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Measuring Digital Citizenship: Mobile Access and Broadband

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How should we measure broadband adoption by individuals and communities, given different modes of access, including home broadband, smartphone use, and public access? We measure online activities and indicators of skill to understand opportunities for digital citizenship, or participation in society online. Based on a 2011 survey in Chicago, we find more mobile phone adoption among Blacks than among non-Hispanic Whites, and greater likelihood of Internet use for job searches among residents who rely primarily on smartphones to go online than among home broadband adopters. Yet our analysis also shows that broadband at home remains critically important for digital citizenship, and that the growth in mobile phone use has not erased inequalities in participation online and seems unlikely to do so. Moreover, smartphones are not bridging the gap in disadvantaged communities. Multilevel statistical models show inequality in both Internet access and economic and political activities across geographic areas, or communities. Technology disparities that are patterned by place have implications for opportunity and equity at the neighborhood level.

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Measuring Digital Citizenship: Mobile Access and Broadband

How should we measure broadband adoption by individuals and communities? The National Broadband Plan calls for universal access to broadband, but this access is a means to achieve other ends, such as improvements in health, government services, civic engagement, education, and economic development.

At the individual level, broadband adoption is an important policy issue insofar as it facilitates what has been called digital citizenship, or the *ability* to participate in society online (Mossberger, Tolbert, & McNeal, 2008, p. 1). In much the same way that education and literacy have promoted democracy and economic growth, more widespread use of the Internet has the potential to generate "spillover benefits" for communities and society as a whole (DiMaggio & Bonikowski, 2008; Krueger, 2006; Mossberger, Tolbert, & McNeal, 2008). It facilitates social inclusion through greater access to resources for individual well-being, such as government services, online news, and health care information (DiMaggio, Hargittai, Celeste, & Shafer, 2004).

Digital citizenship requires regular and effective Internet access and the skills to use the technology. This suggests meeting multiple needs—access to high-speed connections at home, hardware and software, technical skills, and critical thinking skills—to enable evaluation and use of information online.[2] Both access and skills vary in quality, defying a simple dichotomy or divide (DiMaggio et al., 2004; Hargittai, 2002; Mossberger, Tolbert, & Stansbury, 2003; Van Dijk, 2009; Warschauer, 2003).

This article compares home broadband use to Internet use among the "less connected," focusing on mobile-only access. We examine unequal access and digital citizenship, first for individuals and then for communities, using multilevel models. In 2012, nearly half of Americans use the Internet on mobile phones. Those who primarily rely on smartphones to go online are disproportionately young, minority, and poor, and thus popular rhetoric holds that cell phones (smartphones) are bridging the access divide. Yet our research empirically shows the limits of depending on this form of Internet access. Regarding online activities, the 2011 Chicago survey described here shows some improvement for mobile-only Internet users compared with those with no personal Internet access at all. Overall, however, those who rely exclusively upon smartphones or Internet access outside the home display less skill and are less engaged online than individuals with home broadband.

In this article, we focus on the regular access to high-speed connections that is important for digital citizenship and is most often achieved through home broadband use.[3] Yet the most recent national data show that less than two thirds of Americans had home broadband access in 2012 (Zickuhr & Smith, 2012) and more than one third are offline or "less connected" (Mossberger, Tolbert, & Franko, 2012).

[2] The latter has been called "information literacy" (see Mossberger et al., 2003 for a review), but basic literacy and educational competencies also greatly enrich the capacity to use the Internet.

[3] We are agnostic about the precise technologies used to attain regular and full access to the Internet. For example, a laptop with a wireless aircard may achieve outcomes similar to a home connection and a personal computer.

Among the less connected are individuals who depend on public access or other connections outside the home, such as wireless hot spots, coffee houses, or the homes of friends and relatives. The less connected also include those who cannot access the full content of the Web owing to slow dial-up connections at home, and individuals who use the Internet on their mobile phones but do not have broadband at home. These smartphone-reliant Internet users made up only 8% of the U.S. population in 2011, according to estimates by the Pew Research Center (Zickuhr & Smith, 2012), and 4% of Chicago residents in the 2011 survey analyzed here. Of the 46% of Americans connected to the Internet with smartphones in 2012, the majority have high-speed broadband at home as well (Horrigan, 2012; Zickuhr & Smith, 2012)

We present evidence from a 2011 study of Chicago, comparing the activities and skills of smartphone and home broadband users at the individual level, and patterns of access and use across poor and minority neighborhoods. Using a unique random digit-dialed telephone survey of 3,000 respondents in Chicago, we employ multilevel statistical analysis to estimate home broadband adoption, smartphone use, and activities online across Chicago's 77 official neighborhoods. The models show that neighborhood context exacerbates individual-level inequalities. Maps provide further evidence of these disparities in Internet access and use across geographic areas and their collective impacts. The results underscore the continued importance of broadband, showing that quality of access matters considerably for individual capabilities and potential public benefits.

Mobile Access: Is It a Game Changer?

The ways in which people connect to the Internet are more varied today than they were a decade ago. As of 2011 one in five Americans is completely offline, and almost 4 in 10 lack high-speed access at home. A 2011 Pew survey found 62% of all American adults have high-speed Internet at home, including two thirds (66%) of Whites. But only half of Blacks (49%) and Hispanics (51%) have such access (Zickuhr & Smith, 2012). The survey also found gaps based on age, income, and educational attainment. The proliferation of mobile devices is unquestionably changing the way in which many people go online, and cell phone adoption is prevalent among minorities and the young. How do cell phone-only Internet users compare with those who have broadband at home? Do they differ from other Internet users who are "less connected," such as those who depend upon public access or dial-up connections?

In 2012, smartphone adoption was slightly higher nationally for Blacks and Latinos (at 49%) than for non-Hispanic Whites (at 45%) (Zickuhr & Smith, 2012). This contrasts with home broadband adoption, where Blacks and Latinos lag behind (Horrigan, 2012; NTIA, 2011). Most mobile phone Internet users, however, also have home broadband (Horrigan, 2012) and are generally younger, higher-income, and more educated than those without smartphones (Zickuhr & Smith, 2012).

Among smartphone owners, young adults, minorities, those with no college experience, and those with lower household income levels are more likely than other groups to say that their phone is their main source of Internet access (Mossberger et al., 2012; Zickuhr & Smith, 2012). Smartphones are also used by low-income teens at higher than average rates, often to compensate for a lack of Internet access at home (Brown, Campbell, & Ling, 2011). Smartphone-only Internet users are more likely to be young than others who are less connected (Mossberger et al., 2012).

Given that the data presented in this article are for Chicago, it is important to note how central city residents differ from national trends in previous research. In multivariate models based on national data from 2009, race and ethnicity predicted mobile phone access differently across geography (Mossberger et al., 2012). Among urban residents, Blacks were more likely than Latinos to have only mobile Internet access.[4] These patterns may reflect the tendency for urban Latinos to be more recent immigrants, as Spanish-dominant Latinos are less likely than any other group to have experience with the Internet (Livingston, 2010). Controlling for language, studies show inner-city Latinos are more technologically disadvantaged than either rural or suburban Latinos. City residents who are less connected tend to have no Internet access at home, rather than dial-up (Mossberger et al., 2012, Chapter 3).

The Chicago data allow us to examine whether smartphone use is closing gaps in Internet use in low-income urban communities. A large literature on "neighborhood effects" in urban policy suggests that living in areas of concentrated poverty or segregation influences opportunities for education, jobs, health care, and more (Federal Reserve & Brookings Institution, 2008; Jargowsky, 1997; Newburger, Birch, & Wachter, 2011; Wilson, 1987, 1996). Environmental factors such as the quality of schools and other public institutions, access to labor markets, and knowledge or resources in social networks may have effects beyond individual-level poverty or disadvantage. Neighborhood context also affects technology use and barriers to home Internet use, magnifying inequalities (Kaplan & Mossberger, 2012; Mossberger, Tolbert, & Gilbert, 2006; Mossberger, Kaplan, &, Gilbert, 2008; Mossberger, Tolbert, Bowen, & Jimenez, in press).

Could affordable smartphone use remedy disparities in access, given the enthusiasm for the devices among many demographic groups that are offline or less connected? Are they assisting low-income individuals and low-income communities? This is a contention often reflected in popular headlines (Peterson, 2010; Wortham, 2009), though others have countered that this is second-class access (Crawford, 2011). Despite the development of many new applications, reliance on cell phones to go online offers users a more functionally limited Internet. Mobile phones may be useful for social networking, texting, gaming, and reading headline news, but may not replace high-speed access on laptop or desktop computers for activities such as applying for jobs, carrying out work-related tasks, and researching health issues (Horrigan, 2012; Wortham, 2009).

Modes of Access and the Measurement of Digital Citizenship

The activities that individuals engage in online provide an important measure for comparing modes of access against their potential for digital citizenship and spillover benefits for society as a whole. Hargittai (2002) has characterized variation in activities online as a second-level digital divide that emerges in a society as some experience with the Internet becomes more widespread. This variation suggests differences in abilities as well. A 2012 Pew survey found that over 90% of Internet users in the United States use e-mail or have used a search engine, and 66% use a social networking site such as

[4] Of individuals living in the suburbs, Latinos are more likely to connect to the Internet on mobile devices than non-Hispanic Whites, but suburban Blacks do not differ (statistically) from suburban Whites (Mossberger, Tolbert, & Franko, 2012, Chapter 4).

Facebook. Eight in 10 Internet users check the weather online, 75% read news online (up from 61% in 2011), and more than 6 in 10 look up political information online. They also seek out government information: 67% have visited a local, state or federal government website (up from 56% in 2011). Economic activity online is widespread: 60% do banking online, 71% have purchased a product online, and 56% look online for information about a job. Online information even affects people's place of residence: 4 in 10 Internet users look for a place to live online (Zickuhr & Smith, 2012; Pew Internet and American Life Project 2012). But which activities should we measure as indicators of digital citizenship?

In the context of the United States, liberal ideas of citizenship have supported the belief that individuals should have equal access to the tools necessary to compete economically (Hartz, 1955; Smith, 1993). Civic republicanism, which also forms a part of the American political heritage, emphasizes citizen participation (Skocpol, 1992; Smith, 1993). Thomas Jefferson argued that Americans' participation in a democratic form of government, was the primary justification for public education. Building on these traditions of citizenship, Mossberger and colleagues (2008) developed the argument that the ability to participate in society online, or digital citizenship, requires economic opportunity and political participation.

Thus political and economic activities online, but not entertainment or other online activities, may justify government policy. There is indeed evidence that such activities influence outcomes important for equal opportunity: Internet use at work has been linked to higher wages (DiMaggio & Bonikowski, 2008; Goss & Phillips, 2002; Mossberger, Tolbert, & McNeal, 2008), even for less educated workers (Mossberger, Tolbert, & McNeal, 2008), as well as for various aspects of political participation. Individuals reading online news or political information are more likely to vote and participate in politics in myriad ways (Bimber, 2003; Gibson, Lusoli, & Ward, 2005; Krueger, 2006; Mossberger, Tolbert, & McNeal, 2008; Tolbert & McNeal, 2003; see Boulianne, 2009 for a review).

More broadly, online activities related to health, education, housing, government services, and transit (among others) expand capabilities needed for economic opportunity and democratic participation. Some scholars (DiMaggio et al., 2004; Hargittai, 2002, 2006) have seen these Internet activities as enhancing human capital. Not coincidentally, such activities are also identified as policy objectives for broadband use in the National Broadband Plan (Federal Communications Commission [FCC], 2010), given the promise they hold for creating spillover benefits for society as well as individuals. Questions on economic, political, and health-related activities online have consistently been asked by the Pew Internet and American Life Project since 1995 and are included in the U.S. Census Bureau's 2011 Current Population Survey.

The ability to fully participate in society online, however, requires regular (that is, frequent) access to the Internet, with devices and speeds that can accommodate the activities mentioned above. Also required are the skills to use technology effectively for these purposes. This includes technical competence to use the necessary hardware and software, as well as the information literacy needed to find, comprehend, evaluate, and apply the online information (Mossberger et al., 2003). Daily Internet use is a measure of regular access and at least some basic level of skill, and is another indicator of digital citizenship (Mossberger, Tolbert, & McNeal, 2008).

Home Broadband Access

Previous research suggests that the combination of broadband and home use supports the development of digital citizenship. High-speed connections and home access are both predictors of more frequent Internet use, especially daily use (Mossberger, Tolbert, & McNeal, 2008). Higher speeds facilitate online transactions and full multimedia experience of the Internet. Compared with home broadband users, dial-up users go online less often to perform fewer tasks (Horrigan, 2010). Frequency of use fosters skill and a greater range of activities online (Howard, Rainie, & Jones, 2001).

A recent longitudinal study showed that home Internet use is related to higher wages, controlling for other factors (DiMaggio & Bonikowski, 2008). Home access affords greater flexibility and convenience than public access or the workplace, allowing individuals to explore a greater range of uses and to gain experience (DiMaggio et al., 2004; Hargittai & Hinnant, 2008). While use in multiple venues is even more strongly related to human capital activities online (Hassani, 2006), home access is particularly important as a resource for digital citizenship.

Less connected individuals, who do not have broadband at home, may manage to go online in various ways. Many, with and without home Internet connections, find a technology lifeline at libraries, community centers, and other places offering public access. Such public access sites offer training, support, and help finding information online. Additionally, they can build social capital as community gathering places and spaces for collective learning (Edwards, Rauseo, & Unger, 2012). Youth and minorities are among the most frequent public access users (Becker et al., 2010; see also Gant, Turner-Lee, Li, & Miller, 2010). Yet those who depend upon public access as their primary means of going online lack the regular, around-the-clock access to the Internet that home Internet connections afford. In 2010–2011, 76% of public libraries reported they did not have enough computers to meet demand (American Library Association, 2011), which led to long waits and time limits.

Mobile Access on Smartphones

Because of their portability, smartphones provide personal Internet access that in some ways affords even greater convenience and more continuous use than home access. Mobile phones with applications that provide real-time or locational information have advantages over home broadband. However, their small screens and keyboards render them poor substitutes for laptops or desktop computers in filling out forms, writing, and reading complex documents not formatted for mobile access. Slow speeds on wireless networks often impede downloading or uploading of information, and data usage caps (common in most wireless plans) may discourage online exploration (Goldman, 2012; Wortham, 2011). Focus groups conducted by researchers at the University of Illinois at Chicago with smartphone-reliant Internet users indicate that such individuals often cobble together multiple forms of access to try to perform activities online. While the term "smartphone-only" is a convenient shorthand for those who rely primarily on their mobile phones to access the Internet, these less connected individuals also use public

access and other Internet resources outside the home to the extent that they can.[5]

Previous research comparing mobile-only Internet users with home broadband users indicates a big gap in activities online, even controlling for demographic differences. Multivariate regression analysis of the national 2009 FCC survey demonstrates that, controlling for other factors, individuals with home broadband were significantly more likely to perform a variety of tasks online than the less connected, including smartphone-only users (Mossberger et al., 2012, Chapter 4). Compared to others without home broadband, such as dial-up or public access users, mobile-only Internet users were somewhat more likely to get local or community news; to search local, state, or federal government websites (e-government); and to obtain national or international news using the Internet.[6] Still, those who relied exclusively on mobile access were clearly disadvantaged compared to those who had home broadband (Mossberger et al., 2012, Chapter 4). Smartphones have increased in sophistication since 2009, and there are now more applications to enable mobile Internet use for banking, e-commerce, news, e-government alerts, and real-time information on public transportation. Using the 2011 Chicago survey, we are able to explore more recent trends in a demographically and economically diverse city with large Black and Latino populations. Moreover, the Chicago data allow us to explore the effects of residence in high-minority or high-poverty neighborhoods, and to map differences across the 77 official community areas of Chicago. We thus seek to measure digital inequality across individuals with varying forms of access, but also geographically, across neighborhoods.

Data and Methods

We draw on a random-sample telephone survey of more than 3,500 Chicago residents aged 18 and older, conducted in July and August 2011. The survey was carried out via both landlines and cell phones. Follow-up included five callbacks to nonresponding numbers, unless a hard refusal was given. Chicago's ZIP codes were used to create the overall geographic area from which the random sample was drawn. Designed by the authors, the survey was administered in Spanish and English and conducted by the Eagleton Poll at Rutgers University.

Previous research has shown Chicago is a median city in terms of technology access, so the patterns of access and inequality found here can be roughly generalized to the nation's urban areas (Mossberger et al., 2012). Results for Chicago are comparable with national averages, as 80% of residents

[5] In 2011, two focus groups were conducted (one in English and one in Spanish) with Chicago, IL, residents who own and use smartphones but do not have Internet access at home. The focus groups were conducted at the University of Illinois at Chicago survey research laboratory.

[6] The FCC survey of 5,005 U.S. residents, conducted in October and November 2009, included questions about a number of activities online, allowing us to compare the types of activities performed by mobile-only Internet users, other less connected individuals, and home broadband users. We analyze economic, political, educational, and health-related activities associated with human capital as well as public policy objectives. Appendix Table A1 (2009 FCC survey, from Mossberger, Tolbert, & Franko, 2012) compares online activities of mobile-only users and home broadband adopters. Frequencies are weighted. The sample is based on the 3,477 respondents who use the Internet.

reported using the Internet in 2011, and 67.5% said they had broadband at home. The national 2012 Pew figures estimate Internet use anywhere at 78% and broadband adoption at 62% of American adults (Zickuhr & Smith, 2012).

Chicago is also an excellent case for observing the differences across racial and ethnic groups, as well as across economically diverse neighborhoods. The city has neighborhoods boasting multimillion-dollar real estate as well as areas of concentrated poverty that scholars have studied (Jargowsky, 1997; Massey & Denton, 1993; Wilson, 1987). According to the 2010 census, Chicago is 32% White non-Hispanic, 32% Black, 29% Latino, and 5% Asian.[7]

To track Internet use in Chicago neighborhoods, the questionnaire asked the respondents for their cross streets, which were used to geocode each respondent's location. Of the 3,500 respondents, roughly 3,000 could be accurately located in a neighborhood. We merged individual-level survey data with census tract-level data from the 2010 U.S. Census measuring socioeconomic conditions of Chicago neighborhoods, including age distributions, poverty, and racial and ethnic populations.

These data were analyzed using multilevel statistical models (random intercept models) to simultaneously test how neighborhood- and individual-level factors affect the probability of having various forms of access to the Internet, or doing activities online (Raudenbush & Bryk, 2002; Steenbergen & Jones, 2002). Many studies of Internet use have relied on descriptive statistics or other methods of analysis that lack multivariate controls to untangle overlapping influences. Descriptive statistics, such as the percentage of mobile phone users who are Black, are useful for tracking trends. But understanding, for example, the effect of home broadband versus mobile access on online political activities requires the use of methods that can better isolate cause and effect. Individuals using mobile access only may differ from home broadband users in a number of ways beyond their race or ethnicity: They may be younger, less affluent, less educated, or live in poorer racially segregated neighborhoods. Multivariate methods allow us to examine which factors are statistically significant for predicting outcomes, holding other factors constant.

To obtain more precise estimates of individual-level access, we use not only multilevel models (individuals nested in neighborhoods) but also statistical models to determine probabilities of access for geographic areas. We use the same method of hierarchical linear modeling discussed above with poststratification weights to estimate Internet use across Chicago's 77 neighborhoods or community areas. These neighborhood-level estimates are mapped. While federal programs have mapped broadband availability based on service provider data, we are able to portray actual use based on estimates of the percent of the population with high-speed Internet at home, for example. We build on work by Lax and Phillips (2009) to create geographic estimates from the multilevel models drawn from both individual- and aggregate-level variables.

[7] U.S. Census Bureau. (2010). *Profile of general population and housing characteristics* [2010 demographic profile data, DP-1, Chicago City, Illinois]. American FactFinder. U.S. Census Bureau.

Despite the advanced methods underlying the findings, we present the results in a format accessible to readers without a background in statistics: tables and figures based on probability simulations that are as easy to understand as simple percentages, but that are based on the multivariate regression coefficients and illustrate the relative size of the impact on outcomes, holding other variables in the models constant at mean values (Long, 1997). The predicted values for the regression models can be read and interpreted in the same way as simple percentages, but they provide a more accurate picture of technology opportunity and inequality.

Comparing Mobile-Only Access and Home Broadband

Tables 1–4 present percentages of Chicago's populations with different forms of access to the Internet. Columns from left to right list increasingly regular and effective access to the Internet, with home broadband access—what we call first-class access—in column 4. Column 3 is individuals who lack home broadband but have mobile access via their smartphones. Following Crawford (2011), we refer to this as second-class access. In column 2 are Internet users who have no personal access—neither home broadband nor mobile Internet—but go online in public libraries, friends' homes, and so on. Finally, in column 1 are the generally less connected, including everyone without home broadband, those who are offline or unconnected, and the small percentage of dial-up users. This is our reference group. Of our sample of 2,905 Chicago residents, 67.5% had high-speed Internet at home, leaving 912 respondents who were less connected, that is, lacking home broadband. We compare these different types of less connected individuals, looking at those who have Internet access on their mobile phones only, as well as Internet users without mobile or home access.

Table 1 lists the demographic characteristics of respondents with these varying forms of Internet access. Column 5 shows the difference between those with mobile access only and those with broadband at home. Blacks are 20% more likely than non-Hispanic Whites to rely on mobile Internet access, and Latinos are 13% more likely. Among Whites, however, home broadband access is most common. Among those with home broadband, 57% are White non-Hispanic, whereas only 23% of those with only mobile access are. Of Chicago residents with mobile access only, 45% are Black and 24% are Latino. Clearly, mobile access on cell phones is common among racial and ethnic minorities in Chicago.

Table 1. Demographics for Mobile Internet Access Only Versus Home Broadband (%).

	No Home Broadband/ Unconnected	Internet User/ No Personal Access	Mobile Access Only	Home Broadband	Difference: Mobile/ Broadband
Race:					
White	34	38	23	57	-34
Black	39	36	45	26	19
Latino	23	22	24	11	13
Asian	1	1	2	3	-1
Other	3	3	6	3	3
Total:	100%	100%	100%	100%	
Education Level:					
Less High School	22	12	12	3	9
High School Degree	32	24	37	12	25
Some College	24	29	27	25	2
Bachelor's or More	22	36	23	59	-36
Total:	100%	101%	99%	99%	
Income:					
Under 20k	44	30	34	12	22
20–39k	28	32	30	18	12
40–75k	20	26	29	25	4
Over 75k	8	13	6	45	-39
Total:	100%	101%	99%	100%	
Age:					
18–29	10	10	50	14	36
30–49	16	25	26	35	-9
50–64	27	34	13	32	-19
65+	48	31	10	19	-9
Total:	101%	100%	99%	100%	
Gender:					
Male	34	39	41	44	-3
Female	66	61	59	56	3
Total:	100%	100%	100%	100%	
Spanish Interview:					
Yes	17	15	10	3	7
No	83	85	90	97	-7
Total:	100%	100%	100%	100%	
Married:					
Yes	33	33	33	50	-17
No/Other	67	67	67	50	17
Total:	100%	100%	100%	100%	

Note: Some columns do not add up to 100% due to rounding.

Note: Frequencies for home broadband access are from a sample of 2,905 Chicago residents responding to a telephone survey conducted in July and August 2011 that included calls to cell phone numbers. No home broadband/unconnected = all individuals without home broadband. Internet users with no personal access comprise 242 of 807 people with no home broadband or mobile access. Mobile access only = individuals using their smartphones to connect to the Internet, from a sample of 912 individuals without home broadband access. Survey conducted by the Eagleton Poll, Rutgers University.

Similar patterns are found for the young and poor. The young, aged 18–29, are 40% more likely to rely on smartphone-only Internet connections than to have home broadband, while the middle-aged (50–64) are 19% less likely to rely on mobile access only than to have home broadband. Individuals earning over $75,000 a year are almost 40% less likely to have mobile access only versus a home broadband connection. The poor, with annual incomes under $20,000, are 20% more likely to have access only via cell phones than to have broadband at home.

Those relying exclusively on mobile access are the young, racial and ethnic minorities, and lower-income individuals Meanwhile, individuals with the most education—a bachelor's degree or higher—are 36% more likely to have broadband access versus cell phone access only. Only 10% of those interviewed in Spanish are mobile-only users, compared to 24% of Latinos more generally, so Spanish-speaking Latinos are less likely to rely on mobile access. There are only small differences for gender, but unmarried individuals are 17% more likely to have mobile access only than to have high-speed Internet at home.

Previous research has found that home broadband promotes digital citizenship, with spillover benefits that confer economic and political advantages not only to the individuals using the technology but to society as a whole (Mossberger, Tolbert, & McNeal, 2008). The Chicago survey included questions about a number of activities online, allowing us to compare the types of activities performed on the Internet by mobile-only Internet users, other less connected individuals, and those with home broadband, as shown in Table 2.

Over the past four years, mobile phone capability for online activities has increased markedly (Mossberger et al., 2012), a trend that is evident in these data (see column 3 of Table 2). In fact, 83% of respondents with mobile access only had used the Internet to get information or apply for a job, compared to 60% of those with home broadband. This seems counterintuitive at first, but there are a few possible explanations. Respondents were asked about Internet use—which could include public access use—rather than what they do on their smartphones, per se. Additionally, smartphones can be used to check e-mail on a regular basis, a useful activity for job hunting. Finally, the young and Blacks are among those most likely to search for jobs online (Mossberger et al., 2003), as well as to be smartphone users.

Table 2. Economic and Political Activities Online for Mobile Access Only Versus Home Broadband Access (%).

	No Home Broadband/ Unconnected	Internet User/No Personal Access	Mobile Access Only	Home Broadband	Difference: Mobile vs. Broadband
Online Activities					
Use Internet to get community or neighborhood news	13%	29%	45%	53%	-8%
Use Internet to visit local, state, or federal government website	18%	43%	55%	75%	-20%
Use Internet to get news online	21%	45%	72%	80%	-8%
Use Internet to get information about politics	17%	42%	52%	73%	-21%
Use City of Chicago website	17%	43%	45%	63%	-18%
Use Internet to do work for a job	13%	32%	41%	58%	-17%
Use Internet to get job information or apply for job	23%	48%	83%	60%	23%
Use Internet to purchase things	11%	23%	38%	49%	-11%
Use Internet to get health information	27%	69%	76%	87%	-11%
Use Internet to get transportation information	21%	49%	69%	71%	-3%
Use Internet to take a class online	10%	23%	35%	41%	-6%
Number of cases	2,905	807	912	2,905	

Note: Frequencies for home broadband access are from a sample of 2,905 Chicago residents responding to a telephone survey conducted in July and August 2011 that included calls to cell phone numbers. No home broadband/unconnected = all individuals without home broadband. Internet users with no personal access comprise 242 people of 807 people with no home broadband or mobile access. Mobile access only = individuals using their smartphones to connect to the Internet, from a sample of 912 individuals without home broadband access. Survey conducted by the Eagleton Poll, Rutgers University.

Outside of online job searches, Internet use disparities between broadband adopters and mobile-only and other less connected users remain significant. Across the various online activities in Table 2 we continue to see gaps, with individuals with home broadband considerably more likely to use the Internet for political and economic activities. With the exception of looking for job information, home broadband users are between 10 and 25% more likely to be engaged in a range of activities: reading online news, obtaining community news, using e-government, doing work for a job, or obtaining online health and transportation information. Individuals with home broadband are 21% more likely than mobile-only users to get information about politics online, 20% more likely to have used e-government, and 18% more likely to have used the City of Chicago website. Despite the growing importance of mobile access, the range of activities differs markedly between those with high-speed Internet at home and those with only mobile phone access. As columns 1 and 2 show, individuals lacking personal access (home broadband or mobile access) are much less likely to engage in any online activities; thus they are less likely to be digital citizens.

Table 3: Entertainment Activities Online for Mobile Access Only Versus Home Broadband Access (%).

	No Home Broadband/ Unconnected	Internet User/No Personal Access	Mobile Access Only	Home Broadband	Difference: Mobile vs. Broadband
Online Entertainment Activities					
Use Internet to visit social networking sites	15%	27%	70%	58%	12%
Use Internet to watch videos	14%	24%	66%	57%	9%
Use Internet to play games	16%	36%	50%	45%	5%
Use Internet to download/listen online to music	19%	38%	73%	65%	8%

Note: Frequencies for home broadband access are from a sample of 2,905 Chicago residents responding to a telephone survey conducted in July and August 2011 that included calls to cell phone numbers. No home broadband/unconnected = all individuals without home broadband. Internet users with no personal access comprise 242 people of 807 people with no home broadband or mobile access. Mobile access only = individuals using their smartphones to connect to the Internet, from a sample of 912 individuals without home broadband access. Survey conducted by the Eagleton Poll, Rutgers University.

Table 3 shows the four types of access in relation to entertainment activities online. Mobile access has historically been used for texting and communication. Individuals with only mobile access are the most likely to use social media websites (Facebook, Twitter) and to watch videos, play games, and listen to music online. While home broadband is associated with a higher frequency of political and economic activities, online entertainment and social networking remain the domain of mobile access. Age may explain some of these differences, especially for social networks, but the results are also consistent with the historical predominance of entertainment among less experienced and less educated Internet users (DiMaggio, Hargittai, Neuman, & Robinson, 2001).

Table 4. Technology Skills for Mobile Access Only Versus Home Broadband Access (%).

Skills . . . know what an/a _____ is?	No Home Broadband/ Unconnected	Internet User/No Personal Access	Mobile Access Only	Home Broadband	Difference: Mobile vs. Broadband
Advanced search	30%	49%	65%	75%	-10%
Spyware	23%	38%	57%	73%	-16%
Preference setting	17%	26%	49%	64%	-15%
pdf	18%	31%	48%	70%	-22%
wiki	14%	20%	48%	52%	-4%
Phishing	16%	24%	16%	60%	-44%
Number of cases	2,905	807	912	2,905	

Note: Frequencies for home broadband access are from a sample of 2,905 Chicago residents responding to a telephone survey conducted in July and August 2011 that included calls to cell phone numbers. No home broadband/unconnected = all individuals without home broadband. Internet users with no personal access comprise 242 people of 807 people with no home broadband or mobile access. Mobile access only = individuals using their smartphones to connect to the Internet, from a sample of 912 individuals without home broadband access. Survey conducted by the Eagleton Poll, Rutgers University.

Finally, how do mobile-only users compare with home broadband adopters in measures of Internet skill? Table 4 presents results for questions about Internet knowledge. These questions are measures that have been validated with observations of skill in prior studies (see Hargittai & Hsieh, 2012). The particular measures used have been found appropriate for differentiating levels of skill in populations of less experienced Internet users (Hargittai & Hsieh, 2012). According to our results, smartphone-only

users displayed lower rates of skill than home broadband users on all questions, with the difference ranging from 4 to 44 percentage points. However, mobile-only users exceeded the skill levels of those with no personal access on five of six measures. In general, for both activities and skill, mobile-only users stand somewhere between other less connected individuals and home broadband users.

Why Type of Access Matters: Economic and Political Activities

So far we have described users who connect to the Internet via mobile phone but lack broadband access at home, comparing this group to those with a high-speed connection at home. While these descriptive patterns are illustrative, we need to control for the many factors that predict access. Table 5 uses the online activities reported in Table 2 as dependent or outcome variables. The variables are coded 1 if an individual has engaged in this activity online, and 0 if otherwise. Because the dependent variables are binary, logistic regression is used. Two binary explanatory variables measure broadband access at home or exclusive reliance on mobile access. The reference category is composed of other types of the less connected and individuals who are unconnected.

Table 5. Various Internet Activities, Mobile Access Only vs. Home Broadband Access (2011).

	Online News β/(se)	*Community News* β/(se)	*Political News* β/(se)	*Use for Work* β/(se)	*Find a Job* β/(se)	*Health Info* β/(se)	*Transit Info* β/(se)
Hispanic	-0.328*	-0.363**	-0.615**	0.344*	-0.301^{+}	-0.391*	-0.419**
	(0.16)	(0.14)	(0.17)	(0.15)	(0.18)	(0.17)	(0.16)
Black	-0.375**	-0.385**	-0.349**	-0.09	0.557**	-0.06	-0.287*
	(0.12)	(0.12)	(0.11)	(0.10)	(0.14)	(0.11)	(0.13)
Asian	0.21	-0.631*	-0.33	-0.05	0.09	-0.09	0.41
	(0.45)	(0.29)	(0.29)	(0.29)	(0.26)	(0.36)	(0.39)
Income	0.162**	0.119**	0.124**	0.272**	-0.056*	0.163**	0.03
	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)
Education	0.259**	0.155**	0.322**	0.368**	0.246**	0.244**	0.193**
	(0.03)	(0.03)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)
Age	-0.026**	-0.020**	-0.009**	-0.047**	-0.070**	-0.021**	-0.032**
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Female	-0.339**	-0.170^{+}	-0.254*	-0.16	-0.08	0.389**	0.03
	(0.12)	(0.10)	(0.12)	(0.11)	(0.08)	(0.10)	(0.10)
Parent	0.266*	0.408**	0.14	0.16	0.04	0.24	0.15
	(0.12)	(0.09)	(0.11)	(0.11)	(0.14)	(0.16)	(0.13)
Broadband at home	2.311**	1.644**	2.196**	1.215**	1.537**	2.461**	1.929**
	(0.13)	(0.17)	(0.16)	(0.17)	(0.15)	(0.10)	(0.14)

Mobile Access	2.282**	1.564**	1.918**	0.868**	2.246**	2.080**	1.783**
only	(0.30)	(0.25)	(0.23)	(0.27)	(0.30)	(0.21)	(0.32)
Constant	-1.58**	-1.93**	-2.85**	-2.12**	1.31**	-1.84**	-0.56*
	(0.29)	(0.32)	(0.31)	(0.30)	(0.33)	(0.31)	(0.27)
Observations/*N*	2834	2831	2835	2835	2835	2816	2835
Log Pseudo likelihood	-1212.1	-1545.73	-1356.01	-1343.7	-1371.5	-1100.1	-1460.3
Pseudo R^2	0.36	0.19	0.30	0.03	0.30	0.37	0.25

**0.01, *0.05, $^{+}$0.1 Significance level based on two-tailed significance.

Note: Models estimate whether respondents use the Internet to (1) get news online, (2) get news about their community, (3) get political news, (4) do work for a job, (5) get information about jobs or apply for a job, (6) find health information, and (7) find information about transportation. Unstandardized logistic regression coefficients with robust standard errors clustered by community area are in parentheses.

Results reveal that across the online activities, individuals with a home broadband connection are more likely to be engaged economically and politically online. Similarly, individuals with mobile-only access are more likely than individuals without any personal Internet access to take part in these activities online, although the coefficients are smaller than for home broadband in every case except online job searching. The control variables in the model are in the expected direction, consistent with previous research on digital inequality (DiMaggio et al., 2001; Mossberger et al., 2003), with younger individuals much more likely to participate in all activities online. Those with more education and higher incomes are more likely to be active economically and politically online, while Latinos and Blacks are less likely to do so than White non-Hispanics. The exception is online job search, an activity Blacks are more likely to engage in than Whites—again, a finding consistent with previous research (Mossberger et al., 2003). Asians and White non-Hispanics have similar patterns of online activities.

Because interpretation of the logistic regression coefficients is complex, in Table 6 we convert the coefficients from Table 5 to predicted values (probabilities), holding other variables in the model constant at mean values and varying the type of Internet access. While these estimates are as easy to read as the percentages shown in Tables 1–4, they control for the multiple factors related to engagement in society online. Table 6 again highlights that individuals with home broadband are generally more likely than those with smartphones only to read the news online, do work for a job, find health information, and so on, but the gaps are smaller than what was reported in Table 2. In fact, there is only a 2% difference in using the Internet to obtain community news among home broadband users and those with mobile access only, and only a 3% difference among mobile and broadband users in terms of finding transportation information, which is unsurprising as mobile devices are designed for this activity. Home broadband users remain more likely to use the Internet to do work for a job than those with mobile access only. The only exception to this pattern is online job searching, which mobile-only users are 16% more likely to do than those with home broadband, consistent with the patterns shown in Table 2. Those without home broadband or

smartphones (shown in column 1) are much less likely to be engaged in any of these activities. Now that we can see these patterns of opportunity and inequality across individuals, it is important to understand how modes of access vary across geographic areas.

Table 6. Predicted Probability of Online Activities by Type of Internet Access
(from logit coefficients reported in Table 5).

	No Home Broadband/ Unconnected	Mobile Access Only	Home Broadband	Difference: Mobile vs. Broadband
Use Internet to get news online	24%	76%	76%	0%
Use Internet to get community news	14%	44%	46%	-2%
Use Internet to get information about politics	20%	62%	69%	-7%
Use Internet to do work for a job	20%	37%	45%	-8%
Use Internet to get job information or apply for job	21%	72%	56%	16%
Use Internet to get health information	34%	80%	86%	-6%
Use Internet to get transportation information	23%	64%	67%	-3%

Note: All other variables are set at their mean value.

Neighborhood Context and Individual-Level Predictors of Access

Tables 7 and 8 present random-intercept multilevel logistic regression models. These models are similar to those reported in Table 5, but include neighborhood-level aggregate variables measuring the percentage of Blacks, Latinos, and Asians in Chicago's 77 community areas (neighborhoods), as well as the percent of the population in poverty and the percent over the age of 65. Beyond individual-level factors, we expect neighborhoods with high racial and ethnic minority populations and concentrated poverty to be less likely to have residents with Internet access. Similarly, neighborhoods with older populations should have a higher percentage of the population offline. These expectations are generally borne out in the data.

Table 7 models use of the Internet in any location in column 1, home broadband access in column 2 (our primary outcome variable), mobile access in column 3, and mobile access only in column 4. Column 4 model is a subsample of those without home broadband.

Table 7. Internet Use by Type of Access, Random-Intercept Models.

	Use Internet		*Home Broadband*		*Mobile Access*		*Mobile Access Only*	
Individual Level	*β/(se)*	*p*	*β/(se)*	*p*	*β/(se)*	*p*	*β/(se)*	*p*
Hispanic	-0.89	0.01	-0.68	0.01	0.08	0.64	-0.52	0.14
	(0.22)		(0.17)		(0.17)		(0.35)	
Black	-0.17	0.45	-0.17	0.31	0.44	0.01	-0.05	0.91
	(0.22)		(0.17)		(0.16)		(0.40)	
Asian	0.94	0.37	0.70	0.17	-0.38	0.19	0.69	0.36
	(1.04)		(0.51)		(0.29)		(0.76)	
Income	0.34	0.01	0.33	0.01	0.23	0.01	0.08	0.39
	(0.04)		(0.03)		(0.03)		(0.10)	
Education	0.46	0.01	0.34	0.01	0.17	0.01	0.19	0.05
	(0.04)		(0.04)		(0.04)		(0.09)	
Age	-0.08	0.01	-0.04	0.01	-0.07	0.01	-0.09	0.01
	(0.01)		(0.00)		(0.00)		(0.01)	
Female	-0.16	0.25	-0.04	0.70	-0.14	0.15	0.02	0.94
	(0.13)		(0.11)		(0.10)		(0.25)	
Parent	0.11	0.57	0.35	0.01	0.18	0.10	0.14	0.63
	(0.20)		(0.14)		(0.11)		(0.28)	
Community Area Level								
Percent Latino	-0.66	0.15	-1.03	0.01	-1.45	0.01	-0.45	0.67
	(0.46)		(0.37)		(0.41)		(1.05)	
Percent Black	-0.16	0.73	-0.56	0.10	-0.72	0.08	0.24	0.80
	(0.46)		(0.36)		(0.40)		(0.92)	
Percent Asian	0.08	0.95	-0.74	0.43	0.84	0.40	3.50	0.21
	(1.21)		(0.94)		(1.01)		(2.77)	
Percent Poverty	-0.55	0.65	0.25	0.79	1.81	0.10	2.83	0.29
	(1.20)		(0.96)		(1.09)		(2.65)	
Percent 65+	-2.22	0.31	-5.60	0.01	-3.91	0.04	-0.92	0.88
	(2.18)		(1.71)		(1.85)		(6.12)	
Constant	3.45	0.01	1.08	0.01	0.93	0.02	0.77	0.57
	(0.55)		(0.40)		(0.41)		(1.36)	
Observations/*N*	2828		2828		2828		892	

Pseudo R^2	-	-	-	0.33
Log Likelihood	-834.86	-1241.1	-1364.86	-216.57
Wald Chi^2	566.35	639.12	544.57	164.4
Prob. > chi^2	0.001	0.001	0.001	0.001

Note: Use of Internet, home broadband, and mobile phone access are random-intercept multilevel logistic regressions models with standard errors in parentheses. Use of "mobile access only" is an unstandardized logistic regression with standard errors clustered by community area (presented in parentheses). Probabilities based on two-tailed significance tests.

Once we control for neighborhood-level factors, we find Blacks are no different from Whites in terms of Internet use, home broadband access, or relying exclusively on mobile access. Blacks are more likely to have mobile access than Whites, however. Latinos are considerably less likely to use the Internet in any location or have home broadband, a finding consistent with national results (Livingston, 2010; Mossberger et al., 2012). Notably, we find that context matters and has an independent effect on the probability of access. Individuals living in neighborhoods with higher Latino or Black populations are considerably less likely to have home broadband. They are also less likely to have mobile access to the Internet. Similarly, individuals in neighborhoods with older populations are much less likely to have home broadband or mobile access. Interestingly, residents of high-poverty areas are more likely to rely on mobile access. Thus, beyond individual level factors, community areas with high percentages of Blacks and Latinos are the least likely to have home broadband or mobile access. These contextual effects, which wash out the individual-level effects of Black race, are consistent with previous research based on national survey data collected a decade ago (Mossberger et al., 2006).

Table 8. Online Activities, Random-Intercept Models.

	Use Internet Daily		*Use for Work*		*Look for Job*	
	β/(se)	*p*	*β/(se)*	*p*	*β/(se)*	*p*
Individual Level						
Hispanic	-0.79	0.01	0.20	0.24	-0.52	0.01
	(0.17)		(0.17)		(0.16)	
Black	-0.22	0.17	0.02	0.89	0.34	0.03
	(0.16)		(0.16)		(0.16)	
Asian	-0.02	0.96	-0.08	0.80	0.05	0.87
	(0.39)		(0.31)		(0.33)	
Income	0.31	0.01	0.32	0.01	0.01	0.63
	(0.03)		(0.03)		(0.03)	
Education	0.35	0.01	0.41	0.01	0.32	0.01
	(0.04)		(0.04)		(0.04)	
Age	-0.06	0.01	-0.05	0.01	-0.08	0.01
	(0.01)		(0.01)		(0.01)	
Female	-0.14	0.18	-0.15	0.12	-0.08	0.40
	(0.10)		(0.10)		(0.10)	
Parent	-0.05	0.72	0.20	0.09	0.06	0.59
	(0.13)		(0.12)		(0.12)	
Community Area Level						
Percent Latino	-1.08	0.01	-0.22	0.52	0.61	0.09
	(0.36)		(0.34)		(0.36)	
Percent Black	-0.73	0.04	-0.07	0.83	0.73	0.04
	(0.35)		(0.34)		(0.35)	
Percent Asian	0.16	0.86	1.22	0.15	2.18	0.01
	(0.91)		(0.85)		(0.88)	
Percent Poverty	0.68	0.48	-0.17	0.85	-0.87	0.36
	(0.95)		(0.94)		(0.95)	
Percent 65+	-5.93	0.01	-4.31	0.01	-0.38	0.81
	(1.63)		(1.51)		(1.55)	
Constant	1.70	0.01	-0.78	0.03	2.07	0.01
	(0.39)		(0.36)		(0.38)	
Observations/*N*	2829		2830		2830	

Log Likelihood	-1288.3	-1372.29	-1442.58
Wald Chi^2	713.1	664.56	647.25
Prob. > chi^2	0.001	0.001	0.001

Note: Random-intercept multilevel logistic regressions models with standard errors are in parentheses. Probabilities based on two-tailed significance tests.

Table 8 presents similar multilevel statistical models, but the outcome variables are daily Internet use, using the Internet for work, and online job searching. In terms of individual-level factors, Latinos are less likely to be daily Internet users than White non-Hispanics, while Blacks, Asians, and Whites do not differ in daily use. Latinos are again less likely to search for a job online, while Blacks are more likely to do so. Here, again, contextual factors loom large. Individuals from neighborhoods with larger Latino and Black populations are considerably less likely to be online daily, mirroring the patterns for home broadband access or mobile access. Thus racially and ethnically segregated neighborhoods are less likely to have digital citizens. However, neighborhoods with higher Latino, Black, and Asian populations are each linked to higher use of the Internet for job searching. Ironically, these same disadvantaged neighborhoods where individuals are the least likely to have reliable Internet access are the ones where individuals are most likely to seek economic opportunity online, in terms of finding employment. The barrier is clearly affordable access to the Internet, not lack of effort.

Ranking Chicago Neighborhoods: Opportunity and Inequality

The multilevel statistical models presented in Tables 7 and 8, using poststratification weighting, are also used to create estimates of the percent of the population online across Chicago's 77 community areas. Table A1 (see Appendix) ranks the neighborhoods in terms of broadband access at home in column 1 from high to low. High-speed access at home ranges from a high of 94% of the population in majority-White North Center, to a low of 36% in predominantly Latino Hermosa and Black East Garfield Park. Thus, the variation in broadband access geographically is large, varying by over 50%. Columns 2–7 show, for each Chicago neighborhood, the estimated percentage of residents who use the Internet in any location, engage in daily Internet use, have mobile access, are limited to mobile access only, do work online for a job, and search online for jobs.

These estimates are also mapped in Figures 1–6. Figure 1 maps the estimated probability of home broadband access in Chicago, our key variable of interest. This clearly reflects the geography of poverty and segregation in Chicago, with the heavily Black and Latino south and west sides colored red and orange, showing the lowest levels of home broadband adoption. The predominantly Black south side has some variation in home broadband adoption, given that some community areas have long had middle-class Black populations or have experienced recent gentrification (Pattillo, 1999, 2007).

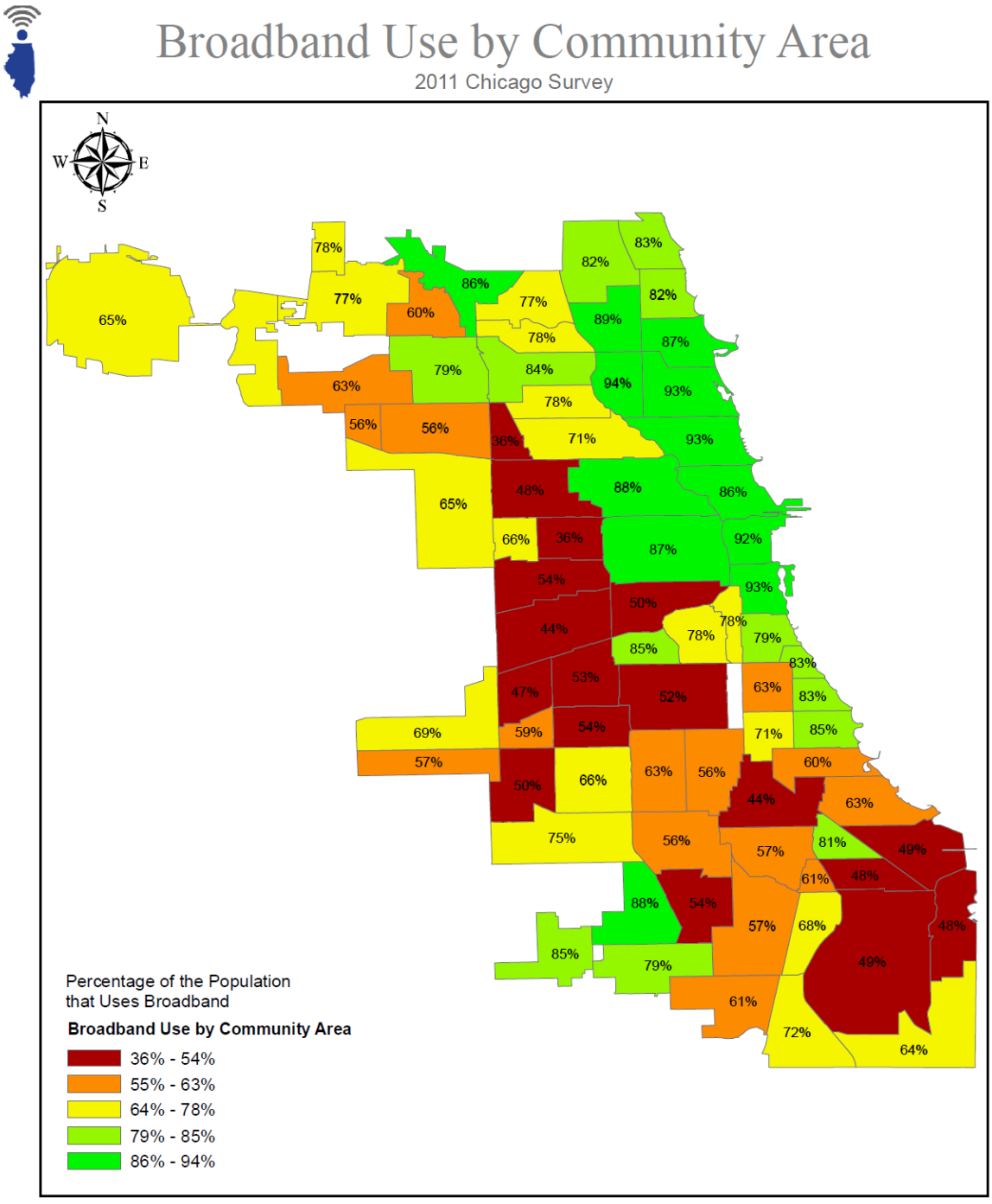

Figure 1. Estimated percent of the population with home broadband.

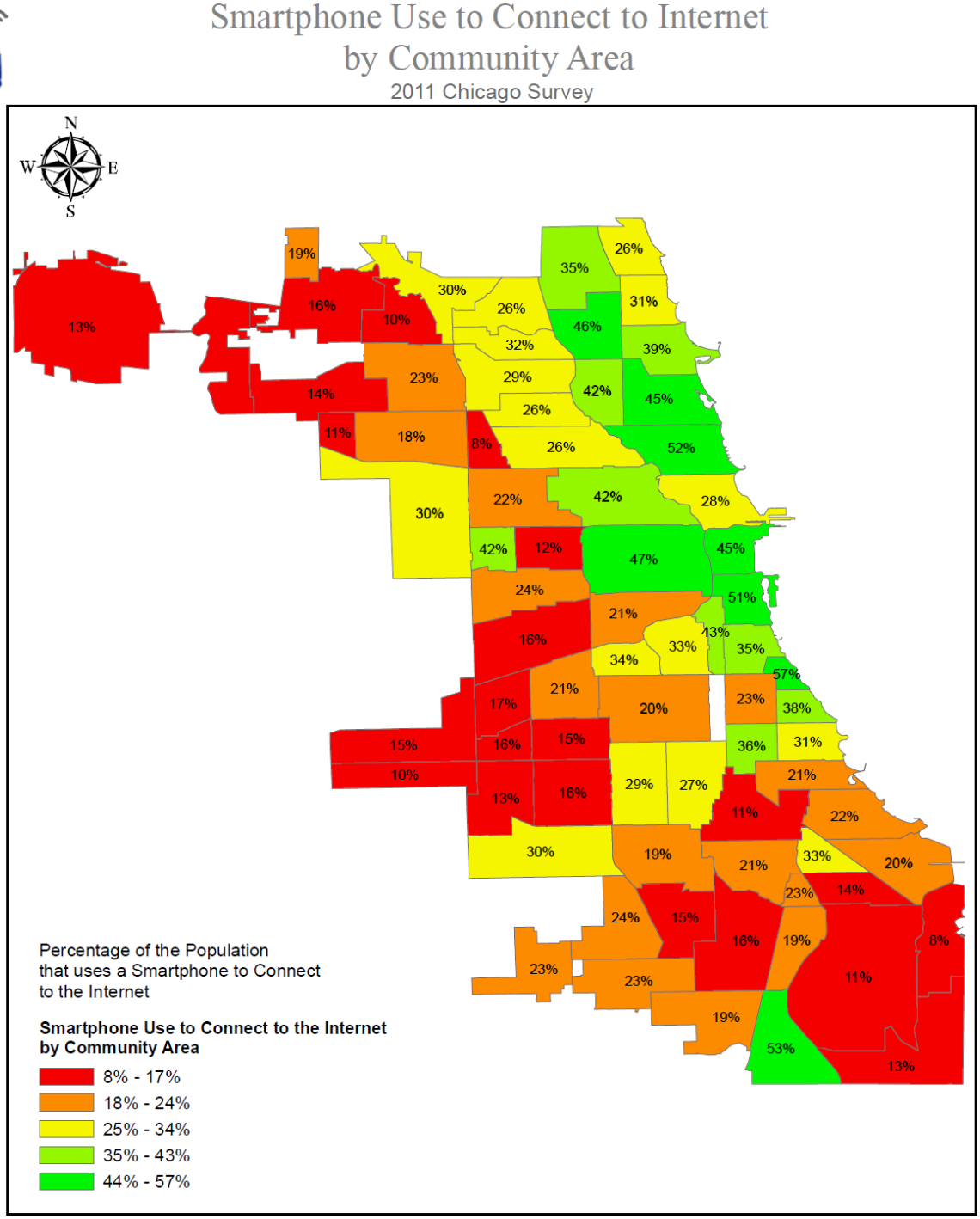

Figure 2. Estimated percent of the population with mobile Internet access.

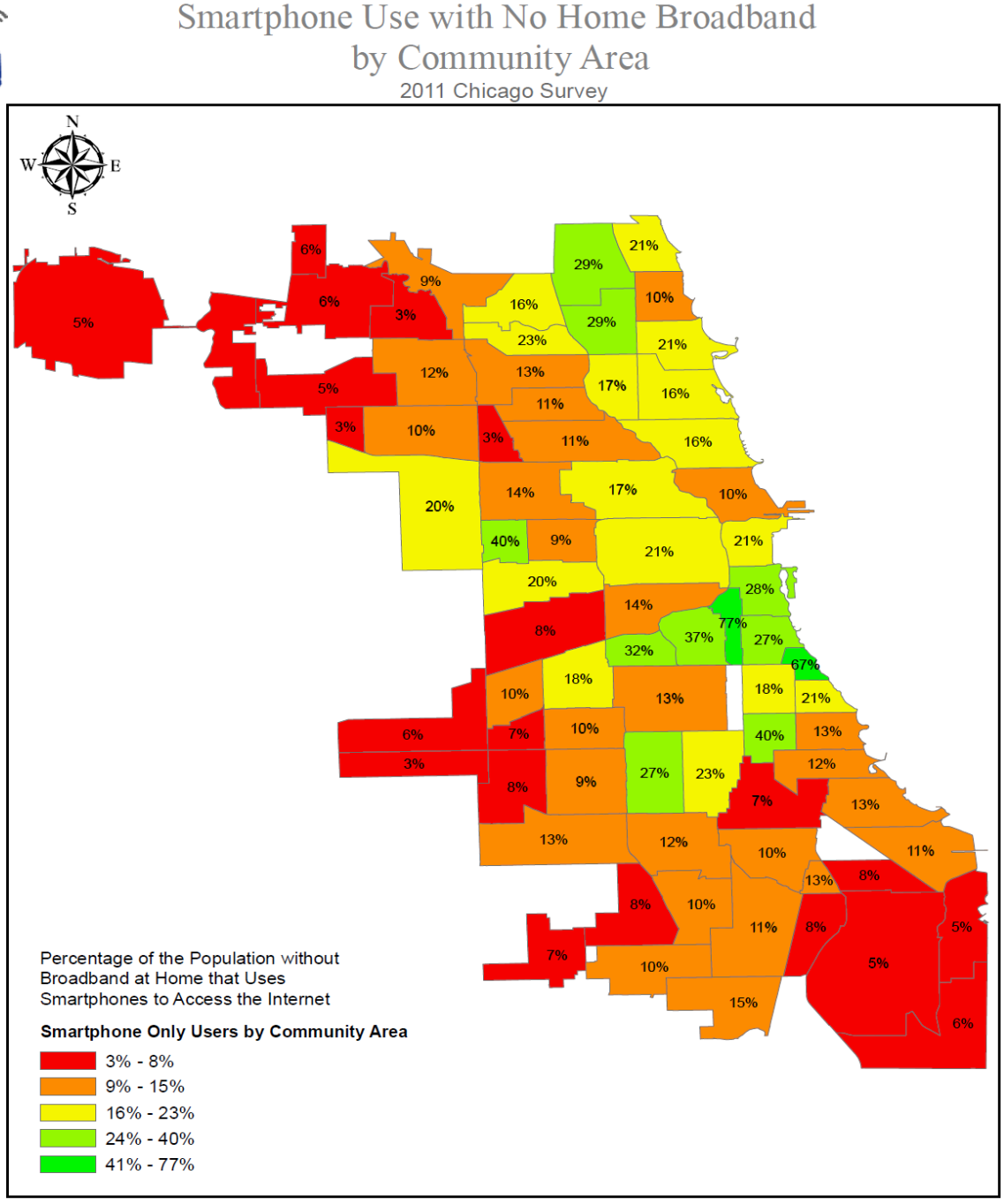

Figure 3. Estimated percent of the population with mobile Internet access only.

Figure 2 demonstrates that smartphone use, which is not as prevalent as broadband, still follows a similar pattern, with high-adopting community areas marked in green tending toward the north side and a few other gentrifying or higher-income areas.

Examining the percentage of those without home broadband who use smartphones in Figure 3, areas with high rates of mobile-only use are not generally the poorest communities. This is clear in the multilevel models that were used to generate the estimates. The map shows that 77% of those without home access use smartphones to go online in Armour Square, home to Chicago's "Chinatown." Oakland, with 67%, is an area that is mostly Black, but has developed new middle-class and mixed-income housing that replaced high-rise public housing in the area (Pattillo, 2007). The exceptions are West Garfield Park (at 40%) and Englewood (at 27%), predominantly Black areas with relatively high rates of mobile-only access and high-poverty populations. Youthful populations may explain high rates of smartphone-only use in some other community areas, especially locations near universities. There is little consistency in the geography of mobile-only access in Chicago, but it is clear that mobile Internet is not necessarily closing the gaps in the low-income communities of racial and ethnic minorities with the lowest rates of broadband adoption. Many of the red and orange areas with the lowest rates of smartphone-only Internet use also rank at the bottom for home broadband.

Figures 4–6 reveal the impact of the geography of adoption in terms of activities online. Daily Internet use is an indicator of the regular access needed to participate in society online, and the map of daily use largely tracks the patterns of home broadband adoption in Figure 4.

Internet use for work is an important indicator of digital citizenship in Chicago neighborhoods. Of course, this reflects the residents' occupations and education as well as their acquisition of Internet skills. Yet Internet use is growing throughout the job market, even in less skilled jobs (Brynjolfsson & Saunders, 2010), and 49% of all Chicagoans used the Internet on the job in 2011. In Figure 5, Internet use for work is especially concentrated in the community areas on the north side of the city along Lake Michigan. Some of these north side areas are wealthy while others are economically and ethnically diverse, but they stand in contrast to the city's poorest communities. This points to technology disparities that exacerbate other inequalities in the labor market, and may contribute to more limited employment options for residents of the poorest and most segregated neighborhoods.

Figure 6 shows that the Chicago neighborhood profile differs markedly for job searching, compared with Internet use at work. Overall in 2011, 48% of Chicago residents used the Internet to look for a job or information about a job. As the models underlying the estimates demonstrate, low-income neighborhoods participate in online job searching at high rates despite low levels of home broadband adoption. Green and yellow areas of high online job searching are scattered throughout the city and over much of the south and west sides. Areas with relatively high Internet job searching (60% or more) include low-income, predominantly Black communities on the west side, such as Austin and West Garfield Park, as well as Washington Park in the south. This demonstrates the motivation to go online that is often apparent in studies of libraries and other public access sites in low-income communities (Becker et al., 2010; Dailey, Bryne, Powell, Karaganis, & Chung, 2010). Yet compared with those who have home broadband, those who are less connected experience greater constraints when looking for a job online.

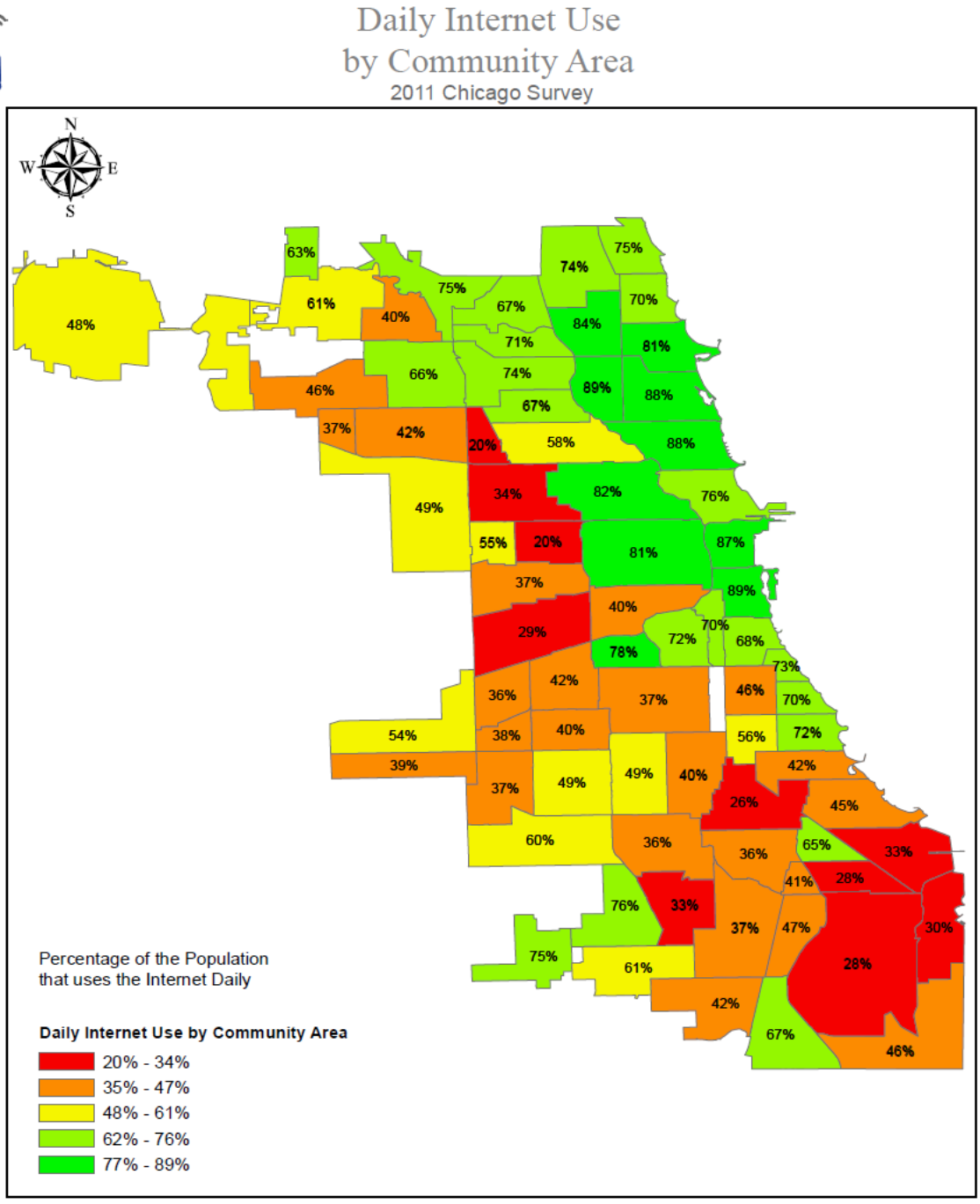

Figure 4. Estimated percent of the population using the Internet daily.

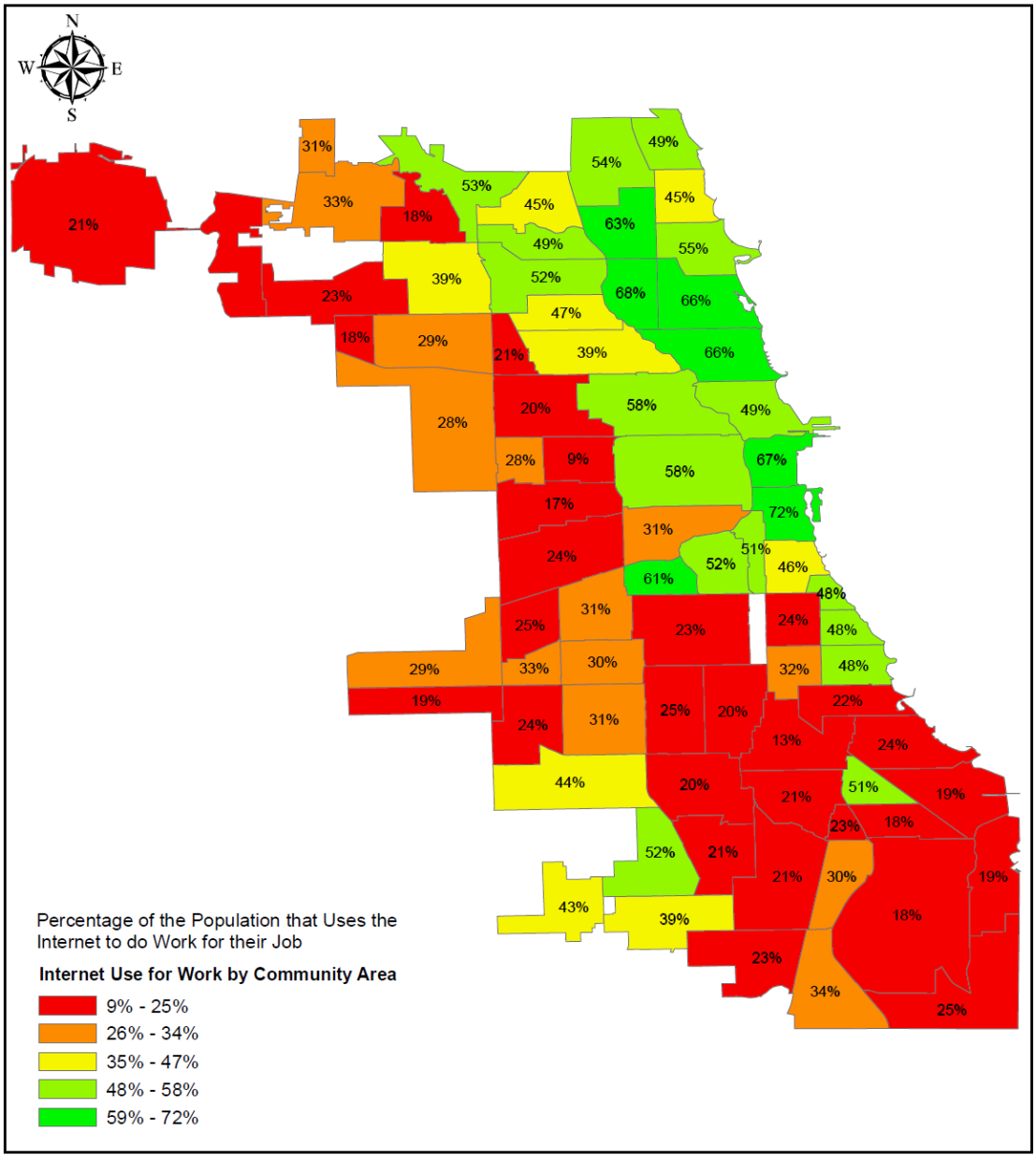

Figure 5. Estimated percent of the population using the Internet for work.

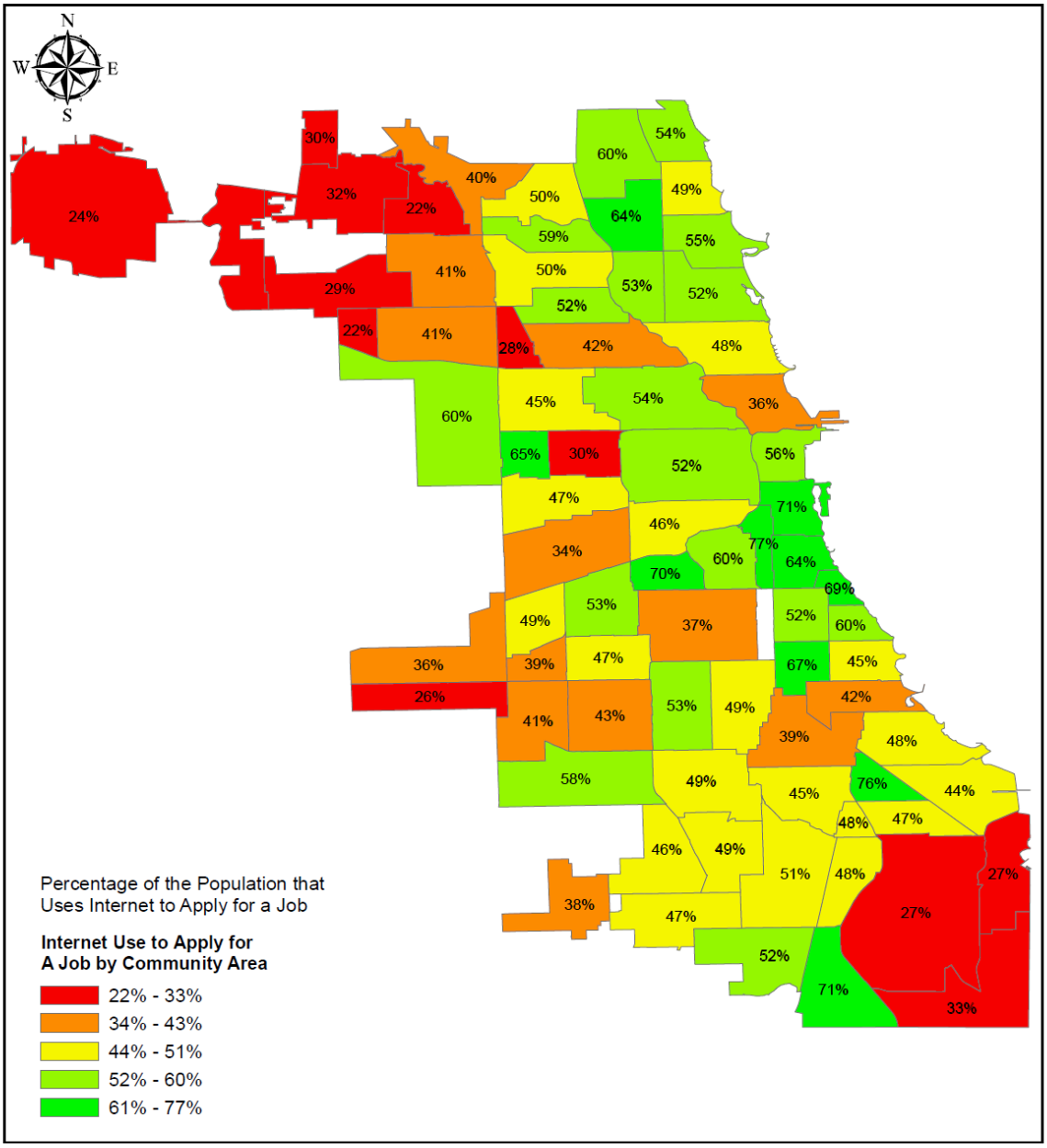

Figure 6. Estimated percent of the population using the Internet for job searches.

The patterns visible for the communities above suggest more than disadvantage at the individual level in poor neighborhoods. They also reinforce other social inequalities, especially for Internet use for work. Residents of poor communities may be more isolated, both from well-paying jobs and from local networks of friends and contacts who could connect them with better job opportunities that include Internet use for work (Kaplan & Mossberger, 2012).

Conclusion: Digital Citizens in Digital Communities

The analysis in this article demonstrates a strong link between different forms of access and capabilities for digital citizenship, including skills and activities online. Mobile phones have become a popular way to connect to the Internet among young people and minorities, and in fact Blacks in Chicago are more likely than Whites to be smartphone users. Yet despite common conceptions of mobile access as a solution for the disadvantaged, it remains a second-class mode of primary access: The personal convenience afforded by smartphones is counterbalanced by their more limited functions. Smartphone-reliant Internet users do better on many measures than other less connected individuals, but they compare unfavorably with home broadband adopters for many political and economic activities online and for all indicators of skill. They are also more likely than home broadband adopters to use the Internet for entertainment.

Mobile-only users in Chicago are, like other less connected individuals, more likely to be low-income, less educated, and Black, similar to results for central cities nationally in prior research (Mossberger et al., 2012). Latinos are most likely to be among those who are not online at all.

Federal programs support the mapping of broadband infrastructure, but the ability to map patterns of Internet use is of even greater consequence. The Internet has become a critical resource for work, job information, civic engagement, access to government services, and health. Yet we see that in Chicago, neighborhood poverty and segregation deepen disparities in access for low-income individuals.

- Residents of neighborhoods with high proportions of Blacks and Latinos (as well as older individuals) are actually *less* likely to own smartphones, as well as less likely to have home broadband. They are thus less likely to be digital citizens who use the Internet on a daily basis. Neighborhood context matters for opportunities to go online, and programs targeting such communities may be needed.

- While smartphone use is higher in poor neighborhoods (controlling for other neighborhood characteristics), mobile-only access does not seem to be closing gaps for many in the least connected community areas, which have low rates of both smartphone and broadband use.

Technology disparities have the potential to reinforce or even deepen existing place-based inequalities in health, the labor market, the democratic sphere, and access to public goods.

At the same time, there is some cause for optimism about future Internet use. One evident theme in these data is economic opportunity as a motivation for digital citizenship.

- Smartphone users, though relatively disadvantaged in access, have *higher* rates of online job searching than home broadband adopters.

- Internet job searching is most prevalent in communities with higher proportions of Blacks, Latinos, and Asians, even though some of these neighborhoods also have the lowest rates of broadband or smartphone access.

Together, these findings suggest that jobs motivate efforts to go online among both low-income individuals who are mobile-only users and residents of high-poverty racial and ethnic minority communities. This is consistent with previous research on attitudes regarding technology and economic opportunity among some disadvantaged groups, especially Blacks (Mossberger et al., 2003).

Additionally, these forms of more limited access may provide mobile-only Internet users and other less connected individuals with a gateway or a first step online. Mobile use is especially interesting in this regard, and more research about the attitudes of mobile-only users is needed to gauge the extent to which they are aware of other activities they could engage in online with more complete access, and whether they perceive a need to do more online. Mobile-only Internet users are younger than other less connected individuals (such as dial-up users), which raises the possibility of smartphone users gaining fuller access in the future. Reforms to the universal service fund and other policy solutions addressing affordability could help cell phone-only Internet users and other less connected individuals go online. But, as the evidence here shows, the growth in mobile phone use has not erased inequalities in economic and political participation online, and seems unlikely to do so as a primary form of Internet access.

The less connected continue to experience significant marginalization from society online, and there is a need for public policy to address the relevant disparities. A report by the Social Science Research Council concluded that the needs of many in low-income communities are "urgent" (Dailey et al., 2010, pp. 15–16), as "educational systems, employers, and government agencies at all levels have shifted services online—and are pushing rapidly to do more" (p. 4). Measuring users' activities online demonstrates the need for affordable broadband access as a critical element of digital citizenship and digital communities.

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Appendix A1. Predicted Probability of Online Activities by Chicago Community Area (CCA), from Tables 7 and 8.

	Home Broadband	*Use Internet Anywhere*	*Daily Internet*	*Mobile Phone Access*	*Mobile Access Only*	*Do Work for Job*	*Apply for Job*
CCA	Average	Average	Average	Average	Average	Average	Average
North Center	0.94	0.98	0.89	0.42	0.17	0.68	0.53
Lake View	0.93	0.98	0.88	0.45	0.16	0.66	0.52
Lincoln Park	0.93	0.98	0.88	0.52	0.16	0.66	0.48
Near South Side	0.93	0.99	0.89	0.51	0.28	0.72	0.71
Loop	0.92	0.98	0.87	0.45	0.21	0.67	0.56
Lincoln Square	0.89	0.98	0.84	0.46	0.29	0.63	0.64
West Town	0.88	0.96	0.82	0.42	0.17	0.58	0.54
Beverly	0.88	0.96	0.76	0.24	0.08	0.52	0.46
Uptown	0.87	0.97	0.81	0.39	0.21	0.55	0.55
Near West Side	0.87	0.96	0.81	0.47	0.21	0.58	0.52
Near North Side	0.86	0.96	0.76	0.28	0.1	0.49	0.36
Forest Glen	0.86	0.96	0.75	0.3	0.09	0.53	0.4
Hyde Park	0.85	0.95	0.72	0.31	0.13	0.48	0.45
McKinley Park	0.85	0.97	0.78	0.34	0.32	0.61	0.7
Mount Greenwood	0.85	0.95	0.75	0.23	0.07	0.43	0.38
Irving Park	0.84	0.95	0.74	0.29	0.13	0.52	0.5
Rogers Park	0.83	0.95	0.75	0.26	0.21	0.49	0.54
Oakland	0.83	0.95	0.73	0.57	0.67	0.48	0.69
Kenwood	0.83	0.95	0.7	0.38	0.21	0.48	0.6
West Ridge	0.82	0.96	0.74	0.35	0.29	0.54	0.6
Edgewater	0.82	0.96	0.7	0.31	0.1	0.45	0.49
Avalon Park	0.81	0.97	0.65	0.33	-	0.51	0.76
Portage Park	0.79	0.93	0.66	0.23	0.12	0.39	0.41
Douglas	0.79	0.94	0.68	0.35	0.27	0.46	0.64
Morgan Park	0.79	0.93	0.61	0.23	0.1	0.39	0.47
Edison Park	0.78	0.92	0.63	0.19	0.06	0.31	0.3
Albany Park	0.78	0.94	0.71	0.32	0.23	0.49	0.59
Avondale	0.78	0.93	0.67	0.26	0.11	0.47	0.52
Armour Square	0.78	0.97	0.7	0.43	0.77	0.51	0.77
Bridgeport	0.78	0.94	0.72	0.33	0.37	0.52	0.6

Norwood Park	0.77	0.93	0.61	0.16	0.06	0.33	0.32
North Park	0.77	0.95	0.67	0.26	0.16	0.45	0.5
Ashburn	0.75	0.93	0.6	0.3	0.13	0.44	0.58
Riverdale	0.72	0.91	0.67	0.53	-	0.34	0.71
Logan Square	0.71	0.88	0.58	0.26	0.11	0.39	0.42
Washington Park	0.71	0.91	0.56	0.36	0.4	0.32	0.67
Garfield Ridge	0.69	0.89	0.54	0.15	0.06	0.29	0.36
Pullman	0.68	0.89	0.47	0.19	0.08	0.3	0.48
West Garfield Park	0.66	0.9	0.55	0.42	0.4	0.28	0.65
Chicago Lawn	0.66	0.85	0.49	0.16	0.09	0.31	0.43
Austin	0.65	0.89	0.49	0.3	0.2	0.28	0.6
O'Hare	0.65	0.83	0.48	0.13	0.05	0.21	0.24
Hegewisch	0.64	0.86	0.46	0.13	0.06	0.25	0.33
Dunning	0.63	0.85	0.46	0.14	0.05	0.23	0.29
Grand Boulevard	0.63	0.86	0.46	0.23	0.18	0.24	0.52
South Shore	0.63	0.85	0.45	0.22	0.13	0.24	0.48
West Englewood	0.63	0.86	0.49	0.29	0.27	0.25	0.53
Burnside	0.61	0.86	0.41	0.23	0.13	0.23	0.48
West Pullman	0.61	0.85	0.42	0.19	0.15	0.23	0.52
Jefferson Park	0.6	0.79	0.4	0.1	0.03	0.18	0.22
Woodlawn	0.6	0.83	0.42	0.21	0.12	0.22	0.42
West Elsdon	0.59	0.81	0.38	0.16	0.07	0.33	0.39
Chatham	0.57	0.82	0.36	0.21	0.1	0.21	0.45
Roseland	0.57	0.84	0.37	0.16	0.11	0.21	0.51
Clearing	0.57	0.77	0.39	0.1	0.03	0.19	0.26
Montclare	0.56	0.76	0.37	0.11	0.03	0.18	0.22
Belmont Cragin	0.56	0.8	0.42	0.18	0.1	0.29	0.41
Englewood	0.56	0.8	0.4	0.27	0.23	0.2	0.49
Auburn Gresham	0.56	0.82	0.36	0.19	0.12	0.2	0.49
North Lawndale	0.54	0.77	0.37	0.24	0.2	0.17	0.47
Gage Park	0.54	0.79	0.4	0.15	0.1	0.3	0.47
Washington Heights	0.54	0.84	0.33	0.15	0.1	0.21	0.49
Brighton Park	0.53	0.81	0.42	0.21	0.18	0.31	0.53
New City	0.52	0.74	0.37	0.2	0.13	0.23	0.37
Lower West Side	0.5	0.79	0.4	0.21	0.14	0.31	0.46
West Lawn	0.5	0.77	0.37	0.13	0.08	0.24	0.41

South Chicago	0.49	0.77	0.33	0.2	0.11	0.19	0.44
South Deering	0.49	0.72	0.28	0.11	0.05	0.18	0.27
Humboldt Park	0.48	0.74	0.34	0.22	0.14	0.2	0.45
Calumet Heights	0.48	0.83	0.28	0.14	0.08	0.18	0.47
East Side	0.48	0.7	0.3	0.08	0.05	0.19	0.27
Archer Heights	0.47	0.78	0.36	0.17	0.1	0.25	0.49
South Lawndale	0.44	0.64	0.29	0.16	0.08	0.24	0.34
Greater Grand Crossing	0.44	0.72	0.26	0.11	0.07	0.13	0.39
Hermosa	0.36	0.57	0.2	0.08	0.03	0.21	0.28
East Garfield Park	0.36	0.57	0.2	0.12	0.09	0.09	0.3

Note: There were no survey respondents from Fuller Park, so no estimates could be generated.