

The Enduring Neighborhood Effect, Everyday Urban Mobility, and Violence in Chicago

Robert J. Sampson[†] and Brian L. Levy^{††}

A longstanding tradition of research linking neighborhood disadvantage to higher rates of violence is based on the characteristics of where people reside. This Essay argues that we need to look beyond residential neighborhoods to consider flows of movement throughout the wider metropolis. Our basic premise is that a neighborhood's well-being depends not only on its own socioeconomic conditions but also on the conditions of neighborhoods that its residents visit and are visited by—connections that form through networks of everyday urban mobility. Based on the analysis of large-scale urban-mobility data, we find that while residents of both advantaged and disadvantaged neighborhoods in Chicago travel far and wide, their relative isolation by race and class persists. Among large U.S. cities, Chicago's level of racially segregated mobility is the second highest. Consistent with our major premise, we further show that mobility-based socioeconomic disadvantage predicts rates of violence in Chicago's neighborhoods beyond their residence-based disadvantage and other neighborhood characteristics, including during recent years that witnessed surges in violence and other broad social changes. Racial disparities in mobility-based disadvantage are pronounced—more so than residential neighborhood disadvantage. We discuss implications of these findings for theories of neighborhood effects on crime and criminal justice contact, collective efficacy, and racial inequality.

Chicago is used to making the national news for violence. Whether for the rat-a-tat days of Al Capone's gangster era in the 1920s, the extreme violence of the late 1980s and early 1990s captured so poignantly in Alex Kotlowitz's *There Are No Children Here*, or the police killing of Laquan McDonald in 2014—which prompted widespread protests—Chicago has played an outsize role in the American tale of violence.¹ Some of this selective

[†] Robert J. Sampson is the Henry Ford II Professor of the Social Sciences at Harvard University and Affiliated Research Professor at the American Bar Foundation.

^{††} Brian L. Levy is an Assistant Professor of Sociology at George Mason University. The authors acknowledge financial support from National Science Foundation Grant SES #1735505. Direct correspondence to rsampson@wjh.harvard.edu.

¹ See generally ALEX KOTLOWITZ, *THERE ARE NO CHILDREN HERE* (1992). In one of the most well-known incidents of violence in that era, seven-year-old Dantrell Davis was shot to death one morning while walking to school with his mother in the Cabrini-Green

attention is misguided. Chicago is not the nation's murder capital, as many have erroneously claimed.² Although by no means a model of peace, Chicago has consistently scored below other U.S. cities like Detroit, Cleveland, Memphis, and New Orleans in per capita murder rates.³

Crime and violent victimization have also fallen in Chicago, as they have elsewhere, in the last quarter century. Black men benefitted the most in the form of increases in life expectancy,⁴ and children of all races coming of age in Chicago in recent years were much less likely to be arrested than kids growing up in the late 1980s and early 1990s.⁵ Moreover, while police brutality in Chicago is legendary⁶—and the reach of incarceration is orders of magnitude higher in the city's predominantly Black neighborhoods than in its White neighborhoods⁷—racial disparities in criminal justice are national in scope, and incarceration rates began to decline around 2010 (especially for Black Americans).⁸ The reputation of Chicago as a uniquely violent city is thus misleading, and things have improved, including for minorities, on many counts.

housing project. Murdered by a gang member who had been aiming to take out a rival, Dantrell's death made national news and became an unwanted symbol of the state of public housing in Chicago. See BEN AUSTEN, *HIGH RISERS: CABRINI-GREEN AND THE FATE OF AMERICAN PUBLIC HOUSING 195–99*, 204–05 (2019); see also *People v. Garrett*, 658 N.E.2d 1216, 1218–20 (Ill. App. Ct. 1995).

² President Donald Trump famously singled out Chicago's violence on several occasions, but he is far from alone in prioritizing rhetoric over factual analysis. See Aziz Z. Huq & John Rappaport, *Symposium Introduction: This Violent City? Urban Violence in Chicago and Beyond*, 89 U. CHI. L. REV. 303, 303 (2022) (concluding that “the empirical data about Chicago's crime and policing trends belie the most dramatic of these claims”).

³ Elisha Fieldstadt, *Murder Map: Deadliest U.S. Cities*, CBS NEWS (Apr. 19, 2021), <https://perma.cc/X7NN-VCZC>; *Cities with Most Murders 2021*, WORLD POPULATION REV., <https://perma.cc/5RWS-AGNR>.

⁴ Patrick Sharkey & Michael Friedson, *The Impact of the Homicide Decline on Life Expectancy of African American Males*, 56 DEMOGRAPHY 645, 646 (2019).

⁵ Roland Neil & Robert J. Sampson, *The Birth Lottery of History: Arrest over the Life Course of Multiple Cohorts Coming of Age, 1995–2018*, 126 AM. J. SOCIO. 1127, 1169 (2021) (“The probability of being arrested is nearly twice as large during the peak ages of delinquency in adolescence for cohorts born in the early to mid-1980s compared to younger cohorts born in the mid-1990s.”).

⁶ See *Jon Burge and Chicago's Legacy of Police Torture*, CHI. TRIB. (Sept. 19, 2018), <https://perma.cc/85DK-MLFE>.

⁷ Robert J. Sampson & Charles Loeffler, *Punishment's Place: The Local Concentration of Mass Incarceration*, DÆDALUS, Summer 2010, at 20, 26–27.

⁸ See Christopher Muller & Alexander F. Roehrkasse, *Racial and Class Inequality in U.S. Incarceration in the Early Twenty-First Century*, SOC. FORCES (forthcoming 2022); John Gramlich, *America's Incarceration Rate Falls to Lowest Level Since 1995*, PEW RSCH. CTR. (Aug. 16, 2021), <https://perma.cc/ES5P-DUR9>.

The city's legacy of punishment and violence is nonetheless deeply troubling and continues apace even as violence has declined considerably from its late-twentieth-century high. In the spring of 2021, for example, the shootings of young children again made national news. On a Sunday afternoon in April, Jaslyn Adams, age seven, was shot to death in her father's car while waiting in a McDonald's drive-thru in Chicago's North Lawndale neighborhood.⁹ A few weeks earlier and less than a mile and a half south, in the city's Little Village neighborhood, thirteen-year-old Adam Toledo was shot to death in an alley by a police officer called to investigate gunshots.¹⁰ While the city's rate of murder is lower than it was in the early 1990s, 2020 also witnessed a decisive surge in killings, up 50% from the previous year.¹¹ One of the victims was one-year-old Sincere Gaston, who was shot to death riding in his mother's car in the Englewood neighborhood on a particularly violent Saturday in June—the same day that a ten-year-old girl was killed sitting at home when a stray bullet ripped through her window.¹²

No one knows if violence will continue or plummet, but the continuing loss of young lives like Jaslyn, Adam, and Sincere demands rigorous scrutiny, not rhetoric. In this Essay, we focus our analytic attention on three central facts exposed by these tragic examples: First, whether at the hands of fellow residents or the state, violent victimization is highly uneven in its spatial distribution. Some neighborhoods are relatively immune while others suffer compounded forms of violence on a regular basis. Second, spatial inequality is far from random. Neighborhoods

⁹ Christian Farr, *Activists, Family Outraged by Fatal Shooting of Girl, 7, in McDonald's Drive-Thru*, NBC CHI. (Apr. 18, 2021), <https://perma.cc/5U36-3J7P>.

¹⁰ Neil Vigdor, *What to Know About the Police Shooting of Adam Toledo*, N.Y. TIMES (Apr. 16, 2021), <https://perma.cc/8L9M-FKG6>.

¹¹ Don Babwin, *Chicago Ends 2020 with 769 Homicides as Gun Violence Surges*, ABC NEWS (Jan. 1, 2021), <https://perma.cc/4QDE-BNQR>.

¹² Jessica Villagomez & William Lee, *After 3 Children Shot, 2 Fatally, Chicago Violence Continues Sunday Morning with 3 More Homicides*, CHI. TRIB. (June 28, 2020), <https://perma.cc/9NNW-MCZQ>; Rosemary Sobol, Jeremy Gerner & Alice Yin, 'When Is This Going to Stop,' Says Chicago Police Chief After Baby Boy Shot with Mom in Englewood Dies, CHI. TRIB. (June 27, 2020), <https://www.chicagotribune.com/news/breaking/ct-child-shot-20200627-axzdl66q3farlf2g5syd3f4zea-story.html>.

In the same neighborhood of Englewood, four more people were murdered three days later. Paige Fry, Jeremy Gerner & Katherine Rosenberg-Douglas, *Young Mother Killed in Englewood Mass Shooting That Left 4 Dead, 4 Injured: 'She Was Supposed to Graduate Today'*, CHI. TRIB. (June 14, 2021), <https://www.chicagotribune.com/news/breaking/ct-chicago-mass-shooting-englewood-20210615-pw2fpkxatzan5hyii5qbsefwu-story.html>.

with the highest rates of violence, incarceration, and police killings are characterized by racial segregation and the correlated adversities of concentrated poverty. Poor Black neighborhoods in particular experience disproportionately high rates of homicide, exerting both short-term and long-term negative effects on the well-being of their residents.¹³ Third, even during an era of social change and marked fluctuations in violence, neighborhoods tend to maintain their positions of privilege and disadvantage. The Near North Side of Chicago maintains its relative safety advantage, for example, while neighborhoods like Englewood on the South Side and North Lawndale on the West Side continue to stand out in their disproportionate exposure to multiple forms of violence and criminal justice contact. Paradoxically, then, neighborhoods are always changing, but they are remarkably persistent in their relative positions of compounded disadvantage.

Taken together, these facts constitute what has been called the enduring neighborhood effect on violence and well-being.¹⁴ In *Great American City: Chicago and the Enduring Neighborhood Effect*, Professor Robert Sampson examined a range of neighborhood effects across multiple units of geography, outcomes, and time scales with a major focus on violence.¹⁵ In this view, neighborhood effects command a broad scope, from individual perceptions to the higher-order social structure of the city. This Essay extends neighborhood-effects theory in the latter direction, pushing beyond the traditional boundaries of a neighborhood to consider flows of movement throughout Chicago and other large U.S. cities. A basic premise is that a neighborhood's well-being depends not only on its own socioeconomic conditions but also on the conditions of the neighborhoods that its residents visit and

¹³ For an in-depth look at the profound effects of exposure to neighborhood violence, see generally PATRICK T. SHARKEY, *UNEASY PEACE: THE GREAT CRIME DECLINE, THE REVIVAL OF CITY LIFE, AND THE NEXT WAR ON VIOLENCE* (2018). Not only is violence a leading cause of racial differences in life expectancy, but there is also recent evidence that racial disparities in violent victimization in Chicago have increased after years of steady decline; this increase is explained by the rise of violence in Chicago in the late 2010s and 2020. See Patrick T. Sharkey & Alisabeth Marsteller, *Neighborhood Inequality and Violence in Chicago, 1965–2020*, 89 U. CHI. L. REV. 349, 370 (2022) (demonstrating that “[t]he overall increase in murders between 2014 and 2020 has disproportionately affected Black residents” and that, “[i]n 2020, the murder rate in the average Black resident’s neighborhood rose to its highest point in the fifty-six-year period”).

¹⁴ See ROBERT J. SAMPSON, *GREAT AMERICAN CITY: CHICAGO AND THE ENDURING NEIGHBORHOOD EFFECT* 362–63 (2012).

¹⁵ *Id.* at 22–24, 407–09.

are visited by—connections that form through networks of everyday urban mobility. The importance of mobility for a neighborhood's vitality and ability to regulate crime has a rich intellectual history; from Jane Jacobs's notions about "eyes [on] the street"¹⁶ to routine-activities theory's conceptualization of motivated offenders, suitable targets, and capable guardians,¹⁷ scholars have long thought that the flow of people in a place matters.

Based on this framework, we highlight three sets of empirical results from research on networks of movement throughout the fifty largest U.S. cities, with a focus on how Chicago fares relative to other cities. The first result is that even though residents of disadvantaged neighborhoods may travel far and wide, their relative isolation by race and class persists. So too does the isolation of the affluent. Second, a city's degree of social connectedness depends on how uneven and concentrated the networks of everyday mobility are among its neighborhoods, which in turn predicts rates of violence across cities. Notably, Chicago's level of racially segregated mobility is one of the highest in the country. Third, building on ideas about connection or isolation among a city's neighborhoods, we find that socioeconomic disadvantage in a neighborhood's mobility network helps explain its rates of violence beyond residential disadvantage. This includes the prediction of violence in Chicago neighborhoods in the last decade, which has seen spikes in murder rates. Our results offer a new way of thinking about enduring neighborhood effects on violence, contact with institutions of criminal legal processing, collective efficacy and prospects for criminal justice reform, and racial inequality.

I. NEIGHBORHOOD AND BEYOND

Inspired in large part by the classic Chicago tradition of urban sociology, the study of variations in crime rates across neighborhoods and cities has a long history. One of the mainstays of inquiry is how the socioeconomic conditions of neighborhoods and cities predict crime rates. Concentrated poverty and racial isolation, especially when concurrent, are strong predictors—and arguably causes—of violence.¹⁸ But neighborhoods do not

¹⁶ JANE JACOBS, *THE DEATH AND LIFE OF GREAT AMERICAN CITIES* 35–38 (1961).

¹⁷ Lawrence E. Cohen & Marcus Felson, *Social Change and Crime Rate Trends: A Routine Activity Approach*, 44 AM. SOCIO. REV. 588, 589 (1979).

¹⁸ See Matthew R. Lee, *Concentrated Poverty, Race, and Homicide*, 41 SOCIO. Q. 189, 202 (2000); Ruth D. Peterson & Lauren J. Krivo, *Racial Segregation and Black Urban*

exist in social or physical isolation, in large part because of strong patterns of residential spatial segregation in the United States.¹⁹ The result is that neighborhoods are often surrounded by other neighborhoods that are socioeconomically similar.²⁰ These extralocal but proximate spatial processes matter—the socioeconomic conditions of nearby neighborhoods are important predictors of violence in a given neighborhood.²¹

Although spatial interdependence has been well studied and methods have been adapted to deal with its presence, a “higher-order” network perspective looks at the connections among neighborhoods originating from individual mobility across the metropolis. Cross-neighborhood ties are distinct from both internal neighborhood processes and spatial processes induced by proximity to adjacent or nearby neighborhoods.²² In *Great American City*, this theoretical view was advanced by examining how individual-level actions created network structures in Chicago through interneighborhood residential mobility and citywide ties among organizational leaders.²³ The idea was that moving from one neighborhood to another creates a tie, as does one leader consulting with another leader in a different community to address a problem, even a problem that is local in nature.²⁴ A city can be further defined by the extent to which its neighborhoods are structurally tied together through the many connections that these actions forge. In this way, the individual, neighborhood, and city levels are united analytically through neighborhood networks.²⁵

Homicide, 71 SOC. FORCES 1001, 1020 (1993); DOUGLAS S. MASSEY & NANCY A. DENTON, *AMERICAN APARTHEID* 15, 150–52 (1993).

¹⁹ See MASSEY & DENTON, *supra* note 18, at 74–77 (describing “hypersegregation” of urban African Americans as characterized—in part—by residential “clustering” of multiple adjacent Black communities).

²⁰ *Id.*

²¹ See RUTH D. PETERSON & LAUREN J. KRIVO, *DIVERGENT SOCIAL WORLDS: NEIGHBORHOOD CRIME AND THE RACIAL-SPATIAL DIVIDE* 102–04 (2010).

²² See Corina Graif, Alina Lungeanu & Alyssa M. Yetter, *Neighborhood Isolation in Chicago: Violent Crime Effects on Structural Isolation and Homophily in Interneighborhood Commuting Networks*, 51 SOC. NETWORKS 40, 40–41 (2017) (examining the impact of violence on interneighborhood connectivity networks); Andrew V. Papachristos & Sara Bastomski, *Connected in Crime: The Enduring Effect of Neighborhood Networks on the Spatial Patterning of Violence*, 124 AM. J. SOCIO. 517, 519–20 (2018) (examining violence diffusion and how cross-neighborhood ties are created by the movement of criminally engaged individuals).

²³ SAMPSON, *supra* note 14, at 311–13, 329–31.

²⁴ *Id.*

²⁵ *Id.* at 309–10; Papachristos & Bastomski, *supra* note 22, at 519–20.

We can expand this idea further by thinking about everyday mobility. People shop, visit friends, go to school, commute to work, and go out to eat in many different places. There is an emerging body of research taking an “everyday-mobility-based” perspective on urban inequality that shows how neighborhoods matter well beyond the boundaries of where one lives.²⁶ A study based on travel accounts from a sample of about three thousand Los Angeles residents found that “social isolation is experienced by residents of both highly disadvantaged and highly advantaged neighborhoods because the two groups spend time in largely nonoverlapping parts of the city”; moreover, racial segregation exacerbates these patterns of social isolation.²⁷ In this paper, we analyze large-scale social-media data and cell phone records to estimate the everyday movement of residents throughout Chicago. Before addressing implications for crime and violence, the focus of this Essay, it is important to first understand patterns of individual urban mobility and neighborhood isolation.²⁸

II. URBAN MOBILITY AND NEIGHBORHOOD ISOLATION BY RACE AND CLASS

Living in disadvantaged neighborhoods is widely assumed to undermine life chances because residents are isolated from middle-class or “mainstream” neighborhoods with greater resources, job possibilities, and other opportunities.²⁹ Many theories of crime thus hypothesize that concentrated poverty and social isolation lead to higher crime rates.³⁰ Yet people do not just live

²⁶ Robert J. Sampson & Brian L. Levy, *Beyond Residential Segregation: Mobility-Based Connectedness and Rates of Violence in Large Cities*, 12 RACE & SOC. PROBS. 77, 77–78 (2020) (reviewing the state of research on the link between violence, disadvantage, and “mobility-based connectedness”).

²⁷ Lauren J. Krivo, Heather M. Washington, Ruth D. Peterson, Christopher R. Browning, Catherine A. Calder & Mei-Po Kwan, *Social Isolation of Disadvantage and Advantage: The Reproduction of Inequality in Urban Space*, 92 SOC. FORCES 141, 141 (2013).

²⁸ We sketch an overview of major findings and refer readers to the original research papers that we draw on for further details, including the measurement of key concepts, analytic methods, and detailed results. For an independent review on urban mobility and crime that is comprehensive in nature, see generally Christopher R. Browning, Nicolo P. Pinchak & Catherine A. Calder, *Human Mobility and Crime: Theoretical Approaches and Novel Data Collection Strategies*, 4 ANN. REV. CRIMINOLOGY 99 (2021).

²⁹ Cf. WILLIAM JULIUS WILSON, THE TRULY DISADVANTAGED: THE INNER CITY, THE UNDERCLASS, AND PUBLIC POLICY 7–8 (1987).

³⁰ Lee, *supra* note 18, at 202.

in their neighborhoods. Common experience and research from travel diaries verify that over the course of a typical day or week, people often leave their neighborhoods of residence and travel throughout the city.³¹ Despite this fact, research that tests the role of concentrated poverty and social isolation from this “extralocal,” or neighborhood-networks, perspective is relatively sparse.³²

To provide a revised conceptualization and test of neighborhood isolation that improves on static measures from census data on home neighborhoods and small-sample studies based on time diaries, Qi Wang, Nolan Phillips, Mario Small, and Robert Sampson leveraged fine-grained dynamic data on the everyday movement of residents from over 650 million geocoded tweets.³³ They used machine-learning techniques on these large-scale data to estimate the home locations of almost four hundred thousand residents of the fifty largest U.S. cities; in turn, they estimated their travel to neighborhoods throughout a city’s entire commuting zone over the course of eighteen months.³⁴ This strategy expands the argument from *Great American City* by directly estimating interneighborhood contact based on everyday travel patterns rather than residential moves to new neighborhoods, which are much rarer.³⁵

A key finding by Wang and colleagues was the “surprisingly high consistency” in patterns of travel from residents of neighborhoods of different race and income characteristics in terms of their average travel distance and number of unique neighbor-

³¹ See Christopher R. Browning, Catherine A. Calder, Brian Soller, Aubrey L. Jackson & Jonathan Dirlam, *Ecological Networks and Neighborhood Social Organization*, 122 AM. J. SOCIO. 1939, 1942–44 (2017); Christopher R. Browning & Brian Soller, *Moving Beyond Neighborhood: Activity Spaces and Ecological Networks as Contexts for Youth Development*, 16 CITYSCAPE 165, 169–70 (2014).

³² For some of the limited work on this subject, see generally Brian L. Levy, Nolan E. Phillips & Robert J. Sampson, *Triple Disadvantage: Neighborhood Networks of Everyday Urban Mobility and Violence in U.S. Cities*, 85 AM. SOCIO. REV. 925 (2020) (exploring the relationship between traditional correlates of neighborhood disadvantage and patterns of interneighborhood movement); Qi Wang, Nolan Edward Phillips, Mario L. Small & Robert J. Sampson, *Urban Mobility and Neighborhood Isolation in America’s 50 Largest Cities*, 115 PROC. NAT’L ACAD. SCI. 7735 (2018) (evaluating social isolation and segregation in light of complex interneighborhood movement patterns); and Nolan E. Phillips, Brian L. Levy, Robert J. Sampson, Mario L. Small & Ryan Q. Wang, *The Social Integration of American Cities: Network Measures of Connectedness Based on Everyday Mobility Across Neighborhoods*, 50 SOCIO. METHODS & RSCH. 1110 (2019) (evaluating neighborhoods’ degrees of structural connectedness in light of their residents’ contacts).

³³ Wang et al., *supra* note 32, at 7736.

³⁴ *Id.* at 7735–36.

³⁵ *Id.*

hoods visited in the metropolitan region.³⁶ This similarity seems to contradict the logic of Professor William Wilson's social-isolation thesis and the corresponding hypothesis of the constraining effects of concentrated poverty.³⁷ Despite relative parity in the breadth of travel, however, there are notable differences in the race and class compositions of the neighborhoods visited.³⁸ Residents of poor neighborhoods are substantially isolated from contacts with nonpoor neighborhoods when they travel.³⁹ Residents of primarily Black and Hispanic neighborhoods—whether poor or not—are also far less exposed to nonpoor neighborhoods than are residents of primarily White neighborhoods.⁴⁰ This result means that race trumps economic status in shaping the mobility patterns of exposure to nonpoor White neighborhoods that often command disparate resources, even though there are minimal (if any) differences in distance traveled and number of neighborhoods visited by race. Put differently, racial inequality may be even more pronounced than we realize once we account for travel patterns.

Focusing on Chicago specifically, we reexamine Wang and colleagues' measure of racial and economic neighborhood isolation—the proportion of a neighborhood's visits that are to nonpoor, White neighborhoods. Figure 1 reveals stark disparities by neighborhood racial composition. Over two-thirds of visits that residents of nonpoor White neighborhoods in Chicago make are to other nonpoor White neighborhoods. For poor White neighborhoods, over six out of every ten resident visits are to nonpoor White neighborhoods. Among Black neighborhoods, by contrast, only 8%–10% of visits are to nonpoor White neighborhoods—regardless of poverty status. The share is somewhat higher among Hispanic neighborhoods; again, however, there is little variation by poverty status. These differences in the likelihoods of Chicagoans visiting nonpoor White neighborhoods by neighborhood racial status, regardless of economic status, outpace even the sizable differences observed in the fifty largest U.S. cities.⁴¹ In

³⁶ *Id.* at 7735, 7739–40 (“Residents of poor minority neighborhoods . . . appear to travel about as widely across their cities and to as many neighborhoods as those of other groups.”).

³⁷ See Wilson, *supra* note 29, at 58–61.

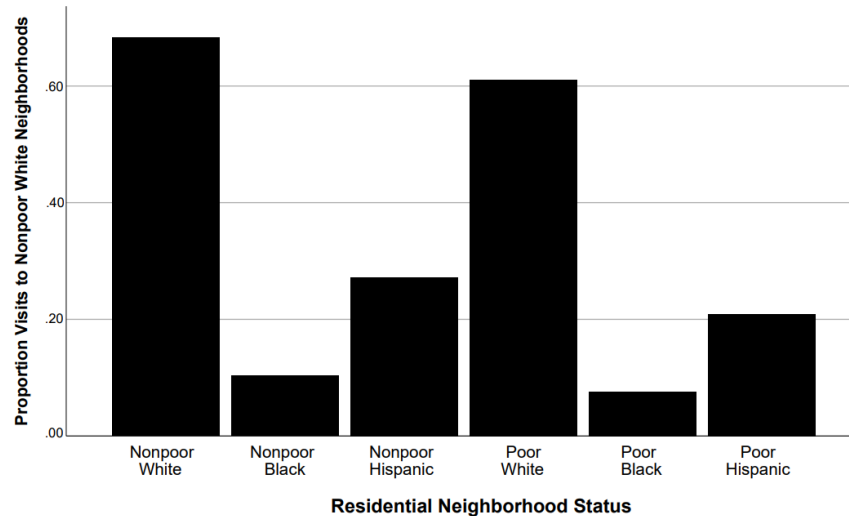
³⁸ Wang et al., *supra* note 32, at 7739–40.

³⁹ *Id.* at 7740.

⁴⁰ *Id.*

⁴¹ See *id.* at 7739.

other words, Chicago appears to be more segregated in mobility by neighborhood race than other major U.S. cities.



III. CITY-LEVEL CONNECTEDNESS THROUGH EVERYDAY MOBILITY

Our neighborhood-networks approach also sheds light on the connectedness of cities, which in turn has theoretical consequences for their crime rates. Drawing on the same underlying data used in the previous studies, Phillips, Brian Levy, Sampson, Small, and Wang conceptualized a city's connectedness (social integration) as the extent to which its neighborhoods are tied to one another by the movement of their residents.⁴² They then developed two formal measures of these concepts. The equitable-mobility index (EMI) reflects the extent to which residents of each neighborhood in a city travel equally to all other neighborhoods in that city.⁴³ The concentrated-mobility index (CMI) represents the extent to which residents' travels outside their residential neighborhoods are concentrated in a small handful of destination neighborhoods.⁴⁴ For example, if every resident in Chicago visited only Grant Park when leaving their

⁴² See Phillips et al., *supra* note 32, at 1111–12.

⁴³ See *id.* at 1112.

⁴⁴ See *id.*

neighborhoods, then concentrated mobility would be at its peak while equitable mobility would be at its nadir.

The measures actually reveal distinct pathways through which a city's neighborhoods can be well connected. All visits could concentrate in a similar cluster of neighborhoods with widely shared public spaces like parks, downtown areas, or other such places (i.e., "hub" connectedness). Alternatively, when equitable mobility is high, each neighborhood's residents are visiting many others with great regularity. By comparison, the potential for connectedness is limited when both equitable mobility and concentrated mobility are low. Phillips and colleagues observe this disconnected pattern in cities like Detroit, Philadelphia, Baltimore, and Cleveland, which have cleaved interneighborhood mobility networks.⁴⁵

We extended this approach to examine whether these two measures of mobility-based (dis)connectedness are related to violence beyond the expected effects of traditionally measured segregation based on residence.⁴⁶ Theoretically, "social integration depends on opportunities for contact, no matter how fleeting."⁴⁷ Opportunities for contact do not guarantee contact, but the absence of opportunities—as indicated by isolated mobility networks—"will undermine an essential precursor of macrosocial integration, in this case of a city."⁴⁸ In addition,

spatial divisions in everyday contact are likely to reduce the identification or concern that residents in any given neighborhood have for the other neighborhoods of a city, which can translate into reluctance to support investment in public goods such as housing, schools, transportation, and substance-abuse treatment, eroding systems of social control that prevent violence.⁴⁹

Again, studying the fifty largest U.S. cities, we found that cities with low equitable mobility and low concentrated mobility—cities with disconnected neighborhoods—tend to have higher

⁴⁵ See *id.* at 1128, 1132 (illustrating that Detroit, Philadelphia, Baltimore, and Cleveland have both low EMI and CMI values, and explaining that "low CMI and EMI values indicate that the mobility network is cleaved, such that residents of the city neither travel to the same neighborhoods en masse nor do they travel to many of the neighborhoods in the city overall").

⁴⁶ See Sampson & Levy, *supra* note 26, at 79–81.

⁴⁷ *Id.* at 78; see also Phillips et al., *supra* note 32, at 1112, 1115.

⁴⁸ Sampson & Levy, *supra* note 26, at 78.

⁴⁹ *Id.*

rates of homicide.⁵⁰ This pattern holds even after controlling for traditional residential-segregation measures and other salient characteristics.⁵¹ In other words, mobility-based connections seem to matter for predicting violence.

It turns out that Chicago has a low level of equitable mobility, but its concentrated mobility is essentially at the average of the fifty cities.⁵² Yet Chicago has a high rate of homicide and violence.⁵³ In another analysis, Professor Jennifer Candipan and colleagues went further to propose a dynamic measure of mobility-based *racial* segregation—the segregated-mobility index—that captures the degree to which neighborhoods of given racial compositions are connected to neighborhoods with different racial compositions in equal measure.⁵⁴ They found that

segregated mobility captures a distinct element of racial segregation, one that it is related to, but not solely a function of, residential segregation. A city's racial composition also matters; minority group threat, especially in cities with large Black populations and a troubled legacy of racial conflict, appears to depress movement across neighbourhoods in ways that produce previously undocumented forms of racial segregation.⁵⁵

Among the fifty largest U.S. cities, Chicago has one of the highest rates of racially segregated mobility.⁵⁶ This finding suggests that although there are locations of concentrated mobility in Chicago, these mobility hubs remain highly racially segregated, which may have implications for integration, shared concern, and the mechanisms for violence highlighted above.

⁵⁰ *Id.* at 81–83.

⁵¹ *Id.*

⁵² See Phillips et al., *supra* note 32, at 1128 fig.3.

⁵³ See OFF. OF THE SUPERINTENDENT, CHI. POLICE DEP'T, 2020 ANNUAL REPORT 39–40 (2021); Sophie Sherry, *Chicago Has Already Seen More Murders and Shootings This Year Than All of 2019. Violence up in Most Neighborhoods Targeted by City*, CHI. SUN-TIMES (Sept. 7, 2021), <https://perma.cc/VE82-GK23>.

⁵⁴ Jennifer Candipan, Nolan Edward Phillips, Robert J. Sampson & Mario Small, *From Residence to Movement: The Nature of Racial Segregation in Everyday Urban Mobility*, 58 URB. STUD. 3095, 3097–99 (2021).

⁵⁵ *Id.* at 3095; see also *id.* at 3113–14.

⁵⁶ See *id.* at 3111–12.

IV. NEIGHBORHOOD NETWORKS, TRIPLE DISADVANTAGE, AND CRIME

Homing in on the neighborhood level, patterns of connectedness and isolation in a city also have potential implications for the capacities of and resources available to specific neighborhoods. Although neighborhoods spatially surrounded by economically disadvantaged neighborhoods exhibit higher rates of violence,⁵⁷ residents often travel far and wide beyond their residential and proximal neighborhoods in the metropolis.⁵⁸ How might these broader and more comprehensive interneighborhood connections impact crime? Levy, Phillips, and Sampson examined how these socioeconomic patterns of urban-mobility flows carry consequences for neighborhood violence.⁵⁹ For a given neighborhood, they estimated the extent to which its residents tend to visit disadvantaged neighborhoods in the city (outdegree disadvantage) as well as the extent to which its visits come from residents of disadvantaged neighborhoods (indegree disadvantage).⁶⁰ Combining these two mobility-based measures of a neighborhood's disadvantage level with the traditional measure, which is a static calculation of its residents' socioeconomic characteristics, Levy and colleagues theorized the concept of "triple neighborhood disadvantage."⁶¹ Of course, the absence of disadvantage is itself a form of advantage; analogously, a neighborhood can also be triply advantaged. Although the authors find fairly strong correlations between the three metrics, they are not duplicative, and there are many cases where the three scores diverge.⁶²

There are several theoretical reasons to focus on the added value of triple disadvantage in explaining rates of neighborhood

⁵⁷ See PETERSON & KRIVO, *supra* note 21, at 102–04.

⁵⁸ See Wang et al., *supra* note 32, at 7739–40 (concluding that "[r]esidents of poor minority neighborhoods . . . travel about as widely across their cities and to as many neighborhoods as those of other groups").

⁵⁹ Levy et al., *supra* note 32, at 928–30.

⁶⁰ "Outdegree" and "indegree" are network-science terms and reflect the underlying calculation of the metrics as weighted averages of disadvantage scores based on the frequency of visits between neighborhoods. See *id.* at 926–27.

⁶¹ *Id.* at 926 ("Most neighborhood effects research considers a neighborhood to be socioeconomically disadvantaged if it scores highly only on one measured trait . . . commonly indexed by measures like residential poverty, unemployment, and public assistance receipt.").

⁶² See *id.* at 935 (finding that the "measures of neighborhood disadvantage are highly correlated in neighborhoods across the 50 cities" but that, "[d]espite these measures being highly correlated, the variables are not deterministic" and that, "[a]cross cities, there is considerable heterogeneity in these correlations").

violence. Triple disadvantage increases the likelihood of interactions occurring with or among nonresidents or strangers of similarly deprived status from other neighborhoods, which arguably increases the potential for conflictual interactions, hence increasing the kinds of interpersonal disputes that trigger violence.⁶³ The ability of a neighborhood to achieve regulatory control also extends beyond these kinds of disputes and even its own institutions, including its ability to marshal crime-prevention resources from municipal and state governments. For example, research identifies that segregation creates a spatial divide that reduces public investment in and erodes the local regulatory capacity of poor Black communities.⁶⁴ Mobility-based segregation is likely to exacerbate this spatial divide. Levy, Phillips, and Sampson also hypothesized that triple-neighborhood disadvantage plays an important role in a neighborhood's ability to maintain social control, develop collective efficacy, and access crime-reducing resources.⁶⁵ More specifically, "[t]he structural connection of a triply (dis)advantaged neighborhood to other similarly situated neighborhoods would amplify its (lack of) resources for successful crime control."⁶⁶

Analyzing nearly 32,000 neighborhoods and 9,700 homicides in thirty-seven of the largest U.S. cities, Levy, Phillips, and Sampson find that "triple disadvantage independently predicts homicides, adjusting for traditional neighborhood correlates of violence, spatial proximity to disadvantage, prior homicides, and city fixed effects. Not only is triple disadvantage a stronger predictor than traditional measures, it accounts for a sizable portion of the association between residential neighborhood disadvantage and homicides."⁶⁷ For example, mobility-based disadvantage can account for roughly one-fifth of the relationship between residential disadvantage and homicide.⁶⁸ Moreover, including the three measures of triple disadvantage improves the explanatory power of a model of neighborhood homicide counts by almost a third as compared to a model including only residential disadvantage with

⁶³ See *id.* at 930 (explaining how "interpersonal friction" between similarly violence-prone adolescents is highest in triply disadvantaged neighborhoods).

⁶⁴ Michael T. Light & Julia T. Thomas, *Segregation and Violence Reconsidered: Do Whites Benefit from Residential Segregation?*, 84 AM. SOCIO. REV. 690, 695 (2019); MASSEY & DENTON, *supra* note 18, at 106–08.

⁶⁵ Levy et al., *supra* note 32, at 930–33.

⁶⁶ *Id.* at 927.

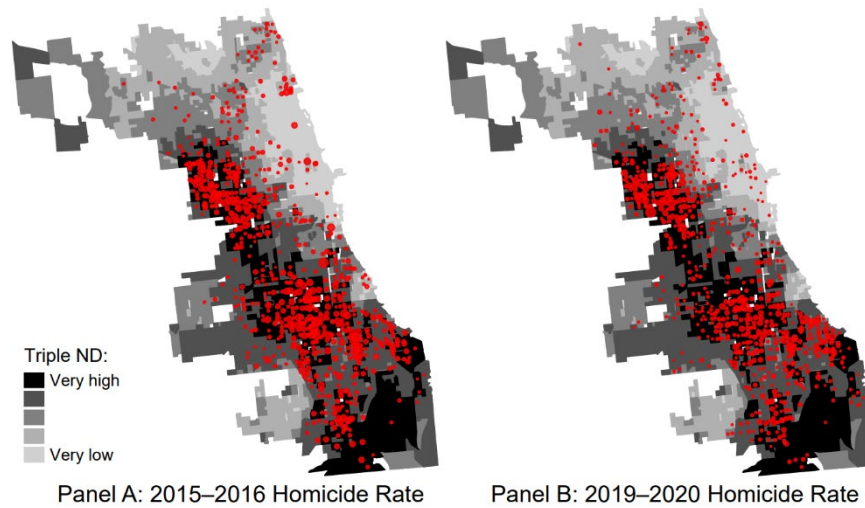
⁶⁷ *Id.* at 925; see also *id.* at 937–38, 949.

⁶⁸ *Id.* at 949.

controls.⁶⁹ For homicides, indegree disadvantage—or the influx of visitors from other poor neighborhoods—is more salient than outdegree disadvantage.⁷⁰ In terms of specific mechanisms, neighborhood drug activity, interpersonal friction, and gun prevalence can explain sizable portions of the association between triple disadvantage and homicides.⁷¹

V. TRIPLE DISADVANTAGE AND VIOLENCE IN CHICAGO

What do patterns of triple disadvantage look like in Chicago, and does the added explanatory power that we observe across large U.S. cities hold there? Briefly, there are large disparities in triple disadvantage among Chicago neighborhoods, and triple disadvantage improves our understanding of Chicago violence and homicide. Figure 2 presents two maps of triple disadvantage and homicide in Chicago.



For a base layer, both use the 2014 measure of triple disadvantage calculated by Levy and colleagues.⁷² This ranges from light shading (indicating a very low triple-disadvantage score for a neighborhood—in essence an advantaged neighborhood given

⁶⁹ *Id.*

⁷⁰ Levy et al., *supra* note 32, at 949.

⁷¹ *Id.* at 944–47.

⁷² *Id.* at 936.

the absence of triple disadvantage) to dark shading (indicating a very high triple-disadvantage neighborhood).

Panel A presents the 2015–2016 neighborhood homicide rate as red circles with size scaled to indicate a higher rate. This period includes the near doubling of Chicago homicides in 2016, just over a year after the murder of Laquan McDonald. Immediately apparent is the strong concentration of homicides in neighborhoods with very high levels of triple disadvantage in Chicago’s South and West Sides. Panel B presents the 2019–2020 homicide rate, which again includes a period of surging violence in 2020—this time a more than 50% increase in homicides during the first year of the COVID-19 pandemic.⁷³ This map demonstrates the stable spatial concentration of homicides over time and the predictive power of triple disadvantage for homicide distribution a half-decade later.

One reason for triple disadvantage’s lasting predictive power for violence is the stability of triple disadvantage over time. For all neighborhoods in the fifty largest U.S. cities, Figure 3 plots their triple-disadvantage scores from 2014 (based on Twitter data), which are used here and in prior analyses,⁷⁴ against newly calculated scores for their triple-disadvantage levels in 2019 using data on mobility from tens of millions of mobile phones. Specifically, the figure plots the correlation in a neighborhood’s 2014 and 2019 measures of indegree neighborhood disadvantage (Indegree ND) in Panel A, outdegree neighborhood disadvantage (Outdegree ND) in Panel B, and the composite triple disadvantage measure in Panel C. As is immediately clear from the Figure, all three variables have very strong stability over time at the neighborhood level.⁷⁵ Remarkably, in Chicago, the correlation in a neighborhood’s triple disadvantage level between 2014 and 2019 is even higher than the level for all fifty large cities. We observe this stability in Chicago and nationwide despite a five-year gap in time—during which gentrification was ongoing in Chicago⁷⁶ as in many large cities—and different methods of

⁷³ OFF. OF THE SUPERINTENDENT, CHI. POLICE DEPT., *supra* note 53, at 40, 44.

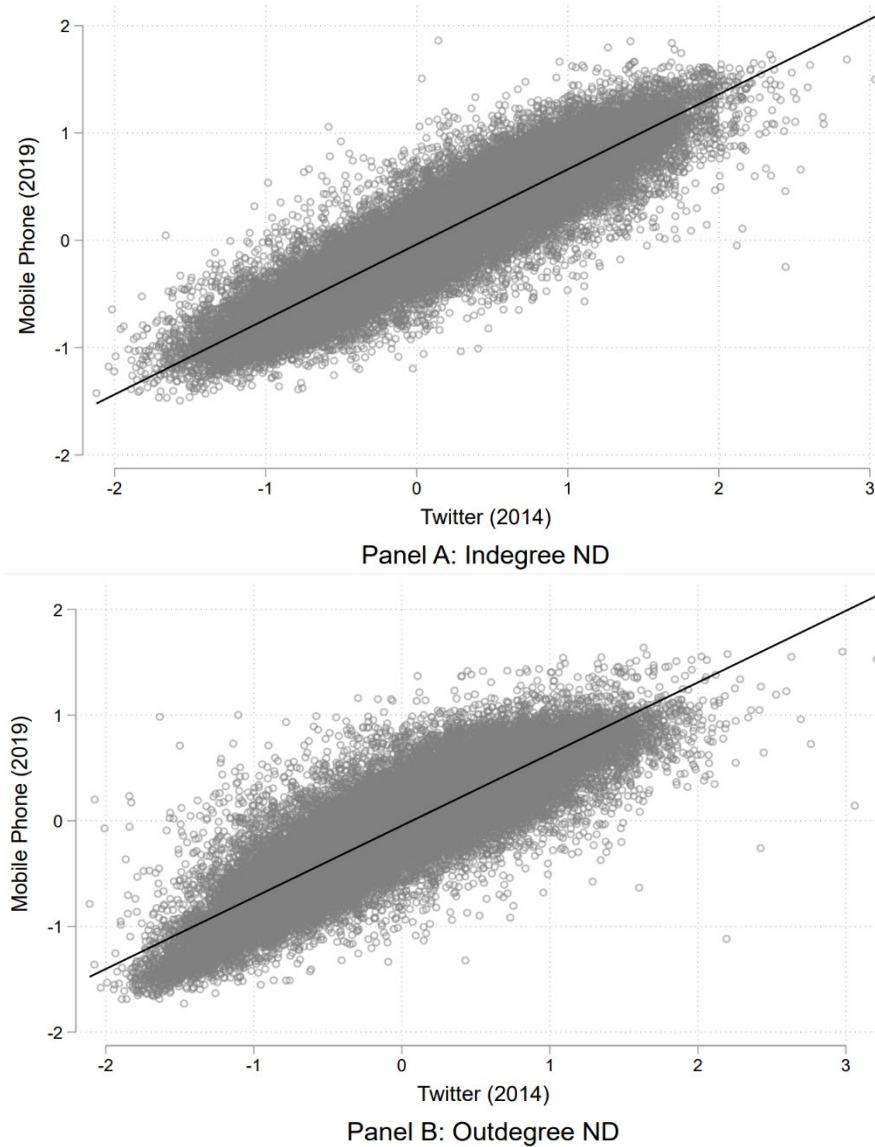
⁷⁴ See generally, e.g., Wang et al., *supra* note 32.

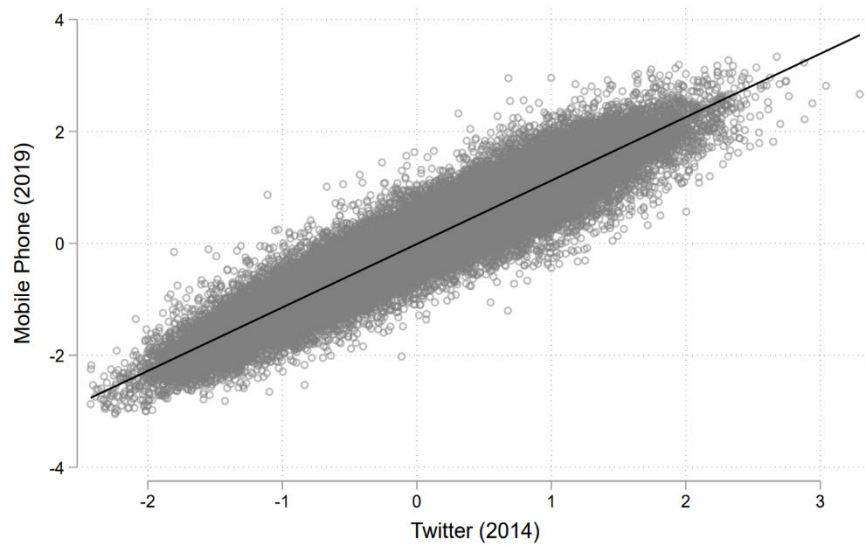
⁷⁵ Specifically, we calculate Pearson correlation coefficients for all three panels. For the fifty largest U.S. cities, the correlations between a neighborhood’s 2014 and 2019 values of indegree, outdegree, and triple disadvantage measures are 0.91, 0.87, and 0.94, respectively. In Chicago, these three correlations are 0.93, 0.88, and 0.96, respectively.

⁷⁶ See Jackelyn Hwang & Robert J. Sampson, *Divergent Pathways of Gentrification: Racial Inequality and the Social Order of Renewal in Chicago Neighborhoods*, 79 AM. SOCIO. REV. 726, 745–46 (2014).

data collection on everyday mobility (geocoded tweets versus mobile-phone-location pings). In addition to revealing why triple disadvantage can predict homicide several years later, this strong correlation between measures using distinct data on urban mobility also improves our confidence in their validity.

FIGURE 3: INDEGREE, OUTDEGREE, AND TRIPLE DISADVANTAGE



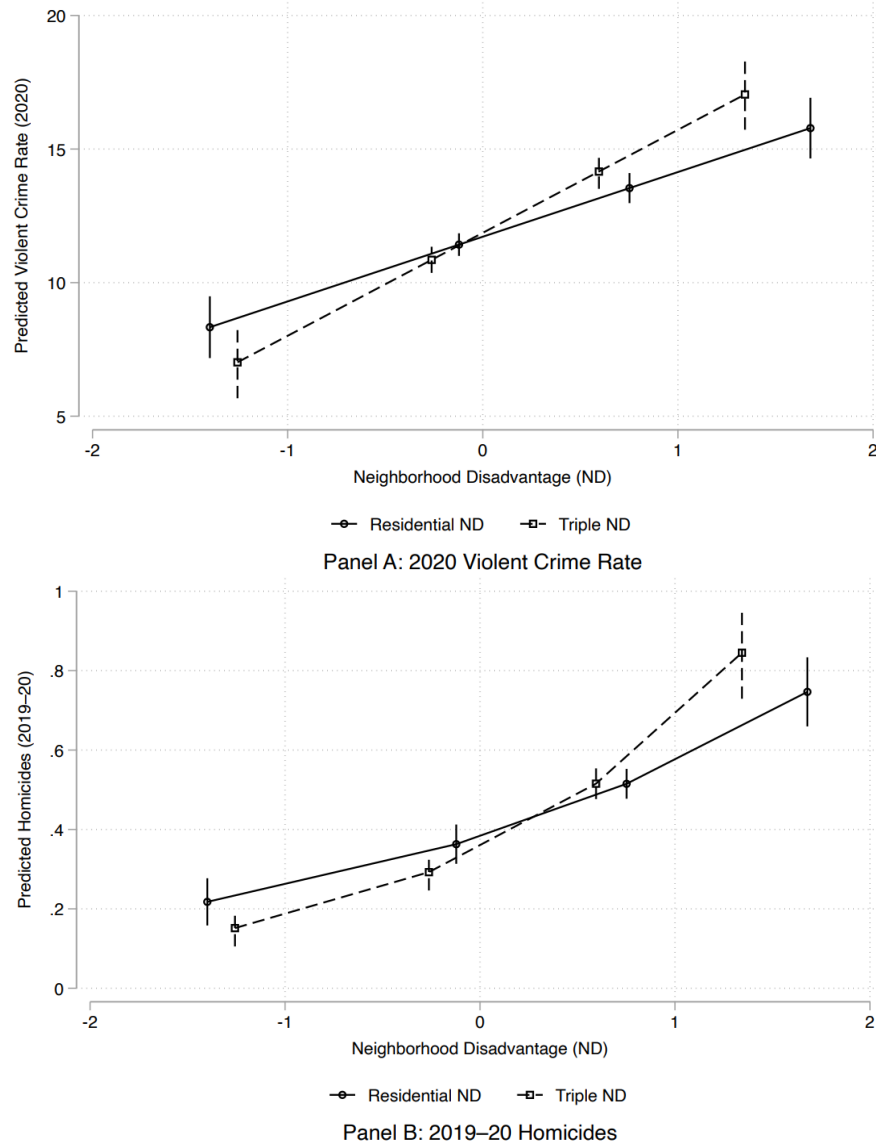


Panel C: Triple ND

The maps of Chicago in Figure 2 indicate a relationship between triple disadvantage and homicide, but they do not adjust for other factors that might explain the relationship—in other words, other independent causes that could drive both triple disadvantage and homicide levels. Levy and colleagues used regression analysis to demonstrate the added predictive power of 2014 triple disadvantage for 2015–2016 homicide rates in neighborhoods of thirty-seven large cities.⁷⁷ In Figure 4, we pool two years of homicide data to analyze whether the 2014 triple-disadvantage levels of Chicago neighborhoods can explain both their rates of violent crime in 2020 and the incidence of homicides in 2019–2020. Again, this period reflects the rash of violence seen from the summer through the winter of 2020. Figure 4 presents the results of these analyses.

⁷⁷ Levy et al., *supra* note 32, at 941–42.

FIGURE 4: NEIGHBORHOOD DISADVANTAGE AND VIOLENT CRIME



Panel A plots a neighborhood's predicted 2020 violent-crime rate based on separate models using residential disadvantage (the solid line) or triple disadvantage (the dashed line). Both models control for other relevant variables.⁷⁸ The figure makes

⁷⁸ Models are estimated using ordinary least squares (OLS) regression and robust errors. Controls include neighborhood-level measures of log population size, log population

clear that, in Chicago, neighborhood-level disparities in violent-crime rates are more pronounced by triple disadvantage than by residential-neighborhood disadvantage alone. Adjusting for controls, a neighborhood at the low end of residential disadvantage in Chicago is expected to have a violent crime rate of roughly 8.33 violent crimes per 1,000 residents. A neighborhood at the high end of residential disadvantage, by contrast, has a predicted rate of about 15.78 violent crimes per 1,000 residents—a gap of 7.45 violent crimes in 2020. Looking at triple disadvantage, however, neighborhoods at the low and high ends have predicted violent crime rates of 7.02 and 17.04 crimes per 1,000 residents, or a gap of roughly 10 violent crimes. Thus, the “low-high disadvantage gap” by triple disadvantage is 35% larger than that by residential disadvantage.

Panel B plots a neighborhood’s predicted homicide count in 2019–2020 based on separate models⁷⁹ using residential disadvantage or triple disadvantage. Again, we see larger disparities by triple disadvantage than by residential disadvantage. Given the relatively rare nature of homicide, predicted homicide counts per neighborhood are less than one across the values of neighborhood disadvantage. This pattern aligns with the data: fewer than one-third of Chicago neighborhoods experienced a homicide in 2019 or 2020.⁸⁰ Still, there are disparities by neighborhood disadvantage. Chicago neighborhoods with the highest levels of residential disadvantage tend to have three to four times the number of homicides as Chicago neighborhoods with the lowest levels of residential disadvantage. By contrast, neighborhoods at the high end of triple disadvantage have five to six times the number of homicides as neighborhoods at the low end of triple disadvantage. Moreover, the low-high disadvantage gap in predicted homicides by triple disadvantage is 31% larger than that by residential disadvantage. In sum, although homicide is rare, we observe important disparities by neighborhood socioeconomic conditions, and these disparities tend to be larger by triple disadvantage.

density, median resident age, share of residents that are males between ages fifteen and thirty-four, share of homes occupied by owners, residential stability (share of long-term householders), and measures of racial composition (shares Black and Hispanic).

⁷⁹ These models are similar to the models of violence in terms of variables. The two differences are that these homicide models use Poisson regression with robust errors and treat log population as an offset variable.

⁸⁰ OFF. OF THE SUPERINTENDENT, CHI. POLICE DEP’T, *supra* note 53, at 44.

Our results are not without limitations. Perhaps most importantly, they are not based on a causal analysis, although we include theoretically important covariates measured with precision. Levy and colleagues go further in their analysis of homicides across thirty-seven cities not only by adjusting for the same controls but also by controlling for city-level fixed effects and lagged homicide counts.⁸¹ We found there—and find here—a substantive and statistically significant relationship between triple-neighborhood disadvantage and homicides. Here, we also identify a direct relationship of triple disadvantage with overall rates of violence after adjusting for other major correlates, which is an outcome not analyzed by Levy and colleagues. Future research, perhaps using natural experiments that change the nature of interneighborhood mobility, might provide a stronger causal design. Future research could also draw on novel data sources that can potentially overcome limitations associated with social-media data, such as cellphone records that capture movement based on GPS data, which we have begun to use here.

VI. DISCUSSION AND CONCLUSION

In this Essay, we advanced an approach to understanding variation in violence and crime among neighborhoods and cities based on the concept of everyday urban mobility. Consistent with our major premise, mobility-based socioeconomic disadvantage predicts rates of violence in Chicago's neighborhoods beyond their residence-based disadvantage and other local characteristics, including during recent years that witnessed surges in violence and other broad social changes. It is perhaps surprising how much explanatory power resides in compounded disadvantage, or what we defined as "triple disadvantage," in explaining rates of homicide and violence across Chicago. By highlighting the independent value of mobility-based disadvantage in explaining neighborhood disparities in violence, our research provides fresh evidence and a new theoretical framework on the importance of extralocal conditions for understanding spatial inequality in Chicago.

Racial disparities in triple disadvantage are pronounced and seemingly at odds with recent declines in racial segregation

⁸¹ Levy et al., *supra* note 32, at 927.

and the increasing diversity of U.S. cities.⁸² A previously unrecognized form of racially inscribed isolation is occurring whereby residents of disadvantaged neighborhoods travel well beyond their home residence, and yet their relative isolation or segregation by race and class persists within the wider metropolis. This finding implies that social isolation by race and class in everyday life operates at a higher-order level than typically appreciated or systematically measured by urban scholars. In fact, among the fifty largest U.S. cities,

mostly black and mostly Hispanic neighborhoods are 31 and 41 times as likely as mostly white neighborhoods to have [residential disadvantage] scores at least one standard deviation above the national mean. Yet, mostly black and Hispanic neighborhoods are 77 and 84 times as likely as mostly white neighborhoods to have [triple disadvantage] scores at least one standard deviation above the mean.⁸³

This pattern suggests that indicators focused solely on resident-based disadvantage obscure the magnitude of racial inequality in neighborhood socioeconomic conditions.⁸⁴

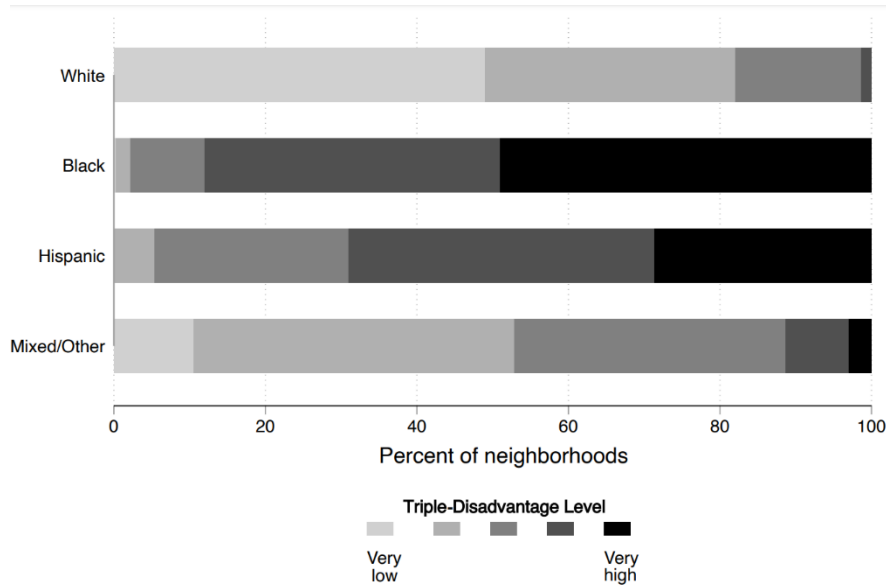
In Chicago, racial inequality in triple disadvantage exists in full force as well. Figure 5 presents the distribution of neighborhoods by majority racial status in a way that the magnitude of differentials in triple disadvantage can be easily visualized. A stark split between neighborhoods is apparent. Approximately half of White neighborhoods are very low in triple disadvantage. The polar opposite is true for Black neighborhoods, with approximately half being very high in triple disadvantage. Hispanic neighborhoods are more disadvantaged than White neighborhoods, but Hispanic neighborhoods are more evenly distributed across disadvantaged types than Black neighborhoods. Other neighborhoods look more like White neighborhoods than like Black or Hispanic neighborhoods.

⁸² See Glenn Firebaugh & Chad R. Farrell, *Still Large, but Narrowing: The Sizable Decline in Racial Neighborhood Inequality in Metropolitan America, 1980–2010*, 53 DEMOGRAPHY 139, 151–54 (2016); Sabrina Tavernise & Robert Gebeloff, *Census Shows Sharply Growing Numbers of Hispanic, Asian and Multiracial Americans*, N.Y. TIMES (Aug. 21, 2021), <https://perma.cc/C2HK-RWLC>.

⁸³ Levy et al., *supra* note 32, at 951.

⁸⁴ See *supra* text accompanying notes 78–79.

FIGURE 5: RACE AND TRIPLE DISADVANTAGE



The inevitable conclusion is that, while the 2020 Census demonstrates that the U.S. is becoming increasingly diverse,⁸⁵ the types of interactions across race and class boundaries in the spaces of our cities that ultimately contribute to societal integration are not taking place in the manner that we might think, perhaps especially so in Chicago. Indeed, among all U.S. cities, Chicago ranks among the very highest in terms of racially segregated mobility patterns, second only to Detroit.⁸⁶ This may prove important because the combination of low overall equitable mobility and the lack of travel to common areas adds to the prediction of homicide and overall violence across U.S. cities, controlling for residential racial segregation, economic inequality, and other traditional factors.⁸⁷ In this sense, social connectedness through everyday mobility is a multilayered force that yields an enduring higher-order structure,⁸⁸ one that is potentially more consequential than most neighborhood-based theories of crime acknowledge. Future research is needed to examine the extent to which rates of crime and violence across cities are related to

⁸⁵ Tavernise & Gebeloff, *supra* note 82.

⁸⁶ Candipan et al., *supra* note 54, at 18.

⁸⁷ Sampson & Levy, *supra* note 26, at 81–83.

⁸⁸ SAMPSON, *supra* note 14, at 375.

racially segregated mobility specifically, or segregated mobility generally.

At the neighborhood level, triple-disadvantage theory should be expanded in future research and tested with other data sources. Further work using georeferenced cell phone tracking presents many opportunities to test the added value of triple disadvantage beyond residential disadvantage for explaining neighborhood disparities in violence in all U.S. cities and potentially around the world, especially during recent years of increasing violence around the country. Because triple disadvantage has been theorized to increase conflictual encounters, it may also prove important in explaining volatile police-citizen encounters and police killings. In addition, the success of community-based movements for criminal justice reform is dependent upon resources and network ties beyond the local neighborhood. We thus conclude that mobility-based advantages, or the lack thereof, should be high on the agenda of future research examining the drivers of both crime and criminal justice outcomes.

The theoretical underpinnings of our approach are general in nature, however, and not limited to violence or criminal justice. Triple disadvantage is plausibly associated with neighborhood capacity and collective efficacy, for example, and these relationships should be explored as additional ways that structural interneighborhood ties can affect vitality. Nonprofit organizations and community-governance institutions constitute important resources for communities that may be particularly sensitive to mobility-based disadvantages.⁸⁹ There are also reasons to believe that interneighborhood mobility presents opportunities for pandemic transmission.⁹⁰ COVID-19 is transmitted primarily through airborne channels, and social distancing and stay-at-home guidelines underscore the importance of reducing the human contact induced by mobility.⁹¹ In addition to the direct

⁸⁹ See, e.g., Nicole P. Marwell & Shannon L. Morrissey, *Organizations and the Governance of Urban Poverty*, 46 ANN. REV. SOCIO. 233, 242–44 (2020); MARIO LUIS SMALL, UNANTICIPATED GAINS: ORIGINS OF NETWORK INEQUALITY IN EVERYDAY LIFE 18–20 (2009).

⁹⁰ See Serina Chang, Emma Pierson, Pang Wei Koh, Jaline Gerardin, Beth Redbird, David Grusky & Jure Leskovec, *Mobility Network Models of COVID-19 Explain Inequities and Inform Reopening*, 589 NATURE 82, 84 (2021); Boyeong Hong, Bartosz J. Bonczak, Arpit Gupta, Lorna E. Thorpe & Constantine E. Kontokosta, *Exposure Density and Neighborhood Disparities in COVID-19 Infection Risk*, 118 PROC. NAT'L ACAD. SCI. 1, 2, 7 (2021).

⁹¹ See Hong et al., *supra* note 90, at 2.

transmission pathway, neighborhood connections can also impact the allocation of municipal funds and institutional capacity to facilitate collective efficacy in response to crisis, such as pandemic spread.⁹² More generally, we argue that triply disadvantaged neighborhoods may lack the necessary coalitions to achieve significant overall public or private investment and may further lack the social or spatial proximity to critical organizational resources that support human flourishing. The higher-order social structure of a city is thus critical for the broad well-being of its neighborhoods and residents.

⁹² Brian L. Levy, Karl Vachuska, S.V. Subramanian & Robert J. Sampson, *Neighborhood Socioeconomic Inequality Based on Everyday Mobility Predicts COVID-19 Infection in San Francisco, Seattle, and Wisconsin*, SCL ADVANCES (forthcoming 2022) (manuscript at 8) (on file with author).