	0.000
IMR (2005-2009)	7.81 (3.43)	7.53 (3.24)	8.58 (3.81)	0.106
Baseline CHC supply				
Number of CHCs (FY 2010), n (col %)				0.000
0 CHCs	144 (72.36%)	125 (86.21%)	19 (35.19%)	
1 CHC	38 (19.10%)	16 (11.03%)	22 (40.74%)	
2 or more CHCs	17 (8.54%)	4 (2.76%)	13 (24.07%)	
Other municipality characteristics				
Total population (in thousands)	25.89 (21.54)	19.35 (15.59)	43.45 (25.34)	0.000
% Population uninsured	13.37% (6.58)	12.48% (6.39%)	15.77% (6.55%)	0.002
Chicago area, col % (n)	77 (38.69%)	42 (28.97%)	35 (64.81%)	0.000

Source: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the Dartmouth Health Atlas Primary Care Service Area Project (2010), and mortality data from the Illinois Department of Public Health (2005-2009). **NOTES:** Values represent mean (standard deviation) for continuous variables and the number of observations (column percent) for categorical variables. P-values were calculated using Wilcoxon rank sum tests for continuous variables and chi-square tests for categorical variables. Col % = column percent; n = number of municipalities (frequency); CHC = community health center; MUA/P = medically underserved area/population; PCP = primary care physician; IMR = infant mortality rate

Table 5.2.2. Distributions of ICE scores among Cook County municipalities by CHC expansion status, 2011-2015

	All municipalities (N = 199)				Nonexpansion municipalities		Expansion municipalities	
	Mean	SD	Min	Max	N	%	N	%
ICE (race)[a]								
Quintiles								
Quintile 1	-0.82	0.13	-1.00	-0.56	21	14.48	19	35.19
Quintile 2	-0.11	0.23	-0.51	0.17	26	17.93	14	25.93
Quintile 3	0.36	0.10	0.17	0.48	28	19.31	12	22.22
Quintile 4	0.63	0.07	0.48	0.74	34	23.45	6	11.11
Quintile 5	0.82	0.06	0.74	0.95	36	24.83	3	5.56
Tertiles								
Tertile 1	-0.58	0.33	-1.00	0.05	39	26.9	28	51.85
Tertile 2	0.35	0.16	0.06	0.59	46	31.72	20	37.04
Tertile 3	0.76	0.09	0.59	0.95	60	41.38	6	11.11
Negative								
No	0.53	0.26	0.00	0.95	109	75.17	29	53.7
Yes	-0.64	0.28	-1.00	-0.04	36	24.83	25	46.3
ICE (race & income)[b]								
Quintiles								
Quintile 1	-0.13	0.05	-0.24	-0.05	20	13.79	20	37.04
Quintile 2	-0.01	0.02	-0.05	0.02	28	19.31	12	22.22
Quintile 3	0.04	0.01	0.02	0.06	34	23.45	6	11.11
Quintile 4	0.08	0.01	0.06	0.11	31	21.38	9	16.67
Quintile 5	0.16	0.04	0.11	0.25	32	22.07	7	12.96
Tertiles								
Tertile 1	-0.09	0.07	-0.24	0.01	41	28.28	26	48.15
Tertile 2	0.04	0.02	0.01	0.07	50	34.48	16	29.63
Tertile 3	0.13	0.05	0.07	0.25	54	37.24	12	22.22
Negative								
No	0.08	0.06	0.00	0.25	108	74.48	29	53.7
Yes	-0.10	0.07	-0.24	0.00	37	25.52	25	46.3

Source: Author's (NJB) analysis of demographic data from the American Community Survey 5-Year Estimates (2011-2015). **Notes**: Expansion municipalities had at least 1 new community health center (CHC) between fiscal years 2011-2019, nonexpansion municipalities had none. The index of concentration at the extremes (ICE) ranges from -1 (concentrated social marginalization) to 1 (concentrated privilege).

[a] Negative values indicate a higher concentration of non-Hispanic Black residents and Positive values indicate a higher concentration of non-Hispanic White residents

[b] Negative values indicate a higher concentration of non-Hispanic Black residents with low income and Positive values indicate a higher concentration of non-Hispanic White residents with high income

Table 5.2.3. Association of ICE for race with gaining at least 1 new community health center among Cook County municipalities (N=199), FYs 2011-2019

	Model 1	Model 2	Model 3	Model 4
Independent variables	**OR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
Negative ICE for race (ref is positive ICE)	2.61**	1.33	0.89	1.03
	(1.36,5.02)	(0.62,2.84)	(0.26,3.04)	(0.28,3.72)
At least 1 MUA/P (FY 2011-2019) (ref is no)		8.32***	2.85*	1.77
		(3.95,17.54)	(1.10,7.37)	(0.62,5.07)
PCPs per 1,000 residents (2010)			1.46*	1.36
			(1.07,2.00)	(0.98,1.88)
Infant mortality rate (2005-2009)			0.95	0.94
			(0.81,1.11)	(0.80,1.10)
Poverty rate			1.08*	1.08*
			(1.02,1.14)	(1.01,1.14)
Percentage of population age 65 and over			0.92	0.95
			(0.83,1.03)	(0.85,1.06)
Number of CHCs at baseline (FY 2010)				3.06***
				(1.66,5.64)

SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the American Medical Association (2010), and mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: The table shows results (odds ratios and 95% confidence intervals) from logistic regression models. A community health center is defined as a HRSA-funded health center site or look-alike site. CHC = community health center; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician; ref = reference group; * p<0.05, ** p<0.01, *** p<0.001

Table 5.2.4. Association of ICE for race and income with gaining at least 1 new community health center among Cook County municipalities (N=199), FYs 2011-2019

	Model 5	Model 6	Model 7	Model 8
Independent variables	**OR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
Negative ICE for race & income (ref is positive)	2.52**	1.22	0.78	0.97
	(1.31,4.83)	(0.57,2.63)	(0.23,2.66)	(0.27,3.54)
At least 1 MUA/P (FY 2011-2019) (ref is no)		8.51***	2.89*	1.78
		(4.01,18.06)	(1.12,7.48)	(0.62,5.10)
PCPs per 1,000 residents (2010)			1.45*	1.36
			(1.06,1.98)	(0.98,1.88)
Infant mortality rate (2005-2009)			0.96	0.94
			(0.82,1.11)	(0.81,1.09)
Poverty rate			1.08*	1.08*
			(1.02,1.15)	(1.01,1.15)
Percentage of population age 65 and over			0.93	0.95
			(0.83,1.03)	(0.85,1.07)
Number of CHCs at baseline (FY 2010)				3.06***
				(1.66,5.63)

SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the American Medical Association (2010), and mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: The table shows results (odds ratios and 95% confidence intervals) from logistic regression models. A community health center is defined as a HRSA-funded health center site or look-alike site. CHC = community health center; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician; ref = reference group; * p<0.05, ** p<0.01, *** p<0.001

5.3 Chicago Results

5.3.1 Reflexive Essay #2: 10 South Kedzie

My greatest personal, political, and theoretical lessons on life, access to care, and racism in Chicago have come from my mother. My mother was raised on the South Side of Chicago and often says, “Everybody I know went to the doctor at 10 South Kedzie.” This observation may mean nothing if you are unfamiliar with Chicago’s geography and the racialization of that geography. Ten South Kedzie is on the West Side of Chicago, nowhere near where my mother grew up. But it is not unusual for Black folks, especially poor Black folks, who live on the South Side to travel far for basic services like quality and affordable health care. But why? Why would someone who lives on the South Side have to go all the way Out West to see a doctor?

5.3.2 Descriptive Statistics

The sample consisted of the 793 census tracts in Chicago at the time of the 2010 US Census. There were 28 census tracts in the Central region, 79 on the Far South Side, 118 on the South Side, 134 on the North Side, 138 on the Southwest Side, and 140 on the Northwest Side (Table 5.3.1). The Northwest Side had the largest total population between 2011 and 2015 (n=573,477) and the smallest percent of non-Hispanic Black residents (2.53%). The Central region had the smallest total population (n=141,554), but the largest average census tract population (n=5,056 residents per tract). The South Side of Chicago was the only region with a majority (>50%) non-Hispanic Black population (82.85%).

Overall, the number of CHCs in Chicago increased from 69 in FY 2010 to 164 in FY 2019. During this time, Chicago CTs gained between 0 and 3 new CHCs, with 89.79% gaining none, 8.70% gaining 1, and less than 2% gaining more than 2 new CHCs (Figure 5.3.1). The

West Side had the largest percentage of CTs (18.59%) with a new CHC. Two CTs, on in Rogers Park on the North Side and one in Englewood on the Southwest Side, each had 3 new CHCs.

Nearly half (45.15%) of Chicago CTs were federally designated MUAs (n=275) or had a federally designated MUP (n=83), but few MUA/Ps (n=50) gained a new CHC between FYs 2011 and 2019 (Figure 5.3.2). Of the 358 MUA/Ps in Chicago, 13.97% gained at least 1 new CHC during the study period. Despite the growth in CHC supply, by FY 2019, 77.37% of Chicago MUA/Ps still did not have a single CHC.

There were no new or withdrawn MUA/P designations during the study period, but many Chicago census tracts without an MUA/P were eligible for one (Figure 5.3.3). Data from baseline and the first 4 years of the CHCF indicate that 22.57% (n=179) of Chicago tracts were undesignated MUA/Ps (i.e., census tracts with an index of medical underservice (IMU) score $\leq$ 62.0, but no MUA/P designation). At the same time, 19.92% (n=158) of Chicago tracts had an MUA/P, but were ineligible for the designation because their IMU score was > 62.0. The percentage of ineligible MUA/Ps was highest in the Central region (39.29%) and on the West Side (28.21%). The percentage of undesignated MUA/Ps was highest on the Far South (44.30%) and South (36.44%) Sides.

ICE for race (-1.00 to 0.93) varied more than ICE for race and income (-0.38 to 0.32), but the lowest values (Q1) of both indices were clustered among census tracts on the West, South, and Far South Sides (Figures 5.3.4 and 5.3.5). Unlike all other regions, the majority of census tracts on the South and Far South Sides had ICE values in the lowest quintile, indicating a high concentration of marginalized racial and racialized economic groups in these areas. More specifically, census tracts on the South and Far South sides were more likely than census tracts in any other area of the City to have the highest concentration of Black residents (χ^2=202.19; p<0.001) and the highest concentration of low-income Black residents (χ^2=175.48; p<0.001). In stark contrast, none of the census tracts on the North Side and near downtown (the Central

region) had Q1 ICE for race values and only 1 on the North Side had a Q1 for race and income value. Most census tracts in these regions had a higher concentration of White residents and high-income White residents (Q4 and Q5 ICE values).

Contemporary redlining (i.e., high loan denial rates and majority Black areas) was clustered on the West, Far South, and South Sides (Figure 5.3.6). Still, the South Side was unique in being the only region where the majority (56.78%) of census tracts were redlined at baseline. Compared to non-redlined census tracts, census tracts that were redlined in 2010 were significantly more likely to have the highest concentration of Black residents (χ^2=353.64; p<0.001) and low-income Black residents (χ^2=336.23; p<0.001) in 2011 – 2015. Redlined census tracts were also more likely than non-redlined census tracts to have an MUA/P (χ^2=10.36; p<0.01) and be an undesignated MUA/P (χ^2=27.95; p<001). No association existed between redlining at baseline and gaining at least 1 new CHC between FYs 2011 and 2019 (χ^2=0.86; p=0.35).

Of the 622 Chicago census tracts the HOLC assessed in 1940, the HOLC labeled 56.27% “definitely declining” (grade C) and 34.73% “hazardous” (grade D); only 9.00% of Chicago census tracts received a top grade (A or B) from the HOLC (Figure 5.3.7). Historically redlined (HOLC grade D) census tracts were more likely than census tracts with higher grades (A – C) to have a MUA/P between FYs 2011 and 2019 (χ^2=11.34; p<0.01). There weas no difference in undesignated MUA/Ps or CHC expansion between historically redlined and non-redlined census tracts.

Expansion and nonexpansion census tracts

Only 10.21% of Chicago’s 793 census tracts had at least 1 new CHC between FYs 2011 and 2019 (Table 5.3.2). These expansion tracts were more likely than nonexpansion tracts to have a high concentration of Black residents (negative ICE for race) and low-income Black

residents (negative ICE for race and income). These differences were not statistically significant. Similarly, expansion counties were more likely to be redlined at baseline, but not significantly so. In contrast, a larger proportion of nonexpansion counties (27.81%) received a HOLC grade D than expansion counties (22.22%).

Differences in racial residential segregation and redlining were not significant, but differences in MUA/P designation, ineligibility and criteria were. For example, expansion tracts were more likely to have a MUA or MUA/P designation between FYs 2011 and 2019 than nonexpansion tracts. There was no statistically significant difference in IMU scores, but expansion tracts were more likely to have an ineligible MUA/P than non-expansion tracts (χ^2=10.17; p<0.01). On average, expansion tracts also had more primary care physicians per 1,000 residents, a higher poverty rate, a smaller percent of residents age 65 and over, and more CHCs at baseline.

5.3.3 Main Regression Analyses

Effect of ICE scores on CHC expansion

As shown in Tables 5.3.3 and 5.3.4, neither the concentration of Black residents versus White residents (negative ICE for race) or the concentration of low-income Black residents versus high income White residents had a significant effect on gaining a new CHC between FYs 2011 and 2019 among Chicago census tracts. Although the association was not statistically significant, census tracts with a greater concentration of non-Hispanic Black (versus non-Hispanic White) residents had a higher odds of gaining a new CHC between FYs 2011 and 2019 in the unadjusted model (Model 1) and model controlling for MUA/P designation (Model 2), but a lower odds of gaining a new CHC after adjusting for MUA/P criteria (Model 3) and baseline CHC supply (Model 4). The same pattern was observed for census tracts with a greater

concentration of low-income non-Hispanic Black (versus high-income non-Hispanic White) residents (Models 5 – 8).

The odds of gaining at least 1 new CHC between FYs 2011 and 2019 was 2 times higher for census tracts with a MUA/P designation compared to census tracts without a MUA/P after adjusting for the concentration of Black versus White residents (ICE for race; Model 2) or the concentration of low income Black versus high income White residents (ICE for race and income; Model 6). The magnitude and significance of this effect were attenuated after adjusting for MUA/P criteria and baseline CHC supply.

In the fully adjusted models (Models 4 and 8) only the poverty rate and baseline CHC supply had a statistically significant association with CHC expansion. For example, a 1 unit increase in the poverty rate was associated with a 4% increase in the odds of gaining a CHC among Chicago census tracts after controlling for the concentration of Black and White residents, MUA/P designation and other criteria, and baseline CHC supply (Model 4). Baseline CHC supply had a larger effect, with a 1 unit increase in the number of CHCs in FY 2010 associated with a 96% increase in the odds of gaining a new CHC between FYs 2011 and 2019 after adjusting for the concentration of Black and White residents and MUA/P designation and criteria (Model 4). Similar and slightly smaller effects were observed in the fully adjusted model including the concentration of low-income Black and high income White residents (Model 8).

5.3.4 Moderation Analyses

Table 5.3.5 presents unadjusted and adjusted odds ratios from logistic regression models estimating the effect of an IMU of 62 or less and redlining on MUA/P designation among Chicago census tracts. In the unadjusted model (Model 9), the odds of a census tract having a MUA/P designation was 81% higher for census tracts with an eligible IMU score ($\leq$62) compared to census tracts with an ineligible IMU score (>62) ($p<0.001$). The effect was no

longer significant after adjusting for MUA/P criteria (Model 10), baseline CHC supply (Model 11), and redlining (Models 12 and 13).

The association between an IMU of 62 and MUA/P designation was significantly moderated by contemporary redlining, but not historical redlining. The odds ratio for the interaction term of contemporary redlining and MUA/P eligibility was less than 1, indicating that redlining negatively affected the association between MUA/P eligibility and designation. For example, redlining in 2010 (a high loan denial rate in a majority Black census tract) was associated with a 2.31 increase in the odds of having a MUA/P designation among census tracts with an *ineligible* (>62) IMU score after adjusting for MUA/P criteria and baseline CHC supply. Among redlined neighborhoods, the probability of MUA/P designation was 59.87% for neighborhoods with an *ineligible* IMU and 45.84% for neighborhoods with an *eligible* IMU (Figure 5.3.8).

Table 5.3.6 presents unadjusted and adjusted odds ratios from logistic regression models estimating the effect of an IMU of 62 or less and redlining on gaining a new CHC among Chicago census tracts. MUA/P eligibility was negatively associated with CHC expansion. For example, having an IMU of 62 or less was associated with a 47% reduction in the odds of gaining a new CHC between FYs 2011 and 2019 among Chicago census tracts, controlling for MUA/P criteria and baseline CHC ($p<0.05$). The association between an IMU of 62 and gaining a new CHC was negative in all models, but not statistically significant in the unadjusted model (Model 14) or the model including redlining at baseline and its interaction with the IMU (Model 17). In addition, redlining at baseline (i.e., a high loan denial rate in 2010 in a majority Black tract) did not moderate the association between an IMU of 62 and gaining a new CHC between FYs 2011 and 2019 (Model 17).

Table 5.3.7 presents unadjusted and adjusted odds ratios from logistic regression models estimating the effect of MUA/P designation on gaining a new CHC among Chicago census tracts. As in previous models (Models 2 and 8), having a MUA/P was positively

associated with CHC expansion. In the unadjusted model (Model 19), having a MUA/P was associated with a 2.12 increase in the odds of gaining a new CHC between FYs 2011 and 2019 among Chicago census tracts ($p<0.01$). The effect of MUA/P designation was not significant when covariates were included (Models 20-22). Redlining at baseline did not significantly moderate the association between MUA/P designation and CHC expansion (Model 22).

The number of expansion tracts in most HOLC groups was low (e.g., less than 10) when census tracts were stratified by MUA/P eligibility and designation (Table 5.3.8). For this reason, the moderation effect of HOLC grade on the associations between gaining a new CHC and MUA/P eligibility and designation was not tested. Instead, HOLC grade was added to the final model as an independent variable without the interaction term between HOLC grade and the primary predictor (e.g., IMU of 62 or less and MUA/P designation).

Historical redlining had a significant effect on CHC expansion between FYs 2011 and 2019 among Chicago census tracts. Compared to census tracts the HOLC labeled “best” or “still desirable” in 1940, the odds of gaining at least 1 new CHC between FYs 2011 and 2019 was 72% lower for tracts labeled “definitely declining” ($p<0.01$), 83% lower for tracts labeled “hazardous” ($p<0.001$), and 66% lower for tracts with no grade ($p<0.05$) after adjusting for MUA/P criteria, baseline CHC supply, and an IMU of 62 or less (Model 18). HOLC grade had a similar effect on gaining a new CHC among Chicago census tracts when MUA/P designation was the primary predictor instead of an IMU of 62 or less (Model 23).

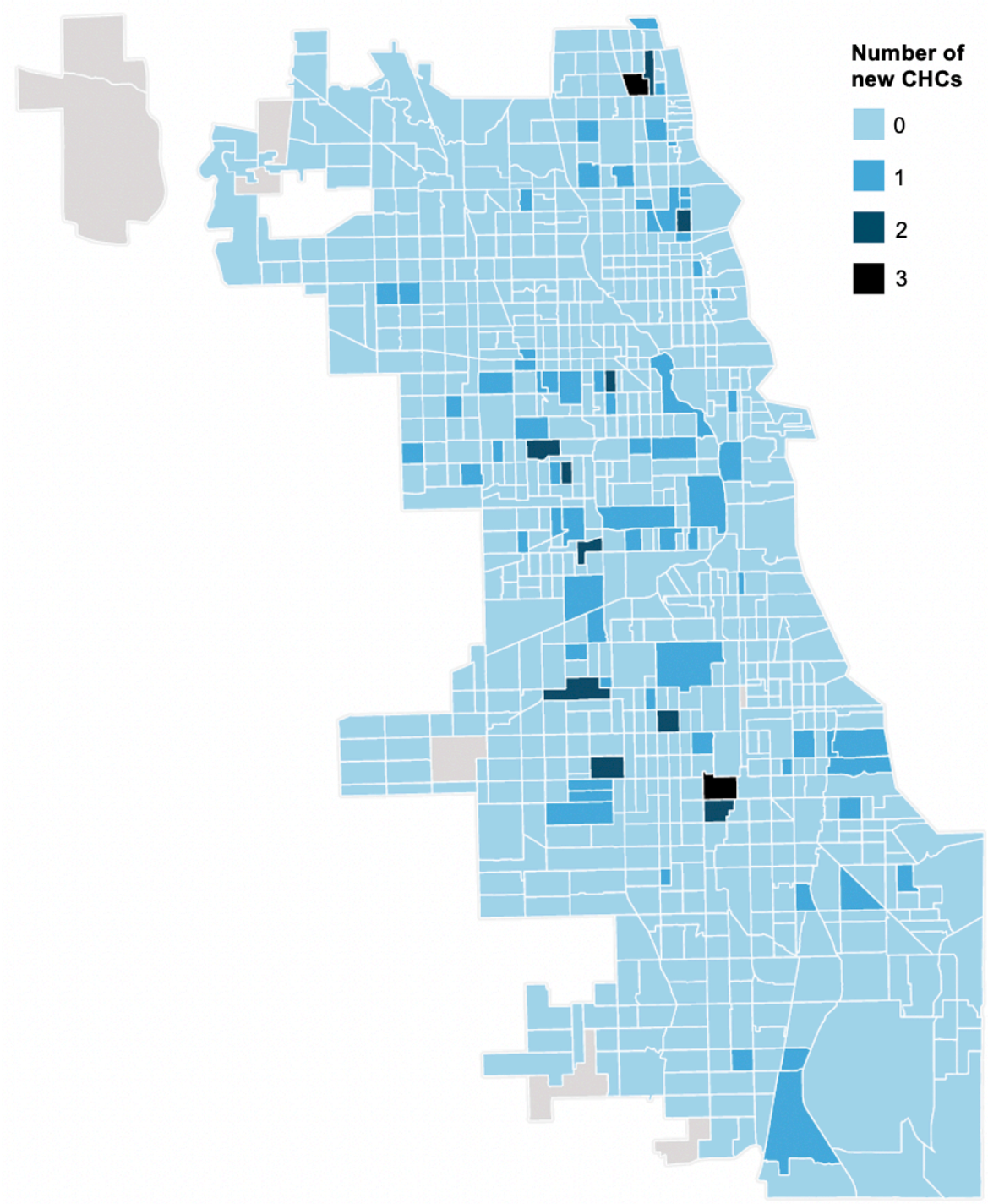
5.3.5 Tables and Figures

Table 5.3.1. Selected population characteristics of Chicago census tracts by region, 2011-2015 (N=793)

Region	Number of census tracts	Total population	Average census tract population	Non-Hispanic Black population	% Population non-Hispanic Black
Central	28	141,554	5056	17,423	12.31%
Far South	79	267,607	3387	183,662	68.63%
North	134	477,178	3561	49,432	10.36%
Northwest	140	573,477	4096	14,525	2.53%
South	118	299,617	2539	248,219	82.85%
Southwest	138	475,634	3447	121,654	25.58%
West	156	481,914	3089	205,273	42.60%
City Total	793	2,716,981	3426	840,188	30.92%

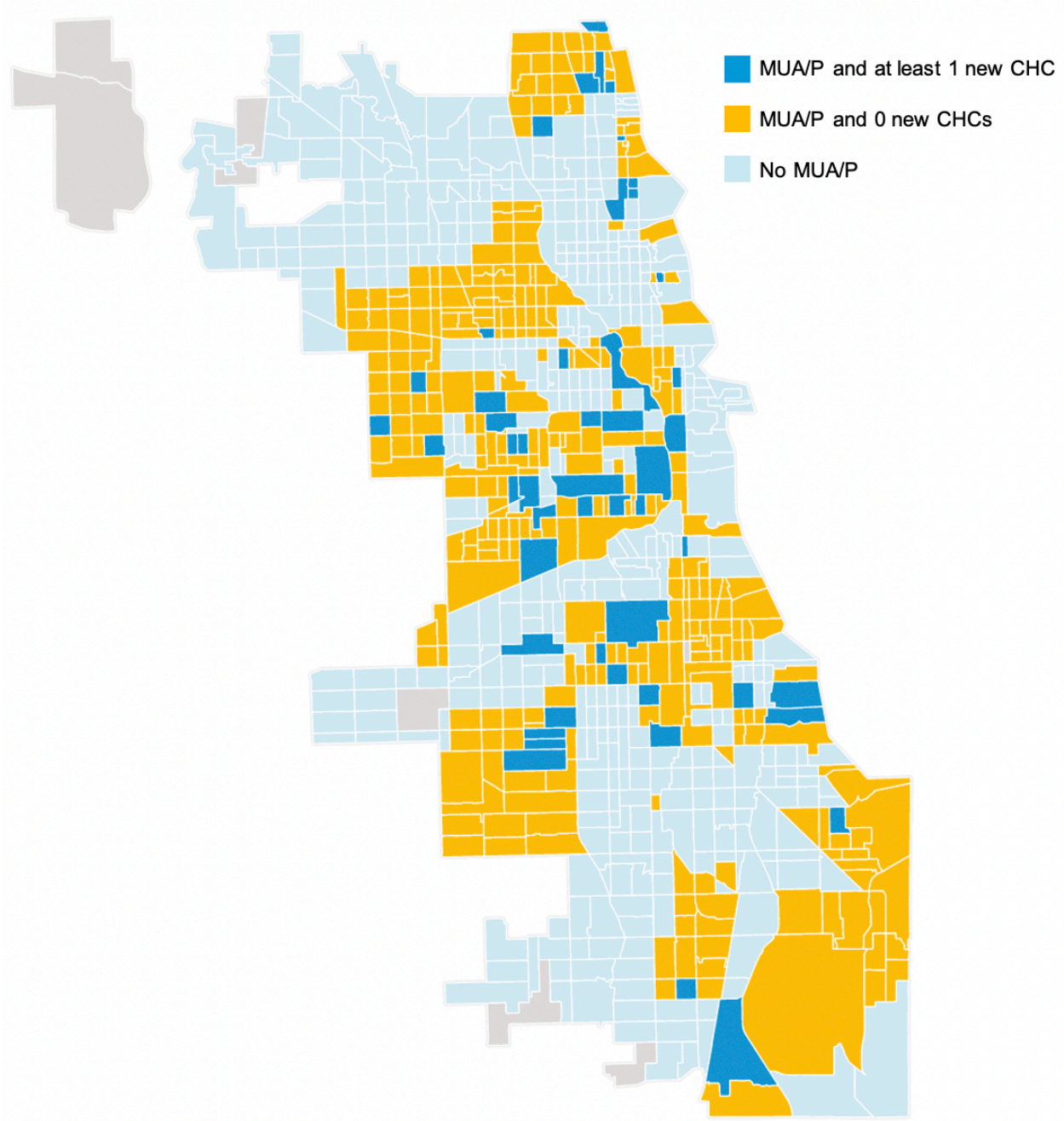
Source: Author's (NJB) analysis of American Community Survey 5-Year Estimates (2011-2015). **Notes**: Regions are the Chicago Department of Public Health's Health System Planning Regions.

Figure 5.3.1. Community Health Center Expansion Among Chicago Census Tracts (N=793), FY 2011-2019



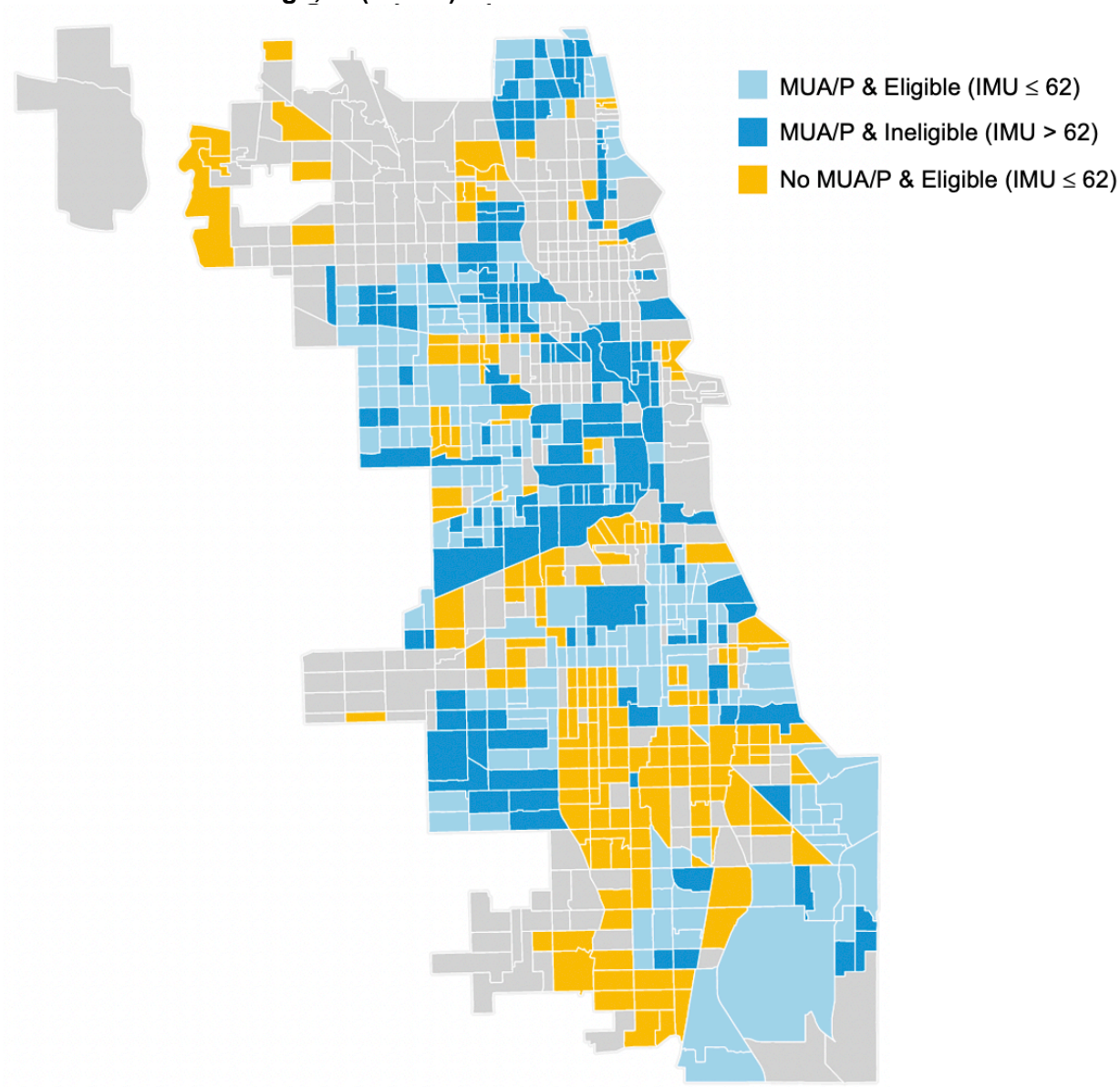
SOURCE Author's (NJB) analysis of community health center (CHC) data from the Health Resources and Services Administration (HRSA). **NOTES**: A CHC is a HRSA-funded health center site or look-alike site. White lines represent census tract boundaries. Gray areas are census tracts were not populated or existing at the time of the study and were excluded from the analysis.

Figure 5.3.2. Community health center (CHC) expansion by medically underserved area/population (MUA/P) designation among census tracts in Chicago, IL (N=793), FYs 2011 - 2019



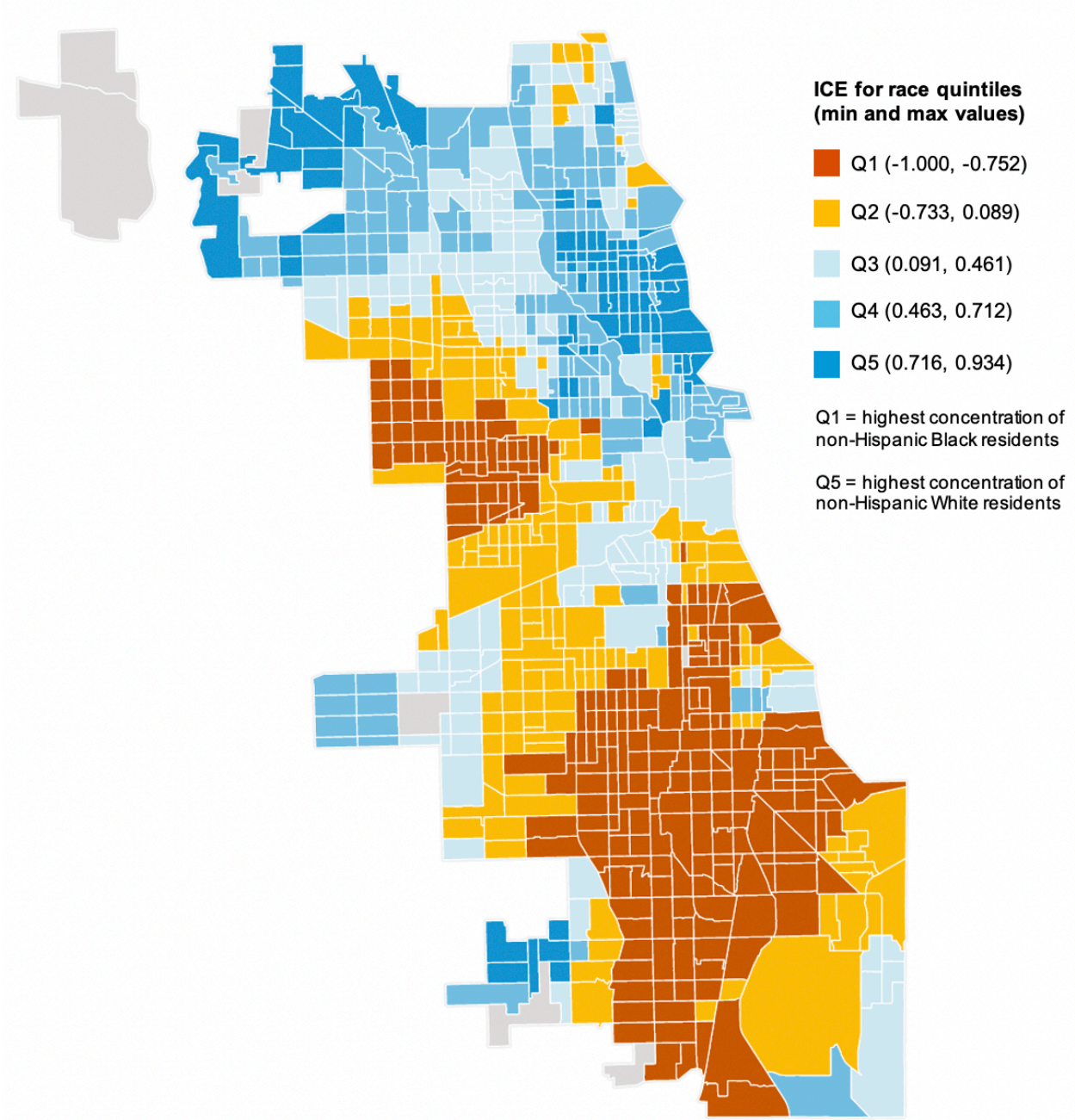
SOURCE: Author's (NJB) analysis of community health center (CHC) and medically underserved area/population (MUA/P) data from the Health Resources and Services Administration (HRSA). **NOTES**: A CHC is a HRSA-funded health center site or look-alike site. White lines represent census tract boundaries. Gray areas are census tracts were not populated or existing at the time of the study and were excluded from the analysis.

Figure 5.3.3. Medically underserved area/population designations and eligibility among census tracts in Chicago, IL (N=793)



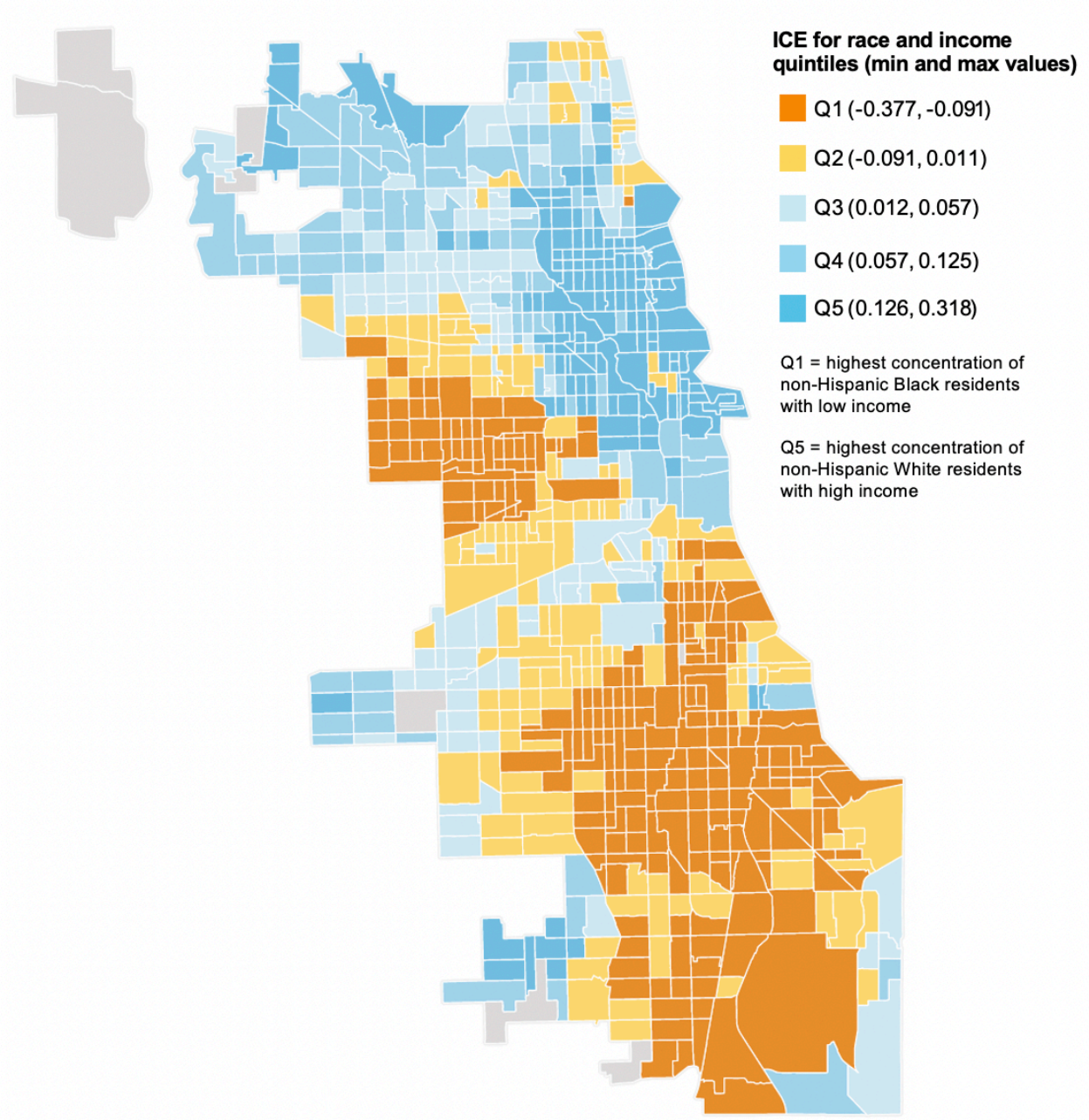
SOURCE: Author's (NJB) analysis of medically underserved area/population (MUA/P) data from the Health Resources and Services Administration (HRSA) and demographic data from the American Community Survey 5-Year Estimates (2011-2015). **NOTES**: HRSA's index of medical underservice (IMU) is a summation of the weighted value of an area's physician to population ratio, poverty rate, infant mortality rate, and percent of residents age 65 and over. An area/population must have an IMU of 62 or less to be eligible for an MUA/P designation. Non-geographic designations (medically underserved populations; n=83) were excluded.

Figure 5.3.4. Racial segregation among census tracts in Chicago, IL (N=793), 2011-2015



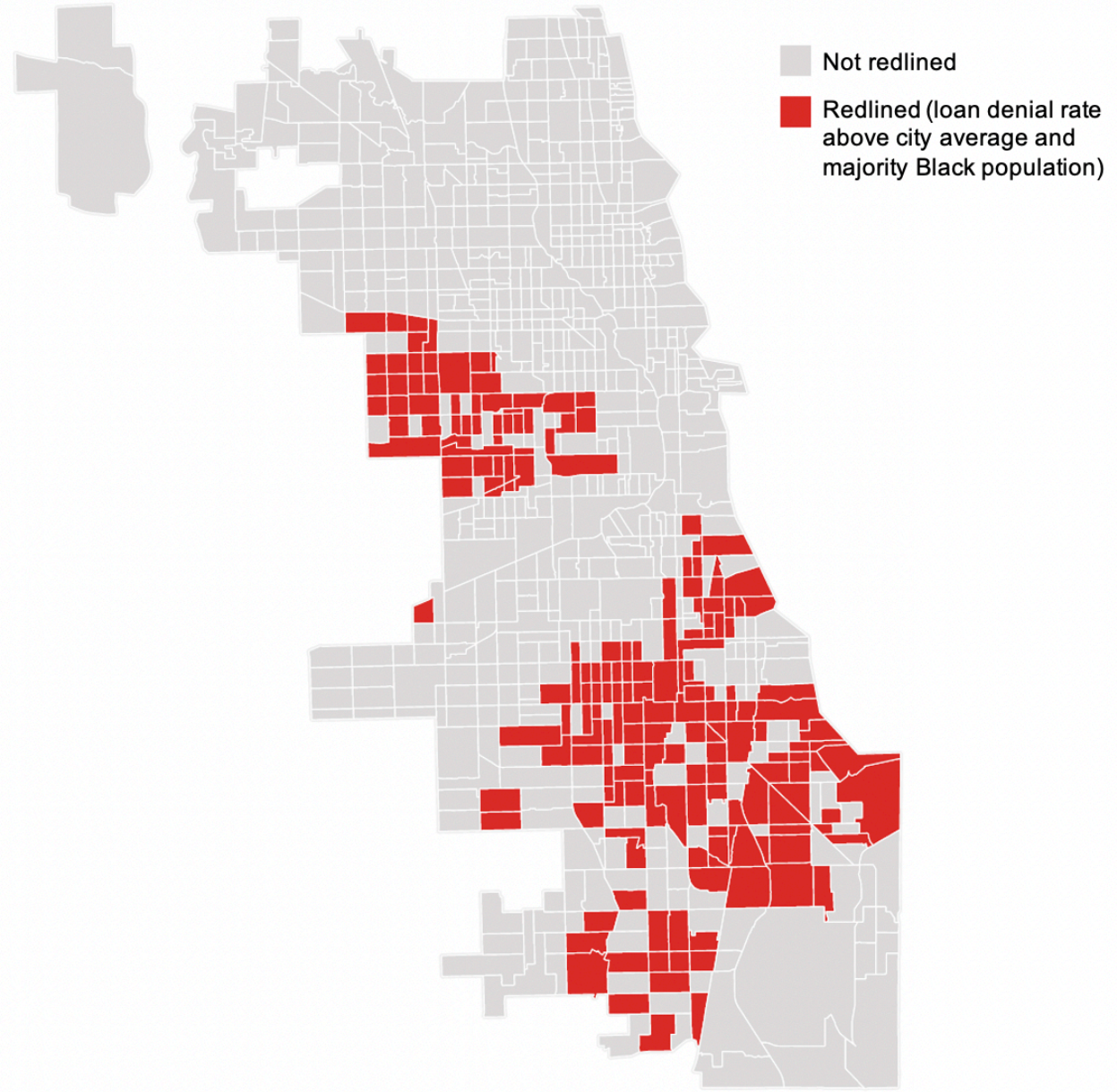
SOURCE: Author's (NJB) analysis of American Community Survey 5-Year Estimates (2011-2015). **NOTES**: Racial residential segregation was measured using the index of concentration at the extremes (ICE) for race which ranges from -1 to 1.

Figure 5.3.5. Racialized economic segregation among census tracts in Chicago, IL (N=793), 2011-2015



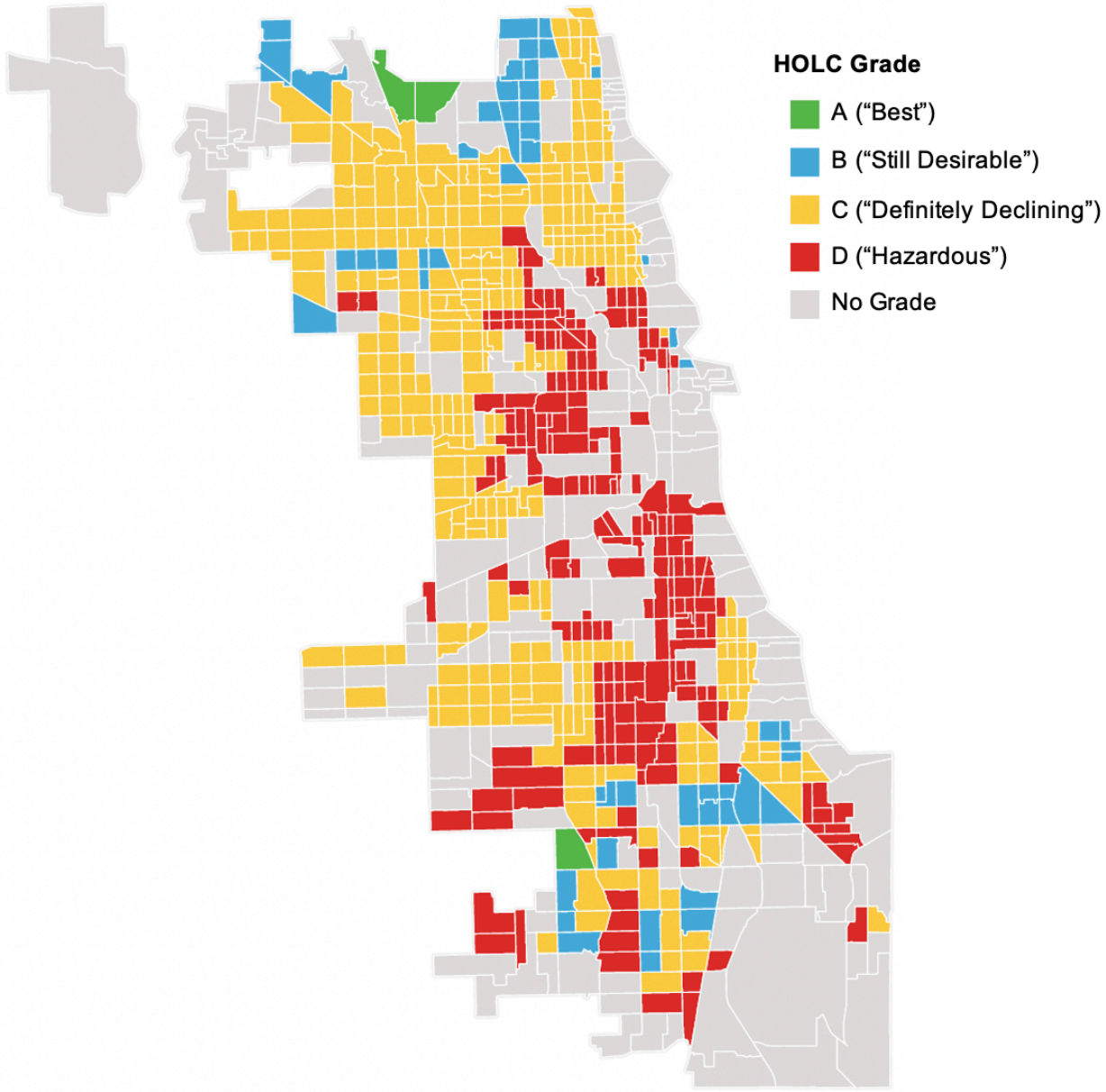
SOURCE: Author's (NJB) analysis of American Community Survey 5-Year Estimates (2011-2015). **NOTES**: Racialized economic segregation was measured using the index of concentration at the extremes (ICE) for race and income which ranges from -1 to 1.

Figure 5.3.6. Contemporary redlining among census tracts in Chicago, IL (N=793), 2010



SOURCE: Author's (NJB) analysis of loan data from the 2010 Home Mortgage Disclosure Act (HMDA) database. **NOTES**: Loan denial rate was calculated as the number of denied loans divided by the total number of loans in the census tract. Areas that were not redlined had a loan denial rate at or below the city average and/or did not have a majority (>50%) non-Hispanic Black population.

Figure 5.3.7. Historic redlining among census tracts in Chicago, IL (N=793), 1940



SOURCE: Author's (NJB) analysis of Home Owners' Loan Corporation (HOLC) data digitized by Mapping Inequality. **NOTES**: HOLC staff graded neighborhoods based on the perceived lending risk in the area. Lower grades indicate higher perceived risk.

Table 5.3.2. Characteristics of Chicago census tracts by CHC expansion status

Variable	All census tracts (N=793)	Nonexpansion tracts (n=712)	Expansion tracts (n=81)	p-value
Residential segregation				
Continuous ICE variables				
ICE for race	-0.06 (0.65)	-0.05 (0.65)	-0.15 (0.62)	0.169
ICE for race & income	-0.00 (0.13)	-0.00 (0.13)	-0.04 (0.13)	0.029
Categorical ICE variables				
Negative ICE for race	334 (42.12%)	297 (41.71%)	37 (45.68%)	0.493
Negative ICE for race & income	352 (44.39%)	310 (43.54%)	42 (51.85%)	0.154
Contemporary Redlining (2010)				
NCR (% of loan applications denied)	0.17 (0.18)	0.17 (0.18)	0.18 (0.2)	0.698
High NCR (NCR above median), n (col %)	394 (49.68%)	350 (49.16%)	44 (54.32%)	0.378
Redlined (High NCR & >50% Black), n (col %)	192 (24.21%)	169 (23.74%)	23 (28.4%)	0.354
Historical redlining (1940)				
HOLC grade, n (col %)				0.238
A (Best)	3 (0.38%)	3 (0.42%)	0 (0.00%)	
B (Still Desirable)	53 (6.68%)	43 (6.04%)	10 (12.35%)	
C (Declining)	350 (44.14%)	314 (44.1%)	36 (44.44%)	
D (Hazardous)	216 (27.24%)	198 (27.81%)	18 (22.22%)	
No grade	171 (21.56%)	154 (21.63%)	17 (20.99%)	
MUA/P Designation & Eligibility				
MUA, n (col %)	275 (34.68%)	230 (32.30%)	45 (55.56%)	0.000
MUA/P, n (col %)	358 (45.15%)	308 (43.26%)	50 (61.73%)	0.002
Index of medical underservice	63.28 (15.59)	63.06 (15.39)	65.26 (17.19)	0.525
Index of medical underservice ≤ 62, n (col %)	379 (47.79%)	343 (48.17%)	36 (44.44%)	0.524
MUA/P designation & IMU eligibility, n (col %)				0.000
MUA/P & Eligible (IMU ≤ 62)	200 (25.22%)	177 (24.86%)	23 (28.4%)	
MUA/P & Ineligible (IMU > 62)	158 (19.92%)	131 (18.4%)	27 (33.33%)	
No MUA/P & Eligible (IMU ≤ 62)	179 (22.57%)	166 (23.31%)	13 (16.05%)	
No MUA/P & Ineligible (IMU > 62)	256 (32.28%)	238 (33.43%)	18 (22.22%)	
MUA/P Criteria				
PCPs per 1000 residents	1.37 (7.47)	1.28 (7.55)	2.17 (6.64)	0.000
Poverty rate	24.17 (14.65)	23.41 (14.48)	30.81 (14.55)	0.000
% age 65 and over	11.04 (6.1)	11.22 (6.16)	9.46 (5.23)	0.011
IMR (2005-2009)	8.21 (4.2)	8.16 (4.25)	8.61 (3.68)	0.119
Baseline CHC supply (FY 2010)				
Number of CHCs at baseline, n (col %)				0.002
No CHCs	731 (92.18%)	662 (92.98%)	69 (85.19%)	
1 CHC	56 (7.06%)	47 (6.6%)	9 (11.11%)	
2 or more CHCs	6 (0.76%)	3 (0.42%)	3 (3.7%)	
Other neighborhood characteristics[a]				
Total population	3,426 (1,798)	3,394 (1,791)	3,708 (1,846)	0.142
% Population uninsured	16.58 (8.47)	16.38 (8.42)	18.37 (8.69)	0.058

Source: Author's (NJB) analysis of CHC and MUA/P data from the Health Resources and Services Administration, demographic data from the American Community Survey (2011-2015), redlining data from the Home Mortgage Disclosure Act (2010) and Home Owners' Loan Corporation (HOLC) (1940), physician supply data from the American Medical Association (2010), and mortality data from the Chicago and Cook County health departments (2005-2009). **Notes**. Expansion tracts had at least 1 new CHC between FYs 2011 and 2019; nonexpansion had none. Mean (SD) reported for continuous variables and frequency (column percentage) for categorical variables. P-values calculated using Wilcoxon rank sum tests for continuous variables and chi-square tests for categorical variables. Col % = column percent; n = number of census tracts (frequency); CHC = community health center; MUA/P = medically underserved area/population; PCP = primary care physician; ICE = index of concentration at the extremes; IMR = infant mortality rate; IMU = index of medical underservice

Table 5.3.3. Association of racial residential segregation (ICE for race) with gaining at least 1 new community health center between FYs 2011 and 2019 among Chicago census tracts (N=793)

	Model 1	Model 2	Model 3	Model 4
Independent variables	**OR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
Negative ICE for race (ref is positive ICE)	1.18	1.03	0.55	0.50
	(0.74,1.86)	(0.64,1.65)	(0.25,1.22)	(0.23,1.12)
MUA/P (FY 2011-2019) (ref is no)		2.11**	1.57	1.54
		(1.30,3.40)	(0.95,2.59)	(0.93,2.55)
PCPs per 1,000 residents (2010)			1.01	1.01
			(0.99,1.04)	(0.99,1.03)
Infant mortality rate (2005-2009)			1.00	1.01
			(0.92,1.09)	(0.92,1.10)
Poverty rate			1.04***	1.04***
			(1.02,1.06)	(1.02,1.06)
Percentage of population age 65 and over			0.97	0.97
			(0.92,1.01)	(0.92,1.02)
Number of CHCs at baseline (FY 2010)				1.96*
				(1.12,3.42)

SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the American Medical Association (2010), and mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: The table shows results (odds ratios and 95% confidence intervals) from logistic regression models. A community health center is defined as a HRSA-funded health center site or look-alike site. CHC = community health center; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician; ref = reference group; * p<0.05, ** p<0.01, *** p<0.001

Table 5.3.4. Association of racialized economic segregation (ICE for race and income) with gaining at least 1 new community health center between FYs 2011 and 2019 among Chicago census tracts (N=793)

	Model 5	Model 6	Model 7	Model 8
Independent variables	**OR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
Negative ICE for race & income (ref is positive)	1.40	1.19	0.80	0.76
	(0.88,2.21)	(0.74,1.92)	(0.37,1.73)	(0.35,1.64)
At least 1 MUA/P (FY 2011-2019) (ref is no)		2.03**	1.56	1.53
		(1.25,3.30)	(0.94,2.59)	(0.92,2.55)
PCPs per 1,000 residents (2010)			1.01	1.01
			(0.99,1.04)	(0.99,1.03)
Infant mortality rate (2005-2009)			0.98	0.98
			(0.90,1.06)	(0.90,1.07)
Poverty rate			1.04**	1.03**
			(1.01,1.06)	(1.01,1.06)
Percentage of population age 65 and over			0.96	0.97
			(0.92,1.01)	(0.92,1.01)
Number of CHCs at baseline (FY 2010)				1.88*
				(1.08,3.27)

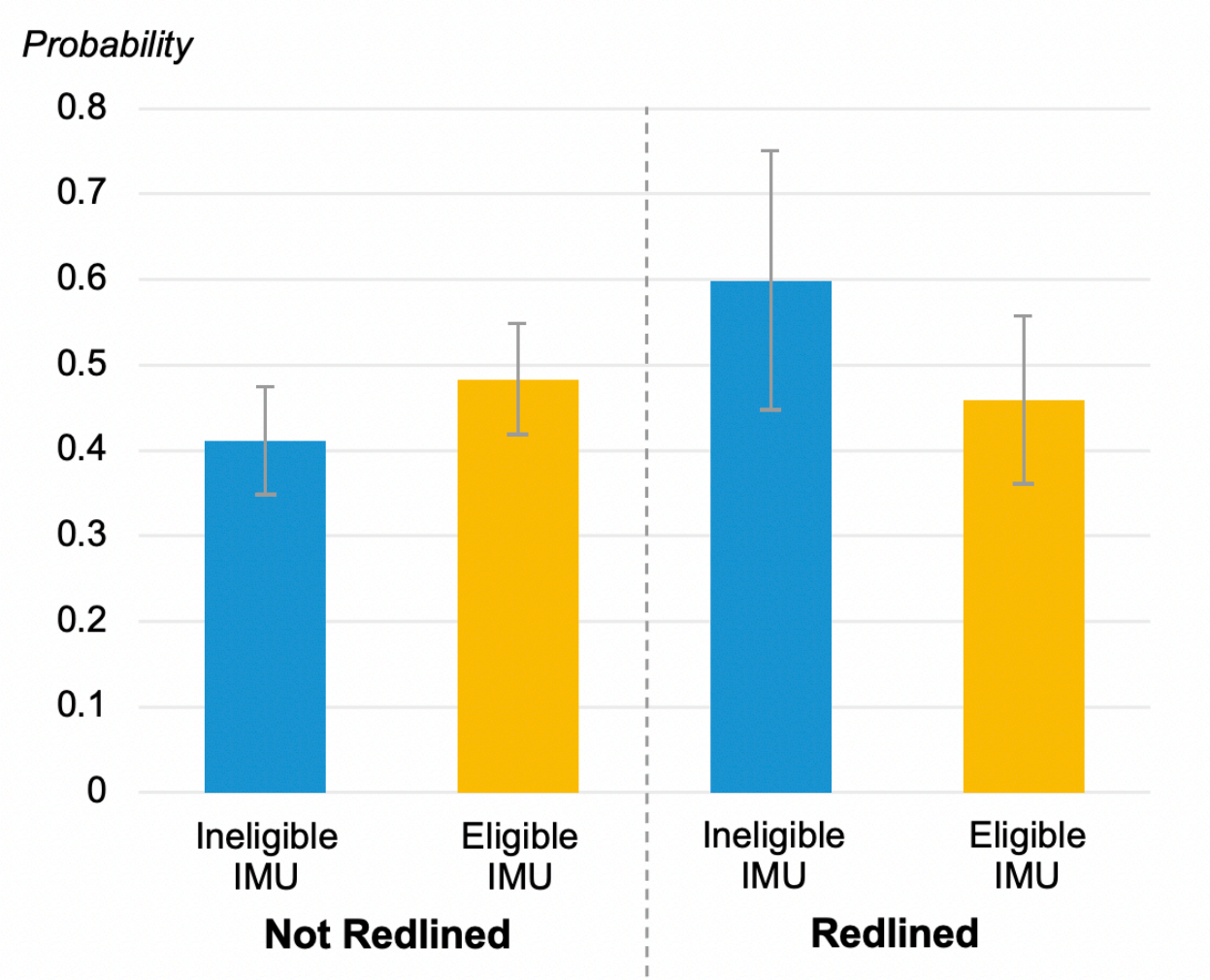
SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the American Medical Association (2010), and mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: The table shows results (odds ratios and 95% confidence intervals) from logistic regression models. A community health center is defined as a HRSA-funded health center site or look-alike site. CHC = community health center; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician; ref = reference group; * p<0.05, ** p<0.01, *** p<0.001

Table 5.3.5. Association of the MUA/P eligibility (index of medical underservice ≤ 62) and redlining with MUA/P designation among Chicago census tracts (N=793)

	Model 9	Model 10	Model 11	Model 12	Model 13
Independent variables	**OR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
Index of medical underservice (IMU) ≤ 62	1.81***	1.05	1.1	1.38	1.15
	[1.36,2.40]	[0.72,1.52]	[0.76,1.61]	[0.90,2.11]	[0.36,3.69]
PCPs per 1,000 residents (2010)		1.02	1.02	1.02	1.01
		[0.99,1.04]	[0.99,1.04]	[0.99,1.04]	[0.99,1.04]
Infant mortality rate (2005-2009)		0.96	0.96	0.95	0.96
		[0.92,1.01]	[0.92,1.01]	[0.90,1.00]	[0.91,1.00]
Poverty rate		1.05***	1.05***	1.05***	1.05***
		[1.04,1.07]	[1.04,1.07]	[1.03,1.07]	[1.04,1.07]
Percentage of population age 65 and over		0.98	0.98	0.98	0.98
		[0.95,1.01]	[0.95,1.01]	[0.95,1.00]	[0.95,1.00]
Number of CHCs at baseline (FY 2010)			1.46	1.49	1.47
			[0.88,2.43]	[0.90,2.49]	[0.88,2.46]
Redlined (Majority Black & NCR)				2.31*	--
				[1.06,5.03]	
IMU ≤ 62 x Redlined				0.39*	--
				[0.17,0.89]	
HOLC Grade (ref is A/B)					
C					0.77
					[0.32,1.86]
D					1.57
					[0.62,3.98]
No Grade					1.71
					[0.68,4.27]
IMU ≤ 62 x HOLC Grade					
IMU ≤ 62 x C					1.24
					[0.36,4.30]
IMU ≤ 62 x D					0.61
					[0.17,2.22]
IMU ≤ 62 x No Grade					0.91
					[0.24,3.38]

SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the American Medical Association (2010), mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: The table shows results (odds ratios and 95% confidence intervals) from logistic regression models. A community health center is defined as a HRSA-funded health center site or look-alike site. CHC = community health center; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician; ref = reference group; * p<0.05, ** p<0.01, *** p<0.001

Figure 5.3.8. Probability of MUA/P Designation Among MUA/P ineligible and eligible Chicago census tracts by presence of redlining (N=793).



SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the American Medical Association (2010), mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: The figure presents the predicted probability of MUA/P designation estimated from a logistic regression model that controlled for neighborhood provider supply, poverty, infant mortality, population age 65 and over, and baseline (FY 2010) CHC supply. The full regression results are in Table 5.3.5 (Model 12). MUA/P = medically underserved area/population; IMU = index of medical underservice.

Table 5.3.6. Association of MUA/P eligibility (index of medical underservice ≤ 62) and redlining with gaining at least 1 new CHC between FYs 2011 and 2019 among Chicago census tracts (N=793)

	Model 14	Model 15	Model 16	Model 17	Model 18
Independent variables	**OR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
Index of medical underservice (IMU) ≤ 62	0.86	0.48*	0.53*	0.57	0.52*
	[0.54,1.37]	[0.27,0.85]	[0.29,0.96]	[0.29,1.15]	[0.29,0.94]
PCPs per 1,000 residents (2010)		1.01	1.01	1.01	1.01
		[0.98,1.03]	[0.98,1.03]	[0.98,1.03]	[0.99,1.04]
Infant mortality rate (2005-2009)		0.97	0.97	0.97	0.98
		[0.90,1.05]	[0.90,1.05]	[0.89,1.05]	[0.91,1.06]
Poverty rate		1.05***	1.04***	1.04***	1.05***
		[1.03,1.07]	[1.02,1.07]	[1.02,1.07]	[1.03,1.08]
Percentage of population age 65 and over		0.97	0.97	0.96	0.95*
		[0.92,1.01]	[0.92,1.01]	[0.92,1.01]	[0.90,1.00]
Number of CHCs at baseline (FY 2010)			1.66	1.68	1.6
			[0.94,2.95]	[0.94,2.98]	[0.89,2.89]
Redlined (majority Black & high loan denial rate)				1.27	--
				[0.46,3.54]	
IMU ≤ 62 x Redlined				0.78	--
				[0.25,2.45]	
HOLC Grade (ref is A/B)					
C					0.28**
					[0.12,0.65]
D					0.17***
					[0.06,0.43]
No Grade					0.34*
					[0.14,0.83]

SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the American Medical Association (2010), mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: The table shows results (odds ratios and 95% confidence intervals) from logistic regression models. All models account for state fixed effects and exclude counties with fewer than 100 Black residents and counties composed of a single census tract. A community health center is defined as a HRSA-funded health center site or look-alike site. CHC = community health center; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician; ref = reference group; * p<0.05, ** p<0.01, *** p<0.001

Table 5.3.7. Association of MUA/P designation and redlining with gaining at least 1 new CHC among Chicago census tracts (N=793)

	Model 19	Model 20	Model 21	Model 22	Model 23
Independent variables	**OR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
MUA/P designation (no is ref)	2.12**	1.53	1.5	1.23	1.5
	[1.32,3.39]	[0.93,2.53]	[0.90,2.48]	[0.68,2.21]	[0.90,2.52]
PCPs per 1,000 residents (2010)		1.01	1.01	1.01	1.02
		[0.99,1.04]	[0.99,1.03]	[0.99,1.03]	[0.99,1.04]
Infant mortality rate (2005-2009)		0.96	0.97	0.97	0.98
		[0.90,1.04]	[0.90,1.04]	[0.89,1.05]	[0.91,1.05]
Poverty rate		1.03**	1.03**	1.03**	1.04***
		[1.01,1.05]	[1.01,1.05]	[1.01,1.05]	[1.02,1.06]
Percentage of population age 65 and over		0.96	0.96	0.96	0.94*
		[0.92,1.01]	[0.92,1.01]	[0.92,1.01]	[0.90,0.99]
Number of CHCs at baseline (FY 2010)			1.86*	1.81*	1.80*
			[1.07,3.22]	[1.04,3.14]	[1.02,3.17]
Redlined (majority Black & high loan denial rate)				0.62	--
				[0.20,1.91]	
MUA/P designation x Redlined				2.16	--
				[0.65,7.23]	
HOLC Grade (ref is A/B)					
C					0.28**
					[0.12,0.65]
D					0.17***
					[0.07,0.43]
No Grade					0.32*
					[0.13,0.79]

SOURCE: Author's (NJB) analysis of health center and medically underserved area/population data from the Health Resources and Services Administration (2010-2019), demographic data from the American Community Survey 5-Year Estimates (2011-2015), provider supply data from the American Medical Association (2010), mortality data from the National Center for Health Statistics (2006-2010). **NOTES**: The table shows results (odds ratios and 95% confidence intervals) from logistic regression models. All models account for state fixed effects and exclude counties with fewer than 100 Black residents and counties composed of a single census tract. A community health center is defined as a HRSA-funded health center site or look-alike site. CHC = community health center; FY = fiscal year; MUA/P = medically underserved area/population; PCP = primary care physician; ref = reference group; * p<0.05, ** p<0.01, *** p<0.001

Table 5.3.8. Distribution of HOLC grades by MUA/P eligibility and designation among nonexpansion and expansion Chicago census tracts

	Nonexpansion Tracts (n=712)		Expansion Tracts (n=81)	
HOLC Grade	Ineligible IMU	Eligible IMU	Ineligible IMU	Eligible IMU
A/B	24 (6.50%)	22 (6.41%)	6 (13.33%)	4 (11.11%)
C	177 (47.97%)	137 (39.94%)	19 (42.22%)	17 (47.22%)
D	84 (22.76%)	114 (33.24%)	9 (20.00%)	9 (25.00%)
No Grade	84 (22.76%)	70 (20.41%)	11 (24.44%)	6 (16.67%)
HOLC Grade	No MUAP	MUAP	No MUA/P	MUA/P
A/B	30 (7.43%)	16 (5.19%)	7 (22.58%)	3 (6.00%)
C	193 (47.77%)	121 (39.29%)	17 (54.84%)	19 (38.00%)
D	96 (23.76%)	102 (33.12%)	5 (16.13%)	13 (26.00%)
No Grade	85 (21.04%)	69 (22.40%)	2 (6.45%)	15 (30.00%)

Source: Author's (NJB) analysis of housing discrimination data from the Home Owners' Loan Corporation (HOLC) (1940), health center and medically underserved area/population (MUA/P) data from the Health Resources and Services Administration (HRSA) (2010-2019) and demographic data from the American Community Survey 5-year estimates (2011-2015). Notes: Expansion counties gained at least 1 new community health center (CHC) between FYs 2011 and 2019; nonexpansion counties gained none. To be eligible for a MUA/P designation an area must have an index of medical underservice (IMU) score of 62.0 or less.

CHAPTER 6: DISCUSSION

6.1 Discussion of Aim 1 Findings

The first aim of this study was to examine if CHC expansion and MUA/P designation between FYs 2011 and 2019 were associated with the degree to which Black people lived in areas that were separate from White and nonblack residents (i.e., segregation as a characteristic of a place). I hypothesized that the segregation of Black Americans would be positively associated with CHC expansion and MUA/P designation at the county-level and negatively associated with both at the local level. I also hypothesized that MUA/P designation would mediate these relationships.

There are three key findings from Aim 1 and they partially support my hypotheses. One, the number of new CHCs was larger in counties with higher segregation. Two, MUA/P designation mediated the relationship between CHC expansion and isolation. Three, at the local level, among Cook County municipalities, segregation between Black and White residents was not significantly associated with CHC expansion or MUA/P designation between FYs 2011 and 2019. The following discussion focuses on the county-level results.

There was a positive association between CHC expansion and racial residential segregation at the county-level, after controlling for MUA/P criteria and baseline CHC supply. For example, both the likelihood of having any new CHCs and the number of new CHCs were higher in metropolitan counties with higher Black-White dissimilarity. In addition, CHC expansion was higher in counties where Black residents were more isolated.

Ko and Ponce[83] found that the uneven distribution of nonwhite and White residents across neighborhoods (dissimilarity) was associated with the volume of new CHCs, but not the likelihood of CHC expansion. In contrast, the results of this study indicate that Black-White dissimilarity, as well as Black isolation, were associated with both outcomes. The different

results highlight how grouping racially marginalized residents into a single “nonwhite” category may lead to an incomplete understanding of the relationship between segregation and health care access.

Additional research is needed to understand whether segregation between different racial and ethnic groups has a different effect on CHC expansion. Measuring segregation between nonwhite and White residents, as Ko and Ponce[83] did, obscures the potential salience of differential racialization. Similarly, focusing solely on Black-White segregation, as I did in this study, emphasizes a Black-White binary and minimizes the relational racialization of space. For example, it is unclear if segregation between Black and nonblack residents is also associated with CHC expansion. In a city with a large Latino/a population, like Chicago, segregation between Latino/a and Black residents or between Latino/a and White residents may also have a distinct effect on the local distribution of CHCs.

There are multiple reasons why the segregation of Black Americans, specifically, may be positively associated with CHC expansion. A recent study found that after the Affordable Care Act (ACA) was passed, areas that gained new federally qualified health centers had a larger percentage of Black residents than areas that gained none.[196] Consistent with an understanding that race is a social construct, the authors’ interpretation of that finding connected post-ACA health center expansion in areas with a larger Black population not to any allegedly innate characteristics of Black people and Black neighborhoods, but to the need to address structural barriers to health care access.

Like race, however, racial composition is not a proxy for racism and does not identify the racism-related barriers to care that affect predominantly Black communities. The present study addresses this gap in the literature by providing evidence of the primacy of racism. In particular, at least 2 dimensions of racial residential segregation, Black-White dissimilarity and Black isolation, were associated with the post-ACA rise in CHC supply among metropolitan counties.

These results suggest that the segregation of Black residents in metropolitan areas may be a structural barrier to care that CHCs mitigate. This is plausible because, historically, an implicit goal of the CHC program was to reduce racial and ethnic inequities in health care.[7] Jack Geiger, a pioneer of the CHC movement, explained that, "the initial health center sites had heavily minority populations, [which was] a reflection of… racial segregation and exclusionary policies."[7(p.316)] Researchers also theorize that racial residential segregation is a fundamental cause of racial inequities in health care[47,48] and have found empirical evidence that predominantly Black neighborhoods are more likely to have a shortage of primary care physicians if they are in metropolitan areas with higher segregation.[82]

In light of this historical context and prior work, the present study's findings are simultaneously encouraging and troubling. The positive association between CHC expansion and the segregation of Black Americans suggests that racial health equity continues to be an "implicit goal"[7] of the CHC program. At the same time, the results imply that the need for CHCs is higher in segregated areas which may indicate that racial residential segregation continues to produce health care inequities.

The reasons why highly segregated counties had more new CHCs are not entirely clear. The presence of at least 1 MUA/P designation did not explain why CHC expansion and Black-White dissimilarity were associated, but it did partially explain the relationship between CHC expansion and Black isolation. As hypothesized, both segregation and MUA/P designation were positively associated with CHC expansion. However, the association between segregation and MUA/P designation between FYs 2011 and 2019 varied by segregation dimension. Black isolation, but not Black-White dissimilarity, had a significant effect on whether a metropolitan county had at least 1 MUA/P designation.

These results are consistent with previous studies that find the relationship between health and segregation varies depending on the dimension of segregation. For example, Bell et al.[85] found that among African American women living in large metropolitan areas, infant

birthweight was negatively associated the isolation index, but positively associated with the spatial proximity index (a measure of clustering). Previous findings such as those, coupled with the results of this study suggest that the residential isolation of Black Americans in metropolitan areas may have a particularly negative effect on health and health care outcomes.

Conceptually, isolation may have more significance for MUA/P designation than dissimilarity. Evenness, which the dissimilarity index measures, and exposure, which the isolation index measures, are conceptually distinct dimensions of segregation.[49,197,198] Measures of evenness are about the *distribution* of residents across neighborhoods, while measures of exposure are about the *separation* of residents into different neighborhoods.[198-200] For example, Black residents may be overrepresented in some neighborhoods and underrepresented in others relative to their proportion of the city's total population, but still live in close proximity to White residents. Such a city would have high segregation according to the dissimilarity index, but lower segregation according to the isolation index.

In a county with high isolation, Black and White residents live in separate neighborhoods. Unlike dissimilarity, isolation limits Black residents' access to White neighborhoods and resources in White neighborhoods. To be clear, proximity to whiteness in and of itself does not improve access to care. Rather, the concentration of resources in White neighborhoods increases potential access. Likewise, isolated Black neighborhoods are not inherently disadvantaged. Rather, the scarcity of public and private investment in Black neighborhoods limits resource availability. This unequal development of White and Black neighborhoods may increase the odds that a county has one or more medically underserved areas/populations.

The type of MUA/P designation also mattered. Specifically, single county MUA/Ps had a different relationship with segregation and CHC expansion than the presence of any type of MUA/P. For example, single county MUA/Ps were less common in counties with higher

segregation, regardless of the segregation measure. This suggests that only certain areas within highly segregated counties were underserved.

In addition to being negatively associated with segregation, having a single county MUA/P was also negatively associated with the number of new CHCs expansion counties gained. The reason why an entire county that is designated medically underserved would have fewer new health centers than a county that is partially underserved is unclear. Previous studies suggest that the boundaries of subcounty MUA/Ps are intentionally selected to secure designation.[201] It is possible that organizations in a subcounty MUA/P can document the need for health centers in their specific service area better than organizations that propose to serve an entire county.

6.2 Discussion of Aim 2 Findings

The second aim of this study was to examine the process it takes for a neighborhood to gain a new CHC and where along that process redlining mattered. I hypothesized that Chicago neighborhoods that were eligible for an MUA/P based on their index of medical underservice (IMU) score would be more likely to have a MUA/P designation. I also hypothesized that Chicago neighborhoods with a MUA/P designation would be more likely to have a new CHC. Finally, I hypothesized that both historical and contemporary redlining would reduce the magnitude of the association between MUA/P eligibility, MUA/P designation and CHC expansion.

The study findings support the hypotheses that among Chicago neighborhoods, there was a positive association between MUA/P eligibility and MUA/P designation and the association was moderated by contemporary redlining. This was the only significant interaction effect. However, historically redlined neighborhoods were significantly less likely to gain a CHC. Surprisingly, neighborhoods that had an eligible IMU were also less likely to gain a new CHC

between FYs 2011 and 2019. The following discussion focuses on the positive association between MUA/P eligibility and designation and the negative impact redlining had on that association.

Chicago neighborhoods with an eligible index of medical underservice score were more likely to have a MUA/P designation than neighborhoods with an ineligible score. It is difficult to meaningfully interpret this finding because the index of medical underservice has several limitations. Most notably, beyond denoting whether an area qualifies for a MUA/P designation, an index of medical underservice of 62 or less means little to nothing conceptually.

Whether the index of medical underservice is a valid measure of medical underservice is questionable.[202-204] Researchers, including some who served on the ACA-mandated committee to revise shortage designations, point out that the current index is not based on a theory or conceptual framework.[20,41] The index is also difficult to interpret because it is the summation of the weighted value of health care access, population health, socioeconomic and demographic variables.[20,21]

The designation threshold of 62 represents the median index of medical underservice score of counties in 1975, when the index was created.[41] Thus, a crude interpretation of the positive relationship between MUA/P eligibility and designation is that Chicago neighborhoods with an IMU less than or equal to the 1975 median county IMU were more likely to gain a new CHC between FYs 2011 and 2019. This interpretation of the results highlights the disconnect between the IMU threshold and current trends in health care access.

Unfortunately, the positive association between an eligible index of medical underservice score and MUA/P designation does not necessarily mean that neighborhoods that lacked access to primary care services (i.e., medically underserved areas)[38] were more likely to have a MUA/P designation. Nevertheless, the association has material consequences. Multiple federally funded programs including the Health Center Program use MUA/P designations to determine eligibility and allocate resources.

The relationship between MUA/P eligibility and designation in Chicago is also complicated by the prevalence of ineligible and undesignated MUA/Ps. Between FYs 2011 and 2019, more than a third of Chicago neighborhoods were either ineligible MUA/Ps or undesignated MUA/Ps. Thus, even if the index of medical underservice is a valid measure of underservice, an eligible score does not guarantee designation and an ineligible score does not prohibit designation.

One reason HRSA has failed to pass regulations that would change MUA/P designation criteria is because stakeholders were concerned that existing MUA/Ps would be negatively impacted. In fact, a guiding principle of the ACA-sanctioned Negotiated Rulemaking Committee on shortage designations was to consider "the impact of these changes [to MUA/P designation criteria] on currently designated areas and populations… so as to minimize disruption to existing health care delivery systems."[19]

The loss of MUA/P status is a legitimate concern. There is evidence that if MUA/P criteria were changed, many areas would lose their designation[203] and be ineligible for CHC funding. However, an overemphasis on ineligible MUA/Ps losing their designation ignores the possible plight of undesignated MUA/Ps.

Little is known about access to CHCs among undesignated MUA/Ps. The results of this study suggest that, at least in Chicago, undesignated MUA/Ps are less likely to gain new CHCs than ineligible MUA/Ps. This raises a concern about (1) the unmet need for health care services in neighborhoods that qualify for a MUA/P, but lack a designation and (2) the potential misallocation of safety net resources to neighborhoods that do not meet MUA/P eligibility criteria, but have a MUA/P designation anyway. In the policy implications section, I discuss how HRSA's new Unmet Need Score may address this concern.

The moderation analysis suggest redlining provides context for understanding the paradox of MUA/P designations in MUA/P ineligible neighborhoods. Among currently redlined Chicago neighborhoods – that is majority Black neighborhoods with a high proportion of denied

mortgage applications in 2010 – MUA/P eligible neighborhoods were less likely to have a MUA/P designation than MUA/P ineligible neighborhoods.

To my knowledge this is the first study to examine how redlining affects an area's chances of being designated underserved. However, in a recent study, Erikson et al.[69] found that historically redlined neighborhoods in Richmond City County, Virginia and Guilford County, North Carolina had fewer psychologists, counselors and therapists in 2020 than non-redlined neighborhoods. In other words, Erikson et al. found redlining in the 1930s was associated with medical underservice in 2020.

Among Chicago neighborhoods, I did not find a significant association between historical or contemporary redlining and medical underservice as HRSA defines and designates it. Instead, I found contemporary redlining reversed the positive association between MUA/P eligibility and designation between FYs 2011 and 2019. Additional research is needed to understand health care inequities between redlined and non-redlined neighborhoods across the US. The results from this study suggest future research should also assess differences in health care access among redlined neighborhoods and the causes of those differences.

There is a clear geographic dimension to the relationship between redlining and MUA/P eligibility and designation in Chicago. For example, all currently redlined neighborhoods were on the West Side or South Sides of Chicago. Whereas the West Side had the largest proportion of ineligible MUA/Ps, the South Sides had the largest proportion of undesignated MUA/Ps. Together, these results suggest redlined neighborhoods on the West and South Sides of Chicago are racialized in different ways, and this differential spatial racialization produces racialized geographic inequities in MUA/P designation. Differential spatial racialization, an extension of the CRT concept differential racialization, can be used in future research to better understand how racial meanings change across space.[205]

It is also possible that the interaction between redlining and MUA/P eligibility is acting as a proxy for something else that distinguishes West Side neighborhoods from South Side

neighborhoods. For example, a recent study found that between 1980 and 2016, Chicago's Black population decreased by 350,000.[94] This Black population loss was highest on the West and South Sides, but unlike South Side communities, several West Side communities that had a decline in the number of Black residents also experienced an increase in the number of White residents[94] and gentrification marked by rising property values and household incomes.

At the same time, the South Side of Chicago has struggled to secure needed health care services. For example, research shows that shootings in Chicago have been concentrated on the South and West Sides of Chicago and that the likelihood of death increases as the distance to a trauma center increases.[206] Unlike the West Side, between 1991 and 2017, that is for 27 years, the South Side of Chicago did not have a single level 1 adult trauma center.[207] The results from the present study contribute to evidence documenting a pattern of medical underservice on the South Side of Chicago. A pattern that has had deadly consequences.

6.3 Limitations and strengths

This study has several limitations. For one, I only measured one dimension of health care access: the local supply of CHCs. Supply is a crude measure of availability and does not capture other access related factors like transportation, travel costs, hours of operation, language services, or accommodations for patients with disabilities. Each of these factors may hinder whether a person is able to utilize services at a CHC.

Nevertheless, CHCs must first be present in an area for people to visit them. Furthermore, increasing the supply of CHC sites has been part of federal[16] and local[208] policy objectives to improve health care access, thus providing merit to the investigation of this health care outcome. However, restricting the measurement of CHC expansion to the number of new CHCs may overstate the current supply of CHCs. This issue highlights a second limitation, the need to address CHC closures.

CHC “closure” can mean many things. It could mean that a CHC site was shuttered and no longer provides services. It could also mean that a health care facility that was once a CHC is no longer a CHC, but still operates and delivers care. Third, it is unclear whether HRSA’s Health Care Service Delivery Site database includes all closed CHC sites.

Also not measured is CHC change in ownership. This measure may be particularly important in Chicago during the study period because the city experienced the largest school closure in its (and the country’s) history in 2013, when 47 Chicago public schools were closed. Some of these schools may have had a school-based CHC that served students and the local community. Some school-based CHCs also changed ownership.

Third, the results of the Cook County and Chicago analyses may not be generalizable to other counties and cities. It is possible that segregation and MUA/P designation have a different effect on CHC expansion in other places. For example, the other 2 counties with over 100 new CHCs between FYs 2011 and 2019 were Los Angeles and Miami-Dade. Both counties have a larger Hispanic/Latino population and smaller Black population compared to Cook County, which may affect the relationship between CHC expansion and the segregation of Black Americans.

Lack of generalizability is often framed as a limitation. Attempts to avoid this limitation (e.g., selecting a nationally representative sample) may mask the unique ways racial residential segregation, and racism more broadly, operate and impact health and health care outcomes in different spatial contexts. A commitment to this disciplinary norm (i.e., framing generalizability strictly or primarily as a limitation) may hinder research efforts to examine more nuanced questions and location-specific relationships among structural racism, health and health care. Studies that focus on a specific place may not be generalizable but may be key to unveiling how racism functions and impacts health care access at a local level.

Ecological studies that focus on a specific place, such as this one, may be limited by a small sample size. The small number of Cook County municipalities and even smaller number

of expansion municipalities prevented me from conducting certain analyses and may be one reason many regression estimates were statistically insignificant. For example, I was unable to control for the clustering of Cook County municipalities within regions because of the small number of regions and municipalities per region.

6.4 Research and policy implications

Each concept examined in this study (i.e., racial residential segregation, MUA/P designation, and CHC expansion) is dictated by complex processes. For example, an organization must have many resources including time, statistical expertise, and a strong social network to submit a successful MUA/P or CHC grant application. In regard to segregation, a combination of historical and ongoing institutional and individual decisions, that are racialized, determines where people live. Additional research is needed to understand how an area comes to have a MUA/P designation, a new CHC, and racial residential segregation.

To understand these processes and their connections, health services researchers may need to consider collecting qualitative data. This could be achieved through key informant interviews with local organizations that serve underserved communities, state primary care offices that submit MUA/P designation applications to HRSA, and HRSA staff who review MUA/P and CHC applications. The results of such work could be used to identify and intervene on the enabling factors that influence which areas do and do not receive MUA/P designations and new CHC sites. Considering the results from this research, it is also particularly important to understand how these processes are racialized.

Many studies examine the relationship between segregation and health. This study adds to the relatively smaller body of literature that examines the relationship between segregation and health care. Theoretical frameworks and conceptual models linking racial residential segregation to health outcomes and inequities have cited access to care as a potential mediator. A better understanding of the relationship between segregation and health care

access can help explain racism-related health inequities and identify opportunities for interventions. Additional research on access to CHCs in racially segregated and medically underserved areas is particularly needed to understand the role safety net providers, especially those that are federally funded, play in addressing the health and health care implications of structural racism.

The study of racism and health is not new, but recently scholars have called for more attention to and better measures of structural racism. Efforts to measure structural racism have focused on capturing racial inequities across multiple domains (e.g., education, employment, housing, and health care). This is one way to operationalize the interaction between macrolevel forces that constitutes the structural aspect of racism. Another way is to focus on one domain (e.g., health care) across multiple levels of government. Both approaches stem from an understanding that structural racism involves "connections among institutions and their racialized rules." The results from this study provide evidence that the latter approach may expose previously understudied forms of structural racism.

For the Chicago analyses, I created a new measure of medical underservice that categorized census tracts as eligible MUA/Ps, ineligible MUA/Ps and undesignated MUA/Ps. Descriptive analyses suggested that tracts with a high proportion of Black residents were significantly more likely than tracts with a high proportion of White residents to be undesignated MUA/Ps, suggesting disparate treatment. The presence of this disparate treatment across the MUA/P designation application process may be a form of structural racism. With data from state primary care offices (PCOs) and HRSA, scholars could use methods similar to audit studies and contemporary redlining measures to calculate racial inequities in the denial of 1) MUA/P designation requests local entities submit to state PCOs and 2) MUA/P designation applications state PCOs submit to HRSA.

The aforementioned data are not publicly available nor is data on the CHC grant applications that HRSA denies. While members of the public can submit a FOIA request to

obtain this data, legislation that makes this data permanently available to the public could be one way to monitor health care redlining.

The prevalence of undesignated MUA/Ps, ineligible MUA/Ps, and MUA/Ps without a single CHC raises old concerns about the conceptualization and measurement of medical underservice and the usefulness of MUA/P designations. Future attempts to revise the MUA/P designation process should begin by defining medical underservice and creating a theoretical framework that outlines the determinants of medical underservice. A definition and theory of medical underservice could then be used to determine the best way to measure the concept.

In 2020, HRSA created the unmet need score to identify communities that had a high need for CHCs. The findings from this study suggest that MUA/Ps that lack a CHC may be an indicator of high need. HRSA should consider this alongside the unmet need score when trying to allocate CHC funds to communities most in need.

6.5 Conclusion

In 2010, the Affordable Care Act created the Community Health Center Fund, a multibillion-dollar investment in health center expansion. Initially authorized for 5 years (FY 2011-2015), the fund has been extended 4 times and is currently available through FY 2022. Prior studies show increased CHC funding improves the availability of health centers in medically underserved and racially segregated areas. However, the results from this study suggest racialized geographic inequities in CHC expansion and MUA/P designation existed during the first 9 years of the Community Health Center Fund. Of particular concern is the high unmet need for federal designation and health center facilities among medically underserved, predominantly Black communities on the South Side of Chicago.

The prevalence of undesignated MUA/Ps documented in this study suggest the Department of Health and Human Services needs to reform regulations regarding how MUA/Ps

are defined, identified, and designated. Health services researchers should begin to incorporate policy relevant measures like the index of medical underservice and MUA/P designation into analysis about the need for and supply of safety net resources, especially when examining programs that use these measures to determine eligibility.

An "implicit goal" of the first community health centers was to reduce racial inequities in health care[7] and, more specifically, address the unmet need for primary care in segregated Black communities.[8,9] Half a century later, this study suggests that goal has yet to be fully realized, at least in some places.

6.6 Reflexive Essay #3: Designating Damage

Theoretically, a MUA/P designation is supposed to benefit the designated community. The designation is supposed to help the federal government identify and distribute resources to communities that lack access to primary care services. The designation characterizes a community as underserved, as a site of disinvestment. In exchange for being designated underserved, communities are supposed to gain access to the health care resources they currently lack.

A similar logic exists in research. Critical Race and Indigenous Studies scholar Eve Tuck calls it damage-centered research, "research that operates, even benevolently, from a theory of change that establishes harm or injury in order to achieve reparations" for disenfranchised communities.[209] In other words, "in a damage-centered framework, pain and loss are documented in order to obtain particular political or material gains."[209] But who benefits (most) from designating damage?

In an essay about violence and perceptions of Black people in Chicago, organizer Page May stated, "this is not a war among/between Black people, as the news outlets reported, but a war waged by the State against Black people."[97] May then asks, "What does the State achieve

from a mainstream perception of Chicago as 'Chiraq'?"[97] At the conclusion of this study, I think of this question in the context of the study findings and setting. I wonder:

What does the State achieve by maintaining the current MUA/P designation system?

How does the State benefit from designating damage?

What do researchers achieve by labeling Chicago a laboratory and using it as such?

How do researches benefit from documenting damage?

How might these be forms of violence?

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