Unraveling Different Barriers to Technology Use: Urban Residents and Neighborhood Effects

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FOR PRESENTATION AT

INTERNET, POLICY, POLITICS 2010: AN IMPACT ASSESSMENT

ST. ANNE'S COLLEGE, UNIVERSITY OF OXFORD

16-17 SEPTEMBER, 2010

DRAFT – PLEASE DO NOT CITE WITHOUT PERMISSION

Acknowledgements: This article is based on a study commissioned by the City of Chicago's Department of Innovation and Technology, and supported by the John D. and Catherine T. MacArthur Foundation and the Illinois Department of Commerce and Economic Opportunity. While we gratefully acknowledge this support, the authors are solely responsible for the interpretation of the data and conclusions. We would also like to acknowledge the contributions of David Redlawsk of Rutgers University for the survey he administered while directing the University of Iowa Hawkeye Poll and the work of Nina Savar at the University of Illinois Great Cities Data Visualization Laboratory.

ABSTRACT: The success of the new national broadband plan and federal policy require understanding barriers to broadband adoption. While current federal programs have invested heavily in rural infrastructure, significant disparities remain in urban areas, where broadband networks are available. Multilevel analysis of a random sample telephone survey in the city of Chicago demonstrates that barriers to technology access vary across neighborhood contexts and demographic groups. We show that neighborhood-level factors such as concentrated poverty influence the reasons why residents do not have home access, as well as individual-level factors. There are differences in barriers for African-Americans and Latinos as well. Place effects need to be taken into account in further research and theory on technology inequality, and in public policy as well. Targeted policies to address underserved urban areas demand attention, beyond broadband infrastructure for rural areas.

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Unraveling Different Barriers to Technology Use

Introduction

National broadband policies under the Obama administration create new opportunities to address the "digital divide" – or disparities in technology access and use. Among the policies that have the potential to narrow these inequalities are funding for broadband through the stimulus program, and the creation of a national broadband plan through the Federal Communications Commission (FCC). The American Recovery and Reinvestment Act (ARRA) has included a total of $7.2 billion for broadband stimulus spending, primarily for infrastructure, with smaller amounts devoted to public access and to outreach and training. The stimulus program breaks with past policy in important ways, with the potential to serve households as well as public institutions and to address issues such as the cost as well as the availability of broadband.

The success of broadband policy depends on more than laying fiber or constructing wireless networks, but also on whether it is affecting barriers to broadband adoption, or information technology use more generally. Sparsely-populated rural areas lack broadband infrastructure, and extending the network to those areas has been the major focus of the broadband stimulus program. This focus on the availability of infrastructure can crowd out policy attention to more complex problems for adoption. Urban residents in some neighborhoods also lag far behind in technology use, and better knowledge of the challenges they face can inform policy solutions. How can public policy address these disparities?

A large body of urban policy research suggests that place effects such as segregation and concentrated poverty within inner city neighborhoods affect experiences and opportunities for the poor, especially African-Americans and Latinos (e.g. Wilson 1987; Jargowsky 1997; Massey and Denton 1993; Wilson 1996). Some prior research using multilevel models has shown that residence in poor communities is significantly related to lower rates of technology use, controlling for individual-level factors. While community characteristics matter across racial and ethnic lines, they explain the gap in technology use between African-Americans and whites – it is poor African-Americans living in high-poverty communities that are affected by digital inequality rather than African-Americans as a whole. For Latinos, place effects are significant, but do not entirely explain the disparities (Mossberger, Tolbert and Gilbert 2006). This raises questions such as whether high-poverty communities present particular barriers to adoption, or whether there is variation in reasons for being offline across different poor neighborhoods.

In this paper, we first compare barriers to technology use in urban and rural settings using recent national data (the 2009 Current Population Survey), and follow this with a multilevel analysis of a Chicago survey with unique neighborhood-level data. The multilevel analysis uses a 2008 random-sample telephone survey of 3,453 Chicago residents to explore differences in home access by neighborhood characteristics as well as differences across individuals. We estimate barriers to internet use across Chicago's census tracts and the 77 official community areas of the city. The Chicago study offers an unusual opportunity to explore differences based on neighborhood, especially in high-poverty areas.

While the digital divide has been widely defined in the media and by scholars (Norris 2001; Bimber 2003; Mossberger, Tolbert and Stansbury 2003; Katz and Rice 2002) as a division between the poor who are generally offline and the affluent who are online, we find significant diversity in why some residents are not online. Some are offline by choice, some because of cost, and others because of a lack of skills or language barriers. The study shows that barriers to technology use vary by neighborhood as well as by demographic characteristics, and comparisons with national data show that Chicago is similar to other urban areas.

Chicago has large populations of both African-Americans and Latinos, and offers a good view of the contrasts between these groups. Additionally, many of the Chicago neighborhoods with high percentages of African-American and Latino residents are areas of concentrated poverty, which have been depicted in the urban policy literature as areas of structural disadvantage and social exclusion (see Jargowsky 1997; Massey and Denton 1993; Wilson 1987, 1996: Wilson and Briggs 2005). With comparisons to previous research on technology use and place, we use the Chicago study to suggest more general patterns of need in poor urban neighborhoods, and for diverse populations.

We first review prior research on why home access and broadband matter, the potential barriers for adoption, and how neighborhood effects could influence these barriers. After describing the survey and methods, we present an overview of information technology use in Chicago, followed by evidence on barriers for home internet use. The article closes with a discussion of the need to consider diverse populations and place factors (including neighborhood context) in theory and research on technology use, as well as in shaping public policy solutions.

The Policy Context for Broadband

According to the new National Broadband Plan released by the Federal Communications Commission:

> Every American should have affordable access to robust broadband service, and the means and skills to subscribe if they so choose. Not having access to broadband applications limits an individual's ability to participate in 21st century American life (FCC 2010, 10).

Yet, the latest Current Population Survey (CPS) of 129,000 Americans from the U.S. Census Bureau shows that only 69 percent of households have internet connections, and 63.5 percent have high-speed broadband. For individuals age 3 or older, the National Telecommunications and Information Administration estimates that in 2009, 32 percent of Americans did not use the internet anywhere, 35 percent did not use the internet at home, and 40 percent lacked broadband access at home. Nationally, then, 40 percent of the population (or 36.5 percent of households) were either offline entirely or less-connected in 2009 (NTIA 2010).

Home access and high speed connections encourage "digital citizenship," or the regular and effective use needed to participate in society online (Mossberger, Tolbert and McNeal 2008, 1). Those who have limited experience online are less likely to possess the skills they need to find information and to use the technology. They are less likely to use the internet for a broad range of activities (Howard, Rainie and Jones 2001), including information-seeking activities that can enhance individual opportunity – for jobs, health, education, and political participation among them (Hargittai 2002). Home access is strongly associated with these human capital-enhancing activities, controlling for other factors (Hassani 2006). It affords greater flexibility and convenience than public access or the workplace. Additionally, home access allows internet users more autonomy (DiMaggio et al. 2004; Hargittai and Hinnant 2008) to explore a range of uses and to gain experience free from the constraints on time and privacy that are common when internet use occurs at work or at public access sites such as libraries. The higher speeds and capabilities of broadband convey even more advantages, facilitating a greater range of online activities, as well as experience, frequency of use, and skill (Horrigan 2004; Rappoport, Kridel and Taylor 2002; Mossberger, Tolbert and Stansbury 2003). If home access and high speed access are necessary for full participation in society online, only 60 percent of Americans would qualify as digital citizens. Thus, four in ten Americans are still offline or have limited technology access.

Previous Research on Barriers to Technology Use

How might policy encourage more widespread technology use, at home as well as in multiple settings? Why is it that some people do not go online or do not have home access? The neighborhood environment may be one factor, shaping opportunities and constraints for technology use. Economic, racial and ethnic segregation are common in the U.S., and research on urban poverty has focused on geographic concentration and isolation rather than the less spatially-defined concept of social exclusion. The term has generally been applied to census tracts with a poverty rate of 40 percent or more (Jargowsky 1997), although recent work has argued that all high-poverty neighborhoods have place effects (Federal Reserve and Brookings Institution 2008) or that the traditional definition is too restrictive (Swanstrom 2007).

Concentrated poverty has been regarded as an urban problem, with African-Americans most likely to live in such conditions, although it is common for Latinos as well (Jargowsky 1997).[1] In recent years, there has been an increase in high-poverty neighborhoods that serve as immigrant gateways (Federal Reserve and Brookings Institution 2008). Scholars have portrayed this geography of poverty as responsible for a number of problems.Among them are isolation from mainstream values (Wilson 1987), distance from changing labor markets and exclusion from informal job information networks (Kain 1968, 1992; Kasarda 1993; Granovetter 1973). Such communities are characterized by crime, drug use, single-parent families and higher school dropout rates (Wilson 1987; Jargowsky 1997; South and Crowder 1999). With little commercial investment, such neighborhoods suffer from higher prices and lower quality goods and services (Caplovitz 1967; Federal Reserve and Brookings Institution 2008). Unequal educational opportunities in such neighborhoods are a result of higher needs and fewer resources due to dependence on local property taxes (Orfield and Lee 2005; Stone et al. 2001; Jossart-Marcelli, Musso

[1] The spatial concentration of urban poverty increased between the 1970s and the 1990s, but the 2000 census showed a decline in this trend. The decline was apparently due to the strong economy in the 1990s, which benefitted low-skill workers. More recent data show that concentrated poverty is on the rise again, and that while it has decreased in some areas, such as the Midwest, it has grown in the West and other regions (Jargowsky 2003; Kingsley and Pettit 2003 Swanstrom 2007).

and Wolch 2005) . Concentrated poverty represents a "double burden" for the poor who live in very poor areas (Federal Reserve and Brookings Institution 2008, 5)

Concentrated poverty in urban areas, however, may influence technology use in ways that are different from rural poverty. While public access technology may be more available in urban areas, disparities in education and in the labor market may still present hurdles for gaining skill or for affording high-speed access at home. Survey research in three Northeast Ohio communities (East Cleveland, Youngstown, and Shaker Heights) revealed higher percentages of residents in poor, African-American neighborhoods who used the internet but did not have home access. Neighborhood-level factors were significant predictors of going online without easy access: living in a predominantly African-American neighborhood was associated with a higher probability of technology use without home access, controlling for other factors (Mossberger, Kaplan and Gilbert 2008).[2] These patterns of use may reflect interest in technology despite economic constraints.

Individual attributes obviously matter as well for the acceptance or adoption of new technologies. According to the Theory of Planned Behavior (Ajzen 1991) technology adoption is driven by several factors. **1) Beliefs and attitudes,** including the perceived usefulness of the technology and also the fit between the technology and the individual's needs. **2) Subjective norms,** or peer pressure to use or avoid a particular innovation. **3) Perceived behavior control,** which addresses the resources that individuals need for technology use, or more specifically their own judgments about the adequacy of those resources. While individuals can make choices based on their own beliefs about a technology, those choices are conditioned by their perceptions regarding ease of use, their own abilities, available financial resources, and other factors. These categories involve individual attitudes and perceptions, and are useful for classifying more specific barriers to technology that may be cited by individuals as reasons for not using technology or having home access. The next section reviews possible barriers to technology, discussing

[2] This study used "buffers" that constructed a unique geography for each respondent within a half-mile radius, using data from the 2000 Census. See Mossberger, Kaplan and Gilbert 2008 for a fuller explanation of the methodology.

how the environment of poor urban neighborhoods might magnify the effects of constraints such as poverty or education at the individual level.

Attitudes - Interest. People who do not use the internet at home may simply be uninterested in going online or in making the investment to have home access. Causes for this lack of interest could be varied: a lack of awareness of the uses and potential benefits of the technology; perceived lack of relevance or fit; or rejection of the technology. Katz and Rice (2002, 48) demonstrated that awareness of the internet became less of a barrier between 1995 and 2000. Yet having heard of the internet is not the same as understanding its possible uses and benefits. Individuals who are less-educated may be less knowledgeable about or interested in the informational benefits of technology, while those who live in communities where there are relatively fewer adopters may not as readily learn about its potential uses. Additionally, nonadopters may avoid technology because of fears about unintended consequences, such as privacy and security threats. Recent survey data demonstrate that such fears are higher among those who have little or no experience with the technology (Horrigan 2010).

Choices are made by individuals based on their perceptions of the relevance of technology, according to uses and gratification theory (Katz and Rice 2002, 36-37; Mossberger, Tolbert and McNeal 2008, Chapter 3; Selwyn 2003). Selwyn et al. (2005), describe nonusers in Britain as most often choosing not to adopt technology because of a lack of fit with their lives. Rogers (1995) has identified perceived compatibility with existing practices and relative advantage as a motivation for adopting innovations, and Selwyn's interviews revealed that many who did not use the internet simply did not see a reason to change their current routines. One policy challenge for attracting those who are not currently online may be to demonstrate how technology is useful within their particular contexts. Technology inclusion programs that simply offer hardware and software have often failed to engage individuals in meaningful ways, or to respond to their needs (Warschauer 2003, 199; Katz and Rice 2002, 94-96).

Selwyn (2003) cautions that lack of interest cannot always be equated with knowledge deficits, and may not be remedied by providing nonusers with better information. Some individuals make a

conscious choice not go online in the same way that others choose to avoid television. This ideological refusal (Selwyn 2003) may be a form of opposition to mainstream culture. Haddon (2000) identified the elderly as resistant to innovations and to the values of consumerism.

Do poor and segregated neighborhoods have values or attitudes that downplay the utility of the internet because of social isolation or opposition to mainstream culture? The literature on concentrated poverty in American cities suggests that segregation and the prevalence of poverty can breed different attitudes and values among residents of such communities (Wilson 1987). Yet, in one national study that oversampled in high-poverty census tracts, respondents were asked about attitudes toward the internet. African-Americans were more likely than similarly-situated whites to express positive attitudes toward internet use, associating technology use with economic opportunity across a range of questions – getting a job, getting a promotion, and starting a business. Latinos were significantly more likely than non-Hispanic whites to believe that you need the internet to keep up with the times. Apathy may not be as prevalent in these groups, among nonadopters (Mossberger, Tolbert and Stansbury 2003). While the social networks of residents of poor neighborhoods may not contain as many adopters as in other communities, they do not seem to exhibit peer pressures to avoid technology. Similarly, Lenhart (2003) described nonusers who expected to go online some day as more likely to be young, African-American, and urban.

Resources - Cost. Both hardware and software costs could be expected to affect home access. Information technology can require a substantial up-front investment, despite falling prices for computers in recent years. Repairs and maintenance may add to costs, and outdated computers may not perform the functions that individuals need (Selwyn 2003). Internet services require a monthly payment, and this may be a greater hardship for low-income consumers than the initial costs, forcing monthly decisions about competing priorities. Historically, disparities have been greater in telephone use than in radio and television, which required one-time purchases (Schement and Forbes 2000). Lower-cost dial-up connections are increasingly inadequate for accessing content on the web, including graphics and video, and the price of broadband has not decreased as much as hardware (Van Dijk 2008). In fact, according to

the Pew Internet and American Life Project, the average price for broadband reported in their national survey *increased* from $34.50 per month in May 2008 to $39 per month in May 2009. While there are now many options for premium services, these do not account for the increase in average prices. The average cost of basic service rose from $32.80 to $37.10 over the same period (Horrigan 2009). High-speed broadband connections are more expensive in the U.S. than in many other countries. The U.S. ranks 13th in the average monthly broadband subscription price, with a cost that is about 50 percent more than figures for Greece, Japan, Finland, and the U.K. [3]Income has been found to be a consistent predictor of home access, and cost could be expected to pose a barrier for low-income populations (Fairlie 2004; Mossberger, Tolbert and and McNeal 2008; Katz and Rice 2002). Less experienced and less educated consumers may also experience additional problems with cost. In-depth interviews in high-poverty urban and rural communities indicate that internet provider practices such as bundling and short-term discounts create barriers for maintaining internet services over time (Dailey et al. 2010).

While urban areas generally have some availability of broadband, costs may be higher in poor communities due to a lack of competition or the type of high-speed internet access that is available.[4] The Federal Communications Commission (FCC) publishes data on the number of broadband providers per census tract, but this is not useful for identifying the options available for residential services. The FCC codes from one to three providers as a single provider, and more detailed information is guarded as proprietary data. Anecdotally, some low-income areas in Chicago have only one alternative, which is higher-cost cable modem. Still, without better data it is difficult to tell whether the problem is widespread. . Within poor urban neighborhoods, the availability and prices of goods and services tend to be worse than what is available in other neighborhoods, and financing or credit are less available (Caplovitz 1967; Federal Reserve and Brookings Institution 2008). This may impose extra burdens for

[3] Broadband average monthly subscription price, October 2008. Available at http://www.oecd.org/sti/ict/broadband/.

[4] In the Chicago survey, only 8 respondents cited a lack of broadband availability in their area as one reason for not having broadband at home.

acquiring the hardware and software needed for home broadband access. Higher prices for food and other items in poor neighborhoods may also limit investments in competing goods such as internet access.

Resources – Difficulty and skill. Frustration or anxiety about using technology could be expected to discourage home adoption. Self-reports of difficulty using the internet may be a matter of educational competencies, self-confidence, experience, or physical disabilities. Technology use requires a variety of skills or literacies (Warschauer 2003; Van Dijk 2005, 2008). Some measure of technical competence is needed, as well as online information literacy. The latter involves the ability to find, evaluate, and use information in a web-based environment, and educational disparities can be expected to inhibit such skills (Mossberger, Tolbert and Stansbury 2003). Lack of confidence or fear of technology may be a barrier for some individuals. Self-efficacy, self-image, and locus of control may be important factors influencing attitudes toward computer and technology use (Katz 1994; Ellen, Bearden and Sharma 1991; Todman and Monaghan 1994). Difficulties with technology may be physical as well as cognitive or attitudinal. Physical disabilities, especially those that affect eyesight or fine motor skills, can make it difficult to use screens or keyboards, and such individuals are less likely to be online. Adaptive technologies can compensate for many disabilities, but not everyone is aware of their availability or can afford them. Many individuals with disabilities also have low incomes (Dobransky and Hargittai 2006).

Difficulty using technology tends to be associated with older and less-educated individuals (Van Dijk 2008), although income, race, and ethnicity have also been found to be significant predictors for technical competence and information literacy (Mossberger, Tolbert and Stansbury 2003). There is more debate over the influence of gender on skills. Prior research has found no difference in information literacy and only small differences in self-reported technical competence, holding factors other than gender constant (Mossberger, Tolbert and Stansbury 2003). Women's attitudes toward their own technology competencies have often been ascribed to lower levels of self-efficacy (Pajares 1997, 4; see also Jackson et al. 2001; Liaw 2002; Whitley 1997).[5] In one study of one hundred randomly recruited

[5] See Selwyn (2003) for a review of psychological barriers drawn from the human-computer interaction literature.

participants, women tended to report lower levels of technology skill, yet observations revealed no differences in actual skill based on gender, controlling for other factors (Hargittai and Shafer 2006).

Language may be another barrier as well, and national surveys show large gaps in technology between English-speaking and Spanish-speaking Latinos in the U.S. (Fox 2009) In fact, surveys that include only English-speaking Latinos often find few disparities with non-Hispanic whites.[6] There are different possible explanations for these results. Although the internet has content available in many languages, English still dominates the web. Alternatively, predominantly Spanish-speaking Latinos may be more recent immigrants who have less exposure to the internet. The issue may be knowledge and skill rather than proficiency in English per se.

There may be a spatial dimension to beliefs about self-efficacy and self-reported skill, in areas where there is little exposure to technology, and where members of resident social networks have little familiarity with information technology. Another explanation may be that residents of poor urban neighborhoods are particularly disadvantaged in terms of employment that might include opportunities for learning about technology. The spatial mismatch thesis (Kain 1968, 1992; Kasarda 1993) describes residents of inner-city neighborhoods as distant from lower-skill job opportunities, which are increasingly located in suburban growth areas. Residents of poor neighborhoods may have less job experience or fewer educational skills due to the unequal quality of public education, or employers may assume that this is the case for minority job applicants from inner-city neighborhoods (Holzer 1996). Together these factors suggest place-based disadvantages in the labor market that could impact technology skills.

Neighborhood effects may also be visible in immigrant gateway communities where recent immigrants who are less-educated and poor cluster together in high poverty neighborhoods. There may be some differences between Latino and African-American neighborhoods in terms of perceived skill as a barrier, because of more exposure to technology outside the home in African-American communities. A

[6] See for example, the Usage Over Time spreadsheet that aggregates historical results from Pew surveys, at http://www.pewinternet.org.

number of studies, including the Chicago survey used for this paper, have shown high rates of public access and other technology use outside the home among African-Americans in poor communities.[7]

This review of the literature demonstrates that there are myriad reasons to expect that place matters for the reasons that urban residents do not use the internet at home. It is difficult, however, to tease out causal mechanisms underlying potential place effects. For example, skill barriers may have various causes, as demonstrated above. Indeed, causation for neighborhood effects is a complex issue that is not easily addressed in most of the research (Federal Reserve and Brookings 2008). In this study, we seek to identify whether neighborhood characteristics are significant predictors for barriers to technology use. Future research may explore the causes for neighborhood effects.

While the Chicago study included a number of questions about potential barriers to home adoption, the most common responses in both the Chicago and national CPS data described below are lack of interest, cost, and difficulty using the technology. Our hypotheses and multilevel analyses therefore concentrate on these three reasons for not having the internet at home. In the next section, we examine descriptive national data on barriers to broadband adoption and compare that to descriptive data from the Chicago study, before specifying hypotheses and discussing the multilevel analysis.

Recent National Survey Evidence

National surveys provide a comparative yardstick for evaluating the results in the Chicago study. The National Telecommunications and Information Administration (NTIA) depicts the main reasons that households do not have high-speed (broadband) internet connections at home in a 2010 report drawn from the October 2009 Current Population Survey of 129,000 respondents. The CPS broadband data include people with no internet access of any kind as well as those with dial-up (only a small percentage of home internet users have dial-up). The CPS provides results for rural, urban, and principal city households. The latter are particularly useful for comparison with the Chicago survey.

TABLE 1 ABOUT HERE

[7] See also Mossberger, Kaplan and Gilbert 2008 and Mossberger, Tolbert and McNeal 2008, chapter 5.

In both cities and the nation, the most common reasons for not having broadband at home are lack of interest, cost, and lack of a home computer (or adequate computer). Lack of interest is the most cited reason, although cost is a fairly close second. As Horrigan (2008; 2009) concluded from another national survey, federal policy that supports mainly infrastructure may not be addressing the largest problems for broadband adoption. Principal cities mainly reflect national trends, although clearly lack of availability is a minor issue in most major cities. Central city residents are somewhat less likely than others to say that they do not need the internet (3 percent less likely than Americans overall). They are also slightly more likely to cite cost or the lack of a home computer as a factor. It is difficult to interpret the "no computer" response, because this begs the question of why the household does not have a home computer. Is this because of cost or lack of interest?

More telling for the Chicago analysis are data on race and ethnicity for central city residents, shown in Table 2 below.

TABLE 2 ABOUT HERE

Both African-Americans and Latinos are significantly less likely than non-Hispanic whites to say they are not interested, and are more likely to cite cost and lack of a computer. Central cityAfrican-Americans are 12% less likely to say they are uninterested, whereas Latinos are 15 percent less likely to believe they don't need the internet compared to white non-Hispanics. Only 23 percent of the non-Hispanic whites who lack broadband say it is primarily because of the expense, whereas 34 percent and 36 percent of African-Americans and Latinos cite this reason. Similarly, Latinos (at 24 percent) are most likely to say they lack a home computer or that their computer is inadequate for broadband, whereas 21 percent of African-Americans and 17 percent of whites in central cities cite this barrier. The 2009 CPS reports that while 63 percent of Americans currently have broadband access at home, only 45 percent of African-Americans and only 40 percent of Latinos have broadband at home. Thus, majorities of African-Americans and Latinos do not have high-speed access at home. Race and ethnicity are key variables for understanding variation in technology access and use across neighborhoods.

How do geographic and demographic differences matter for technology access? To explore these questions, we take a closer look at the case study of Chicago.

Data and Methods

We are interested in understanding barriers to technology access and use at home at both the individual level and by place or neighborhoods. From previous research on technology adoption and on neighborhood effects, we would expect the following:

Interest

H1: Those who are less-interested in technology will be older and less-educated.

H2: African-Americans and Latinos will be less likely than non-Hispanic whites without home internet access to say they are uninterested.

Cost

H3: Those who cite costs are more likely to be African-American, Latino, and low-income.

Difficulty/Skill

H4: Those who cite difficulty with technology are more likely to be older, less-educated, and Latino.

Neighborhood Effects

H5: Residents of poor neighborhoods are less likely to cite lack of interest.

H6: Residents of poor neighborhoods are more likely to cite costs.

H7: Residents of poor Latino neighborhoods are more likely to cite difficulty with technology.

We draw on a unique random sample telephone survey of 3,453 Chicago residents conducted in June and July 2008 designed by the authors and conducted for us by the University of Iowa Hawkeye Poll. The survey was conducted in Spanish and English, and the cooperation rate was 27 percent, which is typical for telephone surveys.[8] The survey instrument took 12 minutes to complete (see appendix for survey questionnaire). The sample of residents 18 years and older was fairly representative of Chicago's

[8] This rate is comparable to recent surveys for the Pew Internet and American Life Project, for example (see pewinternet.org). The margin of error is 1.7% and the cooperation rate was 26.7%. Survey interviewers talked to 12,947 people and obtained 3,453 completed interviews for a cooperation rate of 26.7%. The survey included five call-backs for non-responses 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.

population. Of survey respondents, 45 percent were white non-Hispanic, 31 percent were African-American, 3 percent Asian-American, 19 percent Latino and 3 percent other or mixed race. According to the American Community Survey, in 2008, 45 percent of Chicago residents were white, 35 percent were black, 28 percent were Hispanic (of all races), and 5 percent were Asian. The survey was merged with census tract level data measuring neighborhood racial and ethnic context, educational attainment and relative affluence or poverty. The results are presented first analyzing the individual level factors alone, and also as multilevel models controlling for neighborhood-level factors (census tract and Community Area). The results of the multilevel models are reported geographically via maps of point estimates (predicted values) for Chicago's 77 officially-designated community areas.

Before turning to a multivariate analysis of barriers to home access, we highlight some descriptive findings from the study on technology use.

Internet use in the City of Chicago looks remarkably like the rest of the nation. Chicago as a whole parallels national averages, but as a diverse city, it also reflects the gaps in internet use that persist nationwide. As of summer 2008, 75 percent of Chicagoans used the internet, in comparison with 77 percent of households in the 2009 CPS[9] Sixty-one percent of the city's population had a broadband connection at home in 2008, in comparison with 63.5 percent of households nationally in 2009 (NTIA 2010).

Overall, 25 percent of Chicago residents were completely offline, another 6 percent used the internet at times but lacked home access, and 8 percent had more limited and slow dial-up connections rather than high-speed broadband. Approximately 60 percent of Chicago residents had adequate access, but nearly 40 percent had somewhat limited or no internet access. **Thus, 4 in 10 faced technology barriers of varying degrees in Chicago, just as in the nation overall.**

[9] The August 2008 tracking survey, Pew Internet and American Life Project, pewinternet.org shows 75 percent nationally who used the internet at least occasionally in some place. According to the 2009 CPS, 77 percent of households and 68 percent of individuals in the U.S. used the internet somewhere. But, the CPS individual figures include household members age 3 and up. Our data focus only on individuals 18 years and up, and do not include data for everyone in the household.

Reasons for No Home Use

Home access is an important resource for regular and effective technology use. The dependent variables in the following models are reasons for not having home access. The unique telephone survey used in this analysis included a question asking why respondents did not use the internet at home. We asked those who do not use the internet at all as well as those who do not use it at home to choose *any* and *all* reasons for not using the internet at home, and then asked them to select the most important reason for not going online there.[10] In this way, we could better understand whether respondents who said that they cannot afford the internet might simply be uninterested as well, and therefore not motivated to spend money on a computer or a monthly internet bill.

TABLE 3 ABOUT HERE.

Table 3 shows that lack of interest, affordability, and skill stand out as the most important main reasons for not having a home connection in Chicago.[11] We thus focus on these primary reasons in the multivariate analysis below. When respondents are allowed to give multiple answers, issues such as privacy and danger emerge as secondary reasons for many, even though few residents cite them as the main reason for not having the internet at home. Difficulty is also more important as a secondary reason – people who do not have the internet at home may not choose this as the only reason for not investing in the internet, but they are less confident of their skills. Only 5 percent say that use outside the home is their main reason for not having home access, but over half of the respondents can use the internet somewhere else. Still, there is little statistical relationship between the reasons for not using the internet at home in Table 3, even when respondents could choose multiple answers.[12] In other words, our analysis (not shown) revealed that those who are not interested in having the internet at home, for example, are not the same respondents who say that cost is the issue.

TABLE 4 ABOUT HERE.

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[10] See Appendix B for question wording. The data analyzed in models here are from the multiple reasons respondents don't use the internet at home.

[11] The frequencies are weighted to correct for differences between the sample and the population, but weights are not used in multivariate models.

[12] This was explored through factor analysis and through correlations.

There is considerable variation by race and ethnicity in the main reason for not having the internet at home as seen in Table 4. More white and Asian-American residents who do not currently use the internet at home are not interested, and African-Americans and Latinos are more concerned about cost than white non-Hispanics. Thirty percent of African-Americans and almost forty percent of Latinos offline cite affordability as the primary barrier to home access. Cost and lack of interest are nearly tied for African-Americans in this sample, but in comparison with whites, a much lower percentage of African-Americans say they are not interested. A lack of interest is the number one reason cited by white non-Hispanics for lacking the internet at home, with more than 40 percent giving this reason. Latinos are the group most likely to say that difficulty using the internet is the main reason for not having it at home. These figures are comparable to the 2009 CPS.

Predicting Barriers to Home Access at the Individual Level

To sort out differences among Chicago residents in reasons for not having home access, we conducted multivariate logistic regression, using the main reason for not using the internet at home as the dependent variable. The most frequently cited answers for the main reason were "I don't need it/not interested," "the cost is too high," "It's too difficult to use." Table 5 reports three models where the dependent variable is coded 1 if the respondent gave one of these reasons for not having the internet at home, and 0 for all other reasons. We model who reports they are not interested as a reason for being offline, who reports cost as a barrier, and who reports a lack of skills. We allow respondents to include multiple barriers to technology access to measure the full scope of the concept. Primary explanatory variables measure demographic factors paralleling previous research on the digital divide (Mossberger, Tolbert and Stansbury 2003). Age is measured in years, while binary variables for African-Americans, Latinos and Asian-Americans are included with white non-Hispanics as the reference group. Binary variables are included for females (coded 1, males coded 0) and parents with children. Educational attainment and family income are measured on seven-point indices. This first layer of the analysis focuses exclusively on individual-level predictors as explanatory factors.

Table 5 shows diversity in the barriers individuals face in lacking technology access at home. Older individuals and those with more income are more likely to say they are not interested as reasons for being unconnected, controlling for other factors. These individuals are making conscious choices to stay offline, and some may be resistant to new technology or see it as simply irrelevant (Selwyn 2003). However, the poor, Latinos, females and those with lower education are significantly more likely to cite affordability as the main reason for not having the internet at home. A lack of skill is a barrier for older citizens and Latinos. Notably, African-Americans and those with higher education are significantly less likely than other groups to mention a lack of skill as a reason for not having home access. Higher rates of public access use by African-Americans may have some positive effects on confidence in skills.

Because logistic regression coefficients are difficult to interpret in terms of substantive magnitude, we convert the coefficients in Table 5 to predicted probabilities in Table 6. Columns 1 ("I don't need it/not interested"), Column 2 ("The cost is too high"), and 3 ("It's too difficult to use") of Table 4 report the predicted probability of citing the above responses, respectively, by demographic attributes of the respondents. We hold constant all other explanatory variables in the model at their mean or modal values, and then vary each explanatory variable from minimum to maximum values to understand the independent effect of age, for example, on barriers to technology access.

Results: Lack of Interest as a Barrier

The analysis shows that older and more affluent respondents without home access are more likely to cite a lack of interest. African-Americans without home access, however, are significantly less likely than other racial and ethnic groups to say that they have no interest in the internet. Older respondents are 24 percent more likely to cite a lack of interest as the reason they are offline compared to young respondents; a 31 year-old (one standard deviation below the mean) has only a 32 percent probability of saying he or she is not interested, compared to an older individual (67 years, one standard deviation above the mean), who has a 56 percent probability of citing this reason.

Higher-income residents are also more likely to say that they are uninterested. Non-adopters with annual family incomes between $75,000 and $100,000 are 15 percent more likely to cite lack of interest

than respondents with incomes between $10,000 and $20,000. In comparison, education makes a smaller difference than age and income. Residents with a high school diploma are 9 percent more likely than college graduates to say they are not interested in the internet. African-Americans are 7 percent *less* likely than whites to cite a lack of interest in going online.

Results: Cost as a Barrier

Column 2 of Table 6 shows the probability of reporting cost as the primary barrier to the internet at home. Not surprisingly, residents citing cost are in fact low-income. However, Latinos (not African Americans) emerge at the ethnic group most likely to view cost as a barrier to technology access, once we control for factors such as income. The poor (with incomes between $10,000-$20,000 one standard deviation below the mean) are 30 percent more likely to perceive cost as a barrier to home access than the affluent (incomes between $75,000-$100,000, plus one standard deviation above the mean), all else equal. Poor Chicago residents have a 60 percent probability of citing cost barriers, compared to higher-income residents, who have less than a 30 percent chance of saying this.

Holding a respondent's income, education and age constant, Latinos were 15 percent more likely to say cost is a problem for internet access than non-Hispanics. African-Americans, in contrast, were only 3 percent more likely than whites to say cost is the main issue for home access, controlling for other factors. This difference was not statistically significant. The differences between African-Americans and whites in sensitivity to cost (apparent in the descriptive statistics) may therefore be due to higher levels of poverty rather than race per se. Interestingly, women were 15 percent more likely than men to mention cost as a reason for not having home access, all else equal.

Results: Skills as a Barrier

The last column of Table 6 shows that less-educated, older and Latino respondents are more likely to say that they have difficulty using the internet. Older respondents (one standard deviation above the mean) were 30 percent more likely to cite skill barriers compared to the young (one standard deviation below the mean). This is a very large difference based on age alone, and is not surprising given the

research on digital inequality. A lack of formal education also corresponds with a lack of skills. Respondents with only a high school degree were 15 percent more likely to say the internet is "too difficult to use" compared to those with a college degree. Latinos are 14 percent more likely to cite a lack of skills or difficulty going online as a barrier to use than white non-Hispanics, again indicating greater disparities for Latinos. In contrast, African-Americans are 7 percent **less** likely to cite skills as a barrier to use compared to whites who do not have home access. This may reflect internet use outside the home among African-Americans.

Predicting Barriers to Home Access for Individuals Controlling for Neighborhood Context

As a second layer to our analysis we merge our survey data with geographic information from the respondent's community area or neighborhood (census tract) from the 2000 U.S. Census. Previous research shows context matters for technology access, with significant variation between rural and urban areas. Race, ethnicity, education and income have been shown to be significant for technology use at the individual level, and at the aggregate neighborhood level in previous research that includes community-level factors (see Mossberger, Tolbert and Gilbert 2006; Mossberger, Kaplan and Gilbert 2008). These contextual factors affect technology access in both rural and urban areas. Additionally, scholars have found measurement error may occur unless researchers account for the political geography in which individuals reside (Primo, Jacobsmeier, and Milyo 2007). Chicago's community areas and census tracts vary dramatically in terms of affluence, education and racial/ethnic composition. Geographic variables included in the models are the percentage of African-Americans, Latinos, Asian Americans, high school graduates, and population living below poverty levels. These variables correspond to the urban literature on segregation and concentrated poverty.

Because of the multilevel data, we clustered the respondents by either census tract (Column 1) or community area (Column 2) reported in Tables 7, 8 and 9. This more complex analysis allows us to understand how context interacts with individual-level factors to predict technology access. The dependent variables and individual-level explanatory variables are the same as reported in Table 5. Predicted probabilities from the multilevel models are used to create point estimates of the reasons for no

home access for each of Chicago's 77 community areas. These findings are displayed graphically in maps in Figures 1-3.

FIGURE 1 ABOUT HERE.

Table 5 shows that when we add in contextual predictors, income matters at the tract or community level as well as at the individual level. Residents of more affluent neighborhoods without home internet access are more likely to say that they are not interested in going online. The map displayed in Figure 1 shows this pattern clearly for income. Some people are offline by choice, and they tend to be more affluent and live in higher income areas. Community areas in blue are estimated to have 50 percent or more of residents without home access who lack interest in the internet. Community areas in red are estimated to have between 25 and 35 percent of the population without home access who give this reason. Red areas tend to be among low-income areas in Chicago.

While at the individual level African-Americans were not more likely than whites to report cost as a reason for not having technology access at home, the multilevel models reported in Table 8 show that residents of communities with higher African-American populations are significantly more likely to state that cost is the main reason for not having the internet at home. This is an example where using only the individual-level data may mask important variation in what we seek to explain. Similarly, residents in neighborhoods with high proportions of Latinos are also more likely to cite cost. These patterns suggest neighborhoods with high concentrations of African-Americans and Latinos are particularly sensitive to cost burdens or perceived costs. These are areas of concentrated poverty as well, which reflect the confluence of poverty and segregation.

Figure 2 maps the predicted probability of reporting cost as the main reason for no access for Chicago's 77 community areas. The map shows there is dramatic variation across Chicago neighborhoods in cost as a barrier to home access. Community areas are marked in red where 39 percent or more of the population without home internet connections cite cost barriers. Segregated neighborhoods are disadvantaged in terms of technology access and cost appears to be a primary explanation.

FIGURE 2 ABOUT HERE.

Table 7 introduces neighborhood effects to predict a lack of skills as a barrier to home access. The results show individuals residing in higher-poverty census tracts are less likely to cite a lack of skills as a reason for not having home access, controlling for other factors. Residents in poor neighborhoods, whether white, Latino or African-American, may be more likely to cite cost as a barrier rather than a lack of skills. Additionally, residents in neighborhoods with a high percentage of African-Americans are more likely to mention difficulty in use (although at the individual level African-Americans are not). This may suggest some skill deficits or problems concentrated in these areas not captured by the other factors examined here, such as unequal educational opportunities not measured by formal educational attainment. Again, relying on individual-level survey data alone would hide this variation based on neighborhood racial diversity.

FIGURE 3 ABOUT HERE

The map in Figure 3 shows diverse patterns as well. In this case, the community areas colored in red are estimated to have higher percentages of residents without home access who find internet use difficult (between 30 and 45 percent). It is clear that many largely African-American community areas in the south of the city are on this list, but others are also colored in blue, meaning that they have the lowest rates of residents without access who have difficulty online (between 10 and 20 percent). The maps are based on multilevel models that combine neighborhood and individual characteristics, and factors such as age or Latino ethnicity of respondents are reflected in the results as well.

Policy Implications and Conclusion

Theoretically, this paper lends credence to the need for considering how digital inequalities vary by place, not only between cities and rural areas, but across neighborhoods as well. By drawing on large-sample survey data, measures of neighborhood context, and multilevel models, our research provides a more nuanced analysis of barriers to technology access than is possible in national studies. The data analysis demonstrates that barriers to technology access vary across neighborhood contexts and vary across different demographic groups. As expected, residents of more affluent neighborhoods are most likely to say they are simply not interested in going online, and at the individual level, it is older and

higher-income non-adopters who also mention lack of interest. While individual-level models show that African-Americans are not significantly more likely than whites to say that cost is a barrier, costs are more likely to be cited in neighborhoods with high proportions of either African-Americans or Latinos. Additionally, at the individual level, low-income respondents are those most concerned with cost. Self-reported difficulty or skill barriers are less frequently mentioned as reasons for not having home access, but residence in a high-poverty neighborhood is correlated with such skill barriers. While African-Americans are not more likely to cite skill deficits at the individual level, Chicagoans in neighborhoods with high proportions of African-Americans are, indicating some additional disadvantage in these areas. At the individual level, older, less-educated, and Latino respondents were those most concerned with difficulties using technology. Most of these relationships at the individual and neighborhood levels were in the expected direction, but high-poverty African-American neighborhoods appear to concentrate or magnify disadvantages that are not as apparent at the individual level for this group. The neighborhood effects apparent in technology use illustrate the double burden of residence in areas of concentrated poverty.

Barriers in Chicago indicate a need for affordable access in low income communities, as well as outreach and training. The differences between African-American and Latino neighborhoods suggest that strategies for digital inclusion also need to be responsive to particular needs across communities. Inclusion efforts that involve input from residents or community-based organizations can respond to these differences across neighborhoods. African-Americans in Chicago are among the less-connected, but their experience with going online outside of home makes them good candidates for home adoption of affordable broadband.[13] This is also consistent with patterns of technology use in other poor African-

[13] Multivariate models analyzing patterns of technology use based on the 2008 Chicago survey (not included here) show a statistically significant difference between African-Americans and non-Hispanic whites for internet use anywhere. But, probability estimates indicate that this is a relatively small difference once we control for factors other than race – only 6 percentage points – in contrast with the 18 percentage point difference between Latinos and non-Hispanic whites. African-Americans are also 14 percent more likely to use the internet at the library than similarly-situated whites, whereas Latinos are only 8 percent more likely than non-Hispanic whites to be public access technology users. Both groups, however, are 10 percent less likely than similarly-situated white Chicago residents to use the internet at home.

American communities (Mossberger, Kaplan and Gilbert 2008). Latinos stand out as perceiving many barriers to home internet access: cost and difficulty were analyzed here, but results in the full models (Appendix A) show that Latinos are also significantly more likely than non-Hispanic whites to cite lack of time and concerns about privacy. Latinos are also prevalent in the 19 percent of respondents without home access who mention language barriers online. Affordability, technical support and training are all needed to address disparities for Latinos. The wide differences between Spanish language and English language respondents (40 percent) suggest that recent immigrants or others who have learned little English may have a lack of experience with the internet as well as language barriers.

Residents living in areas of concentrated poverty suffer from many structural disadvantages that may affect technology use, including poor access to jobs and unequal educational opportunities (Wilson 1987, 1996; Jargowsky 1997; Massey and Denton 1993). Beyond poverty at the individual level, neighborhoods can serve to structure and reinforce inequality. Why, exactly does neighborhood matter for cost? This may be a matter of perceived costs or lack of information within social networks. It is also possible that the higher costs of other goods and services or the lack of competition in these neighborhoods may in fact make costs higher. Neighborhood effects for skill deficits may reflect long-standing educational disparities in poor communities, limited access to jobs that can encourage skill development, or lack of exposure to technology within social networks (especially in areas with many new immigrants). Future research might address some of these possible causes of community disadvantage. Broadband mapping is being supported by stimulus funding, and better data on competition among internet providers could inform further study. Systematic evaluation of federally-supported inclusion programs may also provide some answers about the causes for these barriers and effective strategies to overcome them.

The Chicago results expand our understanding of national trends, where costs are more frequently cited by urban residents, especially African-Americans and Latinos. Effective policies would make broadband more affordable either in low-income communities or more generally. Federal broadband assistance could be used to create fiber-optic or wireless networks that offer low-cost options in targeted,

underserved areas. Such policy experiments may shed more light on cost as a barrier to broadband adoption and at what level broadband would become affordable in these communities.

To date, however, broadband funding for urban areas has almost exclusively supported outreach and training or public access technology. Outreach and training programs will clearly answer some needs in poor communities, and public access will provide some help for support and for those who would be without internet access at only. But, widespread gains in broadband adoption within urban areas will require addressing affordability as well. Federal proposals for using the Universal Service Fund to subsidize broadband subscriptions (rather than only telephone service) could help some low-income residents, although the program is limited in scope (FCC 2010, 171-73).

Market solutions such as increased competition or new technologies in mobile broadband could also possibly reduce costs and help to close gaps in poor communities. While the National Broadband Plan seeks to encourage more competition, historically the U.S. has left broadband policy in the hands of incumbent providers (Benkler 2010). Recent surveys show greater adoption of cell phones by African-Americans and Latinos (Smith 2010), but to the extent that these remain the primary means of access to the internet, poor minorities will still have more limited capabilities online in many ways.

Ignoring the issue of cost in urban areas perpetuates current inequalities in technology that limit access to well-paying jobs, government services, educational opportunities, health information, and new modes of civic engagement (Bimber 2003; West 2005; Mossberger, Tolbert and McNeal 2008; Schmeida and McNeal 2007). Effective policy must be more inclusive, allowing diverse types of communities to employ a range of solutions to address availability, affordability, outreach, and skills. An important opportunity to truly bring the nation online might otherwise be squandered.

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TABLE 1. Main Reason for No High-Speed Internet At Home, U.S. and Principal City Households, 2009 CPS

Percent with no high-speed broadband or other internet access at home

	U.S.	PRINCIPAL CITIES	
	Total	Total	City/U.S. Difference
Don't need	38%	35%	-3%
Too expensive	26%	29%	3%
Use elsewhere	4%	5%	1%
Not available	4%	1%	-3%
No computer	18%	20%	2%
Privacy/security	0%	0%	0%
Children's access	0%	0%	0%
Lack of skill	3%	3%	0%
Other	6%	6%	0%

Source: Author calculations, Table 7a, 2009 CPS, http://www.ntia.gov

Note: Source tables give responses in thousands; 0% indicates less than 1,000 respondents gave this reason.

TABLE 2. Main Reason for No High-Speed Internet At Home, Principal Cities by Race and Ethnicity, 2009 CPS

	Non-Hisp. White	Black	Black/ White Diff.	Asian	Asian/ White Diff.	Hispanic	Hispanic/ Non-Hisp. White Diff.
Don't need	42%	30%	-12%	40%	-2%	27%	-15%
Too expensive	23%	34%	11%	19%	-4%	36%	14%
Use elsewhere	5%	5%	0%	7%	2%	5%	0%
Not available	1%	1%	0%	1%	0%	1%	0%
No computer	17%	21%	4%	15%	-2%	24%	7%
Privacy/security	1%	0%	-1%	0%	-1%	0%	-1%
Childen's access	0%	0%	0%	0%	0%	0%	0%
Lack of skill	3%	2%	-1%	14%	11%	3%	3%
Other	8%	6%	-2%	4%	-4%	5%	-3%

Source: Author calculations, Table 7a, 2009 CPs, http://www.ntia.doc.gov

Note: Source tables give responses in thousands; 0% indicates less than 1,000 respondents gave this reason.

TABLE 3. Reasons for No Internet at Home, Chicago, 2008
Percent of respondents who do not use the Internet at home

	Main reason	One reason
Don't need it/not interested	30%	48%
Cost is too high	27%	52%
Too difficult to use	9%	43%
Can use it elsewhere	5%	52%
Don't have time	5%	24%
I am worried about privacy	2%	57%
The internet is dangerous	2%	46%
Hard to use information in English	1%	19%
Physical impairment	3%	13%
Other	16%	--

n = 1,011

TABLE 4: Main Reason for No Internet at Home by Race and Ethnicity, Chicago, 2008

Percent of respondents who do not use the internet at home

	White Non-Hispanic	Black	Asian	Latino	Total
Don't need it/not interested	42%	29%	42%	19%	31%
Cost is too high	14%	30%	12%	37%	27%
Too difficult to use	9%	8%	9%	13%	9%

n = 1,011

TABLE 5: Reasons for Not Using Internet at Home (Logistic Regression)

Independent Variables	I am Not Interested			The Cost Is Too High		
	Coef.	Robust Std. Err.	P>|z|	Coef.	Robust Std. Err.	P>|z|
Age	**.029**	**.004**	**.000**	.005	.004	.263
Latino	-.079	.225	.725	**.647**	**.225**	**.004**
Black	**-.280**	**.161**	**.082**	.104	.166	.529
Asian	.784	.746	.293	-.879	.815	.281
Income	**.120**	**.041**	**.004**	**-.256**	**.043**	**.000**
Female	-.158	.145	.275	**.607**	**.146**	**.000**
Education	**-.115**	**.045**	**.012**	**-.084**	**.047**	**.073**
Parent	-.168	.196	.392	-.176	.197	.370
Constant	-1.45	.391	.000	.405	.371	.275
	Number of obs = 1011			Number of obs = 1011		
	Wald chi2(8) = 90.17			Wald chi2(8) = 103.14		
	Prob > chi2 = 0.0000			Prob > chi2 = 0.0000		
	Pseudo R2 = 0.0763			Pseudo R2 = 0.0876		
	Log pseudo likelihood = -645.9321			Log pseudo likelihood = -637.9946		

Independent Variables	It's Too Difficult to Use		
	Coef.	Robust Std. Err.	P>|z|
Age	**.037**	**.005**	**.000**
Latino	**.573**	**.228**	**.012**
Black	-.273	.169	.107
Asian	-.412	.648	.525
Income	**-.087**	**.041**	**.033**
Female	**.250**	**.147**	**.089**
Education	**-.201**	**.047**	**.000**
Parent	.260	.191	.173
Constant	-1.62	.382	.000
	Number of obs = 1011		
	Wald chi2(8) = 103.36		
	Prob > chi2 = 0.0000		
	Pseudo R2 = 0.0930		
	Log pseudo likelihood = -627.89249		

TABLE 6: Predicted Probabilities: What are the Reasons Chicago Residents Do Not Have Home Internet?

	Not Interested	Cost is Too High	Too Difficult to Use
White non-Hispanic (Baseline)	.50 (.04)	.54 (.04)	.43 (.04)
Latino	.48 (.04)	.69 (.05)	.57 (.04)
Difference Latino vs. White	-.02	+.15	+.14
Black	.43 (.04)	.57 (.03)	.36 (.03)
Difference Black vs. White	-.07	+.03	-.07
Male	.55 (.04)	.39 (.04)	.37 (.04)
Difference Female vs. Male	-.05	+.15	+.06
Annual Income			
Very Low ($0, -2SD)	.40 (.05)	.72 (.04)	.50 (.05)
Low ($10,000- $20,000, -1SD)	.47 (.04)	.59 (.03)	.45 (.04)
Mean/Average ($40,000 - $50,000)	.50 (.04)	.54 (.04)	.43 (.04)
High ($75-$100,000, +1SD)	.62 (.05)	.29 (.04)	.35 (.05)
Very High (more than $150,000, +2SD)	.66 (.05)	.21 (.04)	.31 (.05)
Difference Low to High	+.15	-.30	-.10
Education Level			
Less than HS	.54 (.04)	.58 (.04)	.52 (.04)
High School Graduate	.52 (.04)	.56 (.04)	.47 (.04)
Some College	.46 (.04)	.52 (.04)	.37 (.04)
College Graduate	.43 (.04)	.50 (.04)	.32 (.04)
Graduate Degree	.40 (.05)	.47 (.05)	.28 (.04)
Difference HS to College	-.09	-.06	-.15
Age of respondent			
Very young (18 yrs, -2 SD)	.24 (.05)	.50 (.06)	.15 (.04)
Young (31 yrs, -1 SD)	.32 (.05)	.51 (.05)	.22 (.04)
Mean/Average (49 yrs)	.50 (.04)	.54 (.04)	.43 (.04)
Old (67 yrs, +1 SD)	.56 (.03)	.55 (.03)	.52 (.03)
Very old (85 yrs, +2 SD)	.68 (.03)	.57 (.03)	.67 (.03)
Difference Young to Old (27-67 yrs)	+.24	+.04	+.30

Note: Predicted probabilities calculated with Clarify Software from the logistic regression models reported in Table 3. Probabilities estimated with control variables set at mean or modal values. Standard errors of the probability estimate in parentheses. Modal/mean values are a female, white non-Hispanic Chicago resident with no children and average age, income, and education.

Multilevel Models and Maps

TABLE 7: Probability of Citing a Lack of Interest as a Reason for No Internet Access: Multilevel Logistic Regression Estimates, Clustering by Census Tract or Chicago Community Area

	Model 1: Census Tract		Model 2: Community Area	
	Coef. (S.E.)	p>|z|	Coef. (S.E.)	p>|z|
Individual Level Variables				
Age	0.028	0.000	0.029	0.000
	(0.005)		(0.005)	
Latino	-0.084	0.727	-0.127	0.603
	(0.240)		(0.243)	
Black	0.176	0.512	-0.021	0.926
	(0.269)		(0.229)	
Asian	0.828	0.288	0.824	0.298
	(0.780)		(0.791)	
Income	0.110	0.015	0.119	0.008
	(0.045)		(0.045)	
Education	-0.123	0.010	-0.130	0.010
	(0.048)		(0.050)	
Parent	-0.190	0.326	-0.216	0.257
	(0.193)		(0.191)	
Female	-0.154	0.311	-0.138	0.358
	(0.152)		(0.150)	
Geographic Level Variables				
Pct. Latino	0.003	0.538	0.009	0.189
	(0.004)		(0.007)	
Pct. Black	-0.003	0.500	0.004	0.453
	(0.004)		(0.005)	
Pct. Asian	0.010	0.465	0.020	0.166
	(0.014)		(0.014)	
Median Income	0.000	0.099	0.000	0.033
	(0.000)		(0.000)	
Constant	-1.962	0.000	-2.728	0.000
	(0.540)		(0.749)	
Observations	984		984	
Pseudo R-squared	0.0812		0.0816	
Log-likelihood	-625.1008		-624.8473	
Wald Chi2	90.5790		86.2566	
Prob. > chi2	0.0000		0.0000	

Unstandardized logistic regression coefficients with robust standard errors in parentheses. Standard errors adjusted by clustering cases by geographic area (census tract or Chicago community area). Probabilities based on two-tailed significance tests. Variables with a p-value of .10 or lower are considered statistically significant with a 90% confidence interval; a p-value of .05 or lower is considered statistically significant with a 95% confidence interval.

TABLE 8: Probability of Citing Cost as a Reason for No Home Internet Access: Multilevel Logistic Regression Estimates, Clustering by Census Tract or Chicago Community Area

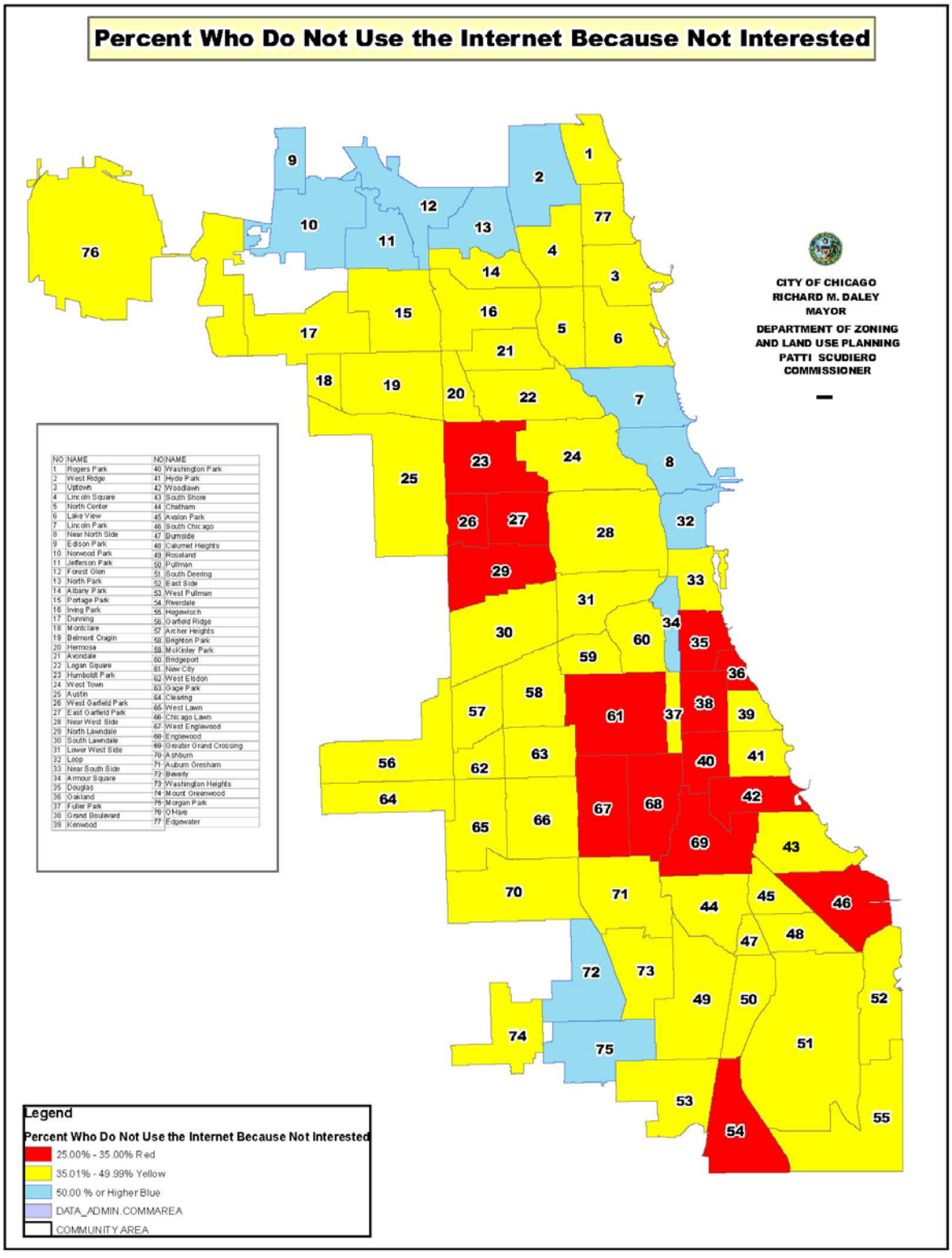
	Model 1: Census Tract		Model 2: Community Area	
	Coef. (S.E.)	p>|z|	Coef. (S.E.)	p>|z|
Individual Level Variables				
Age	0.006	0.143	0.005	0.313
	(0.004)		(0.005)	
Latino	0.310	0.212	0.509	0.009
	(0.248)		(0.196)	
Black	-0.020	0.946	0.052	0.804
	(0.299)		(0.210)	
Asian	-0.951	0.215	-0.906	0.228
	(0.767)		(0.752)	
Income	-0.253	0.000	-0.253	0.000
	(0.047)		(0.046)	
Education	-0.091	0.065	-0.099	0.029
	(0.049)		(0.046)	
Parent	-0.181	0.387	-0.199	0.309
	(0.209)		(0.196)	
Female	0.585	0.000	0.587	0.000
	(0.147)		(0.126)	
Geographic Level Variables				
Pct. Latino	0.020	0.002	0.020	0.007
	(0.006)		(0.007)	
Pct. Black	0.008	0.084	0.010	0.013
	(0.004)		(0.004)	
Pct. Asian	0.011	0.371	0.018	0.038
	(0.013)		(0.009)	
Pct. Below Poverty Line	0.006	0.382	-0.008	0.473
	(0.007)		(0.011)	
Pct. High School Graduate	0.019	0.047	0.020	0.114
	(0.010)		(0.013)	
Constant	-1.807	0.076	-1.737	0.172
	(1.018)		(1.273)	
Observations	984		984	
Pseudo R-squared	0.0959		0.0924	
Log-likelihood	-615.4857		-617.8867	
Wald Chi2	100.6470		101.4212	
Prob. > chi2	0.0000		0.0000	

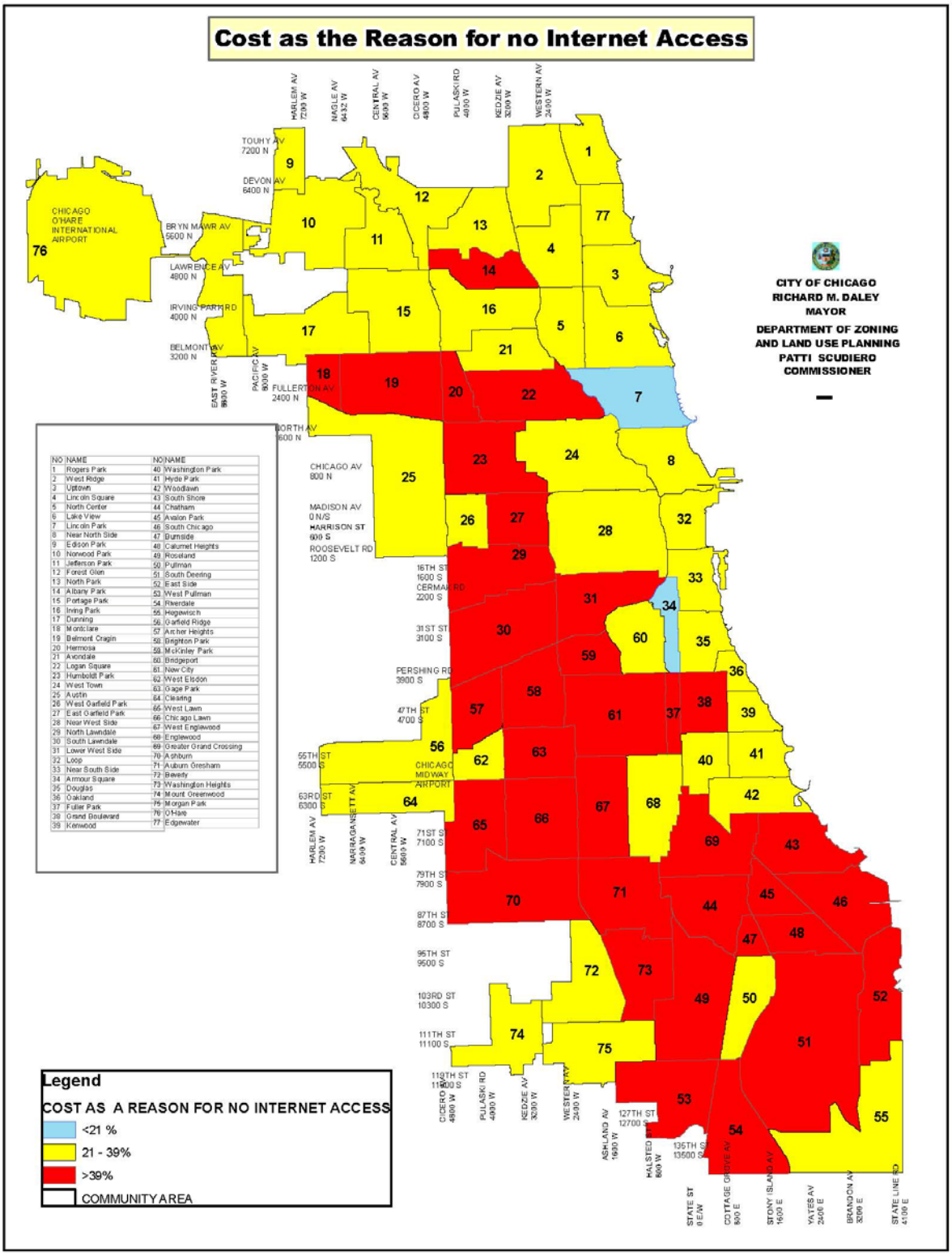
Unstandardized logistic regression coefficients with robust standard errors in parentheses. Standard errors adjusted by clustering cases by geographic area (census tract or Chicago community area). Probabilities based on two-tailed significance tests. Variables with a p-value of .10 or lower are considered statistically significant with a 90% confidence interval; a p-value of .05 or lower is considered statistically significant with a 95% confidence interval.

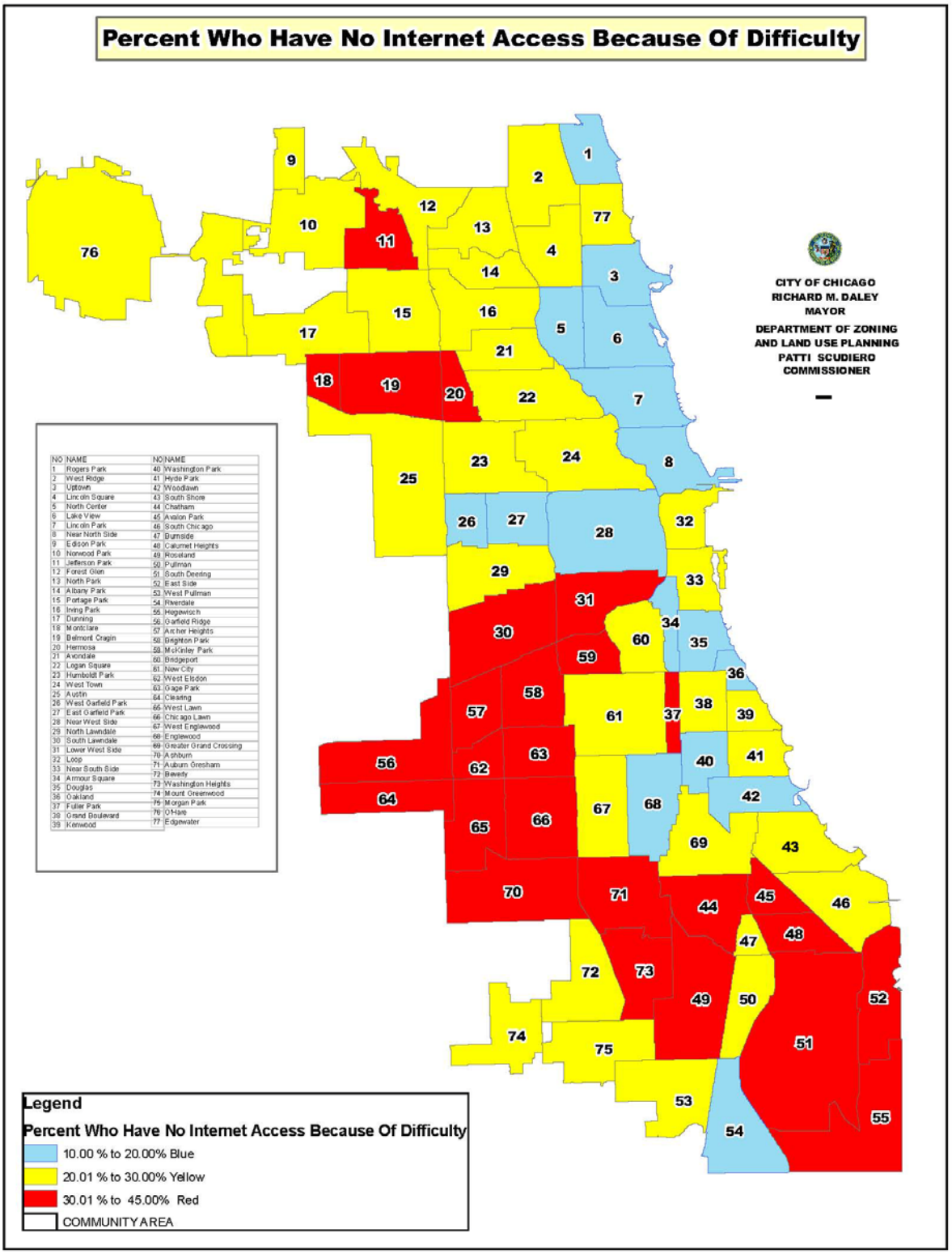
TABLE 9: Probability of Citing Too Difficult as a Reason for No Home Internet Access: Multilevel Logistic Regression Estimates, Clustering by Census Tract or Chicago Community Area

	Model 1: Census Tract		Model 2: Community Area	
	Coef. (S.E.)	p>|z|	Coef. (S.E.)	p>|z|
Individual Level Variables				
Age	0.038	0.000	0.038	0.000
	(0.005)		(0.005)	
Latino	0.603	0.022	0.586	0.051
	(0.264)		(0.300)	
Black	-0.231	0.435	-0.303	0.248
	(0.296)		(0.262)	
Asian	-0.352	0.557	-0.326	0.610
	(0.598)		(0.638)	
Income	-0.094	0.027	-0.096	0.021
	(0.043)		(0.042)	
Education	-0.203	0.000	-0.210	0.000
	(0.049)		(0.049)	
Parent	0.256	0.197	0.259	0.210
	(0.198)		(0.207)	
Female	0.229	0.144	0.218	0.185
	(0.157)		(0.165)	
Geographic Level Variables				
Pct. Latino	0.003	0.659	0.012	0.107
	(0.006)		(0.007)	
Pct. Black	0.005	0.189	0.010	0.036
	(0.004)		(0.005)	
Pct. Asian	0.007	0.569	0.010	0.388
	(0.013)		(0.011)	
Pct. Below Poverty Line	-0.025	0.001	-0.027	0.009
	(0.008)		(0.010)	
Pct. High School Graduate	-0.007	0.477	0.008	0.538
	(0.009)		(0.013)	
Constant	-1.034	0.273	-2.408	0.045
	(0.943)		(1.198)	
Observations	984		984	
Pseudo R-squared	0.1043		0.1039	
Log-likelihood	-602.4645		-602.7304	
Wald Chi2	120.5170		125.6407	
Prob. > chi2	0.0000		0.0000	

Unstandardized logistic regression coefficients with robust standard errors in parentheses. Standard errors adjusted by clustering cases by geographic area (census tract or Chicago community area). Probabilities based on two-tailed significance tests. Variables with a p-value of .10 or lower are considered statistically significant with a 90% confidence interval; a p-value of .05 or lower is considered statistically significant with a 95% confidence interval.


Percent Who Do Not Use the Internet Because Not Interested
CITY OF CHICAGO
RICHARD M. DALEY
MAYOR
DEPARTMENT OF ZONING
AND LAND USE PLANNING
PATTI SCUDIERO
COMMISSIONER
NO NAME
1 Rogers Park
2 West Ridge
3 Uptown
4 Lincoln Square
5 North Center
6 Lake View
7 Lincoln Park
8 Near North Side
9 Edison Park
10 Norwood Park
11 Jefferson Park
12 Forest Glen
13 North Park
14 Albany Park
15 Portage Park
16 Irving Park
17 Dunning
18 Montclare
19 Belmont Cragin
20 Hermosa
21 Avondale
22 Logan Square
23 Humboldt Park
24 West Town
25 Austin
26 West Garfield Park
27 East Garfield Park
28 Near West Side
29 North Lawndale
30 South Lawndale
31 Lower West Side
32 Loop
33 Near South Side
34 Armour Square
35 Douglas
36 Oakland
37 Fuller Park
38 Grand Boulevard
39 Kenwood
40 Washington Park
41 Hyde Park
42 Woodlawn
43 South Shore
44 Chatham
45 Avalon Park
46 South Chicago
47 Burnside
48 Calumet Heights
49 Roseland
50 Pullman
51 South Deering
52 East Side
53 West Pullman
54 Riverdale
55 Hegewisch
56 Garfield Ridge
57 Archer Heights
58 Brighton Park
59 McKinley Park
60 Bridgeport
61 New City
62 West Elsdon
63 Gage Park
64 Clearing
65 West Lawn
66 Chicago Lawn
67 West Englewood
68 Englewood
69 Greater Grand Crossing
70 Ashburn
71 Auburn Gresham
72 Beverly
73 Washington Heights
74 Mount Greenwood
75 Morgan Park
76 O'Hare
77 Edgewater
Legend
Percent Who Do Not Use the Internet Because Not Interested
25.00% - 35.00% Red
35.01% - 49.99% Yellow
50.00 % or Higher Blue
DATA_ADMIN.COMMAREA
COMMUNITY AREA


Cost as the Reason for no Internet Access
CITY OF CHICAGO
RICHARD M. DALEY
MAYOR
DEPARTMENT OF ZONING
AND LAND USE PLANNING
PATTI SCUDIERO
COMMISSIONER
CHICAGO O'HARE INTERNATIONAL AIRPORT
CHICAGO MIDWAY AIRPORT
Legend
COST AS A REASON FOR NO INTERNET ACCESS
<21 %
21 - 39%
>39%
COMMUNITY AREA
NO NAME
1 Rogers Park
2 West Ridge
3 Uptown
4 Lincoln Square
5 North Center
6 Lake View
7 Lincoln Park
8 Near North Side
9 Edison Park
10 Norwood Park
11 Jefferson Park
12 Forest Glen
13 North Park
14 Albany Park
15 Portage Park
16 Irving Park
17 Dunning
18 Montclare
19 Belmont Cragin
20 Hermosa
21 Avondale
22 Logan Square
23 Humboldt Park
24 West Town
25 Austin
26 West Garfield Park
27 East Garfield Park
28 Near West Side
29 North Lawndale
30 South Lawndale
31 Lower West Side
32 Loop
33 Near South Side
34 Armour Square
35 Douglas
36 Oakland
37 Fuller Park
38 Grand Boulevard
39 Kenwood
40 Washington Park
41 Hyde Park
42 Woodlawn
43 South Shore
44 Chatham
45 Avalon Park
46 South Chicago
47 Burnside
48 Calumet Heights
49 Roseland
50 Pullman
51 South Deering
52 East Side
53 West Pullman
54 Riverdale
55 Hegewisch
56 Garfield Ridge
57 Archer Heights
58 Brighton Park
59 McKinley Park
60 Bridgeport
61 New City
62 West Elsdon
63 Gage Park
64 Clearing
65 West Lawn
66 Chicago Lawn
67 West Englewood
68 Englewood
69 Greater Grand Crossing
70 Ashburn
71 Auburn Gresham
72 Beverly
73 Washington Heights
74 Mount Greenwood
75 Morgan Park
76 O'Hare
77 Edgewater


Percent Who Have No Internet Access Because Of Difficulty
CITY OF CHICAGO
RICHARD M. DALEY
MAYOR
DEPARTMENT OF ZONING
AND LAND USE PLANNING
PATTI SCUDIERO
COMMISSIONER
NO NAME
1 Rogers Park
2 West Ridge
3 Uptown
4 Lincoln Square
5 North Center
6 Lake View
7 Lincoln Park
8 Near North Side
9 Edison Park
10 Norwood Park
11 Jefferson Park
12 Forest Glen
13 North Park
14 Albany Park
15 Portage Park
16 Irving Park
17 Dunning
18 Montclare
19 Belmont Cragin
20 Hermosa
21 Avondale
22 Logan Square
23 Humboldt Park
24 West Town
25 Austin
26 West Garfield Park
27 East Garfield Park
28 Near West Side
29 North Lawndale
30 South Lawndale
31 Lower West Side
32 Loop
33 Near South Side
34 Armour Square
35 Douglas
36 Oakland
37 Fuller Park
38 Grand Boulevard
39 Kenwood
40 Washington Park
41 Hyde Park
42 Woodlawn
43 South Shore
44 Chatham
45 Avalon Park
46 South Chicago
47 Burnside
48 Calumet Heights
49 Roseland
50 Pullman
51 South Deering
52 East Side
53 West Pullman
54 Riverdale
55 Hegewisch
56 Garfield Ridge
57 Archer Heights
58 Brighton Park
59 McKinley Park
60 Bridgeport
61 New City
62 West Elsdon
63 Gage Park
64 Clearing
65 West Lawn
66 Chicago Lawn
67 West Englewood
68 Englewood
69 Greater Grand Crossing
70 Ashburn
71 Auburn Gresham
72 Beverly
73 Washington Heights
74 Mount Greenwood
75 Morgan Park
76 O'Hare
77 Edgewater
Legend
Percent Who Have No Internet Access Because Of Difficulty
10.00 % to 20.00% Blue
20.01 % to 30.00% Yellow
30.01 % to 45.00% Red
COMMUNITY AREA

APPENDIX B. SURVEY QUESTION WORDING (Reasons for No Home Internet Access)

Q7
INETHOM Do you ever use the Internet at home?

0 NO
1 YES→ **GO TO Q10**

8 Don't Know
9 Refused

Q8
NOACCESS I am going to read a list of reasons why some people don't use the Internet at home. For each, just tell me whether it applies to you by saying yes if it does, or no if it does not.

Q8A I don't need it, I'm not interested
Q8B The cost is too high for me
Q8C I can use it somewhere else
Q8D I don't have time to use the Internet
Q8E It's too difficult to use
Q8F I am worried about privacy and personal information online
Q8G The Internet is dangerous
Q8H It's hard for me to use the information in English
Q8I I have a physical impairment that makes it difficult to use the Internet

RESPONSE OPTIONS

0 NO
1 YES

8 Don't Know
9 Refused

Q9
MAIN Now, please tell me in a couple words the MAIN reason you don't use the Internet at home? [DON'T READ, CODE ANSWER TO BEST FIT]

1 I don't need it, I'm not interested
2 The cost is too high for me
3 I can use it somewhere else
4 I don't have time to use the Internet
5 It's too difficult to use
6 I am worried about privacy and personal information online
7 The Internet is dangerous
8 It's hard for me to use the information in English
9 I have a physical impairment that makes it difficult to use the Internet
10 Other

11 Don't Know
12 Refused