Tracking Mobility at the Household Level

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Abstract

Considerable literature supports the desirability of studying individuals in the context of their immediate social unit, the household. Focused studies of household composition reveal that households in economically disadvantaged populations with low homeowner-ship rates are particularly likely to experience additions, subtractions, and substitutions among members. This article examines the methodological challenges associated with defining, tracking, and explaining mobility at the household level. We describe a retro-active approach for linking individual household members across waves that was em-ployed for the Making Connections survey, a cross-sectional and longitudinal study of 10 low-income urban communities. Our method involved comparing individuals at three different points in time using a combination of probabilistic matching software, data queries, and human review. The process produced personal identifiers that could be integrated with the household-level data to identify changes beyond numerical shifts in household size. We use the combined data to examine mobility across a gradient of stability in household composition. Our work advances past studies in two ways. First, our definition of adding or losing individuals is calculated based on the presence or absence of a specific person, rather than numerical change in the number of adults and children in the household. Second, we demonstrate a more comprehensive and nuanced understanding of household mobility by examining various types of change in household composition—gaining, losing, or replacing individuals, or being repopulated entirely with new occupants—in combination with physical relocation during a 6-year period. A series of maps compares the patterns of residential movement and household composi-tion change within a specific territory.

Introduction

Considerable literature supports the desirability of studying individuals in the context of their immediate social unit, the household. This approach has only recently been embraced by demographers and other users of population and survey data in studies of residential mobility. In the opening to a special edition of *Population, Space and Place*, Cooke (2008: 1) applauded the emergence of a broader, more transdisciplinary perspective regarding family migration in the last decade, which "emphasizes the broader social and economic implications of family migration processes." He observed that this shift, which geographers initiated, later spread to include economists and sociologists. Cooke suggests that much of the prevailing literature mischaracterizes migration as the behavior of an individual instead of being a family process. This lingering tendency, despite the increasing diversification of family types and new negotiations of work and domestic life in the United States (Geist and McManus, 2008; Thistle, 2006), bears marked consequences for the study of families living in poverty. Focused empirical work on household composition reveals that households in economically disadvantaged populations with low homeownership rates are particularly likely to experience additions, subtractions, and substitutions among members. Analysts have been constrained in their ability to systematically explore temporal changes in household composition using longitudinal data by relying on summary variables measuring major changes in the life course (for example, a birth), numerical change in household size (the "head count"), or marriage and divorce (du Toit and Haggerty, 2012). Thus, migration tends to be characterized as the movement of "an intact family unit from one location to another," even in the emerging family migration studies (Cooke, 2008: 6).

This article examines the methodological challenges associated with defining, tracking, and explaining mobility at the household level. We attempt to build on the migration scholarship exploring the interaction of family events with migration events (see De Jong and Graefe, 2008) by outlining a methodological approach that further refines the former down to the level of the individual. We describe a retroactive technique that was employed after two waves of data collection for the Making Connections survey, a cross-sectional and longitudinal study of 10 low-income urban communities. Our method involved linking all individuals within the household at different points in time using a combination of probabilistic matching software, data queries, and human review. The process produced personal identifiers that could be integrated with the household-level data to identify changes beyond numerical shifts in household size. We used the combined data to examine residential mobility across a gradient of stability in household composition. Our work advances past studies in two ways. First, our definition of adding or losing individuals is calculated based on the presence or absence of a specific person, rather than on numerical change in the number of adults and children in the household. Second, we demonstrate a more comprehensive and nuanced understanding of household mobility by examining various types of change in household composition—gaining, losing, or replacing individuals, or being repopulated entirely with new occupants—in combination with physical relocation during a 6-year period. A series of maps compares the patterns of residential movement and household composition change within a specific territory.

Literature Review

Residential mobility, which has been shown to affect economic and social well-being, has been studied intensely by demographers, sociologists, economists, and geographers. Relocation data may be analyzed to help situate the experiences and perceptions of individuals reported in a survey in a particular geographic context, nested within his or her household. From the perspective of survey operations, changes in residential address increase the complexity and expense of panel studies. For responding households, however, a residential move is symptomatic of a major life change, complete with the challenges associated with adjusting to a new set of neighbors and decisions about where to go for basic services and amenities. Scholars across disciplines have debated the potential motivations for migration but seem to agree that the risks of instability associated with relocation in the short term (if not also in the long term) merit focused study. In his seminal article, "Bowling Alone," Putnam (1995: 75) wrote, "Mobility, like frequent re-potting of plants, tends to disrupt root systems, and it takes time for an uprooted individual to put down new roots."

Space/Place

Numerous studies on space/place, residential mobility, and race and ethnic relations have demonstrated that where one lives has consequences for social and economic well-being. Massey and Denton's landmark book, *American Apartheid: Segregation and the Making of the Underclass* (1998), convinced many American social scientists that residential segregation limits opportunity and perpetuates the impoverishment of African Americans. Mary Pattillo-McCoy's (1999, 2007) ethnographic work in middle-class Black communities reveals how neighborhood context shapes individual experiences of race and class. These authors draw heavily on the foundations of the Chicago School of Sociology, centered at the University of Chicago in the early 20th century, which emphasized using ecological approaches to investigate the dynamics of social boundaries across space. Another body of scholarship has focused on the Gautreaux Assisted Housing Program (1976 to 1998), which inspired the relocation of public housing residents from racially segregated areas with concentrated poverty to communities with greater affluence and better resources. Research by Rubinowitz and Rosenbaum (2000) suggests that moving to suburban neighborhoods positively affects educational and employment outcomes among youths whose families moved during the 1980s as part of the Gautreaux Program. These studies have established the need for systematic investigation of the neighborhood-, household-, and individual-level factors that constrain or promote geographic mobility.

Factors Influencing Residential Mobility

Different populations move at different rates. Between 2007 and 2008, only 12 percent of Americans changed residences—the lowest percentage on record (Cohn and Morin, 2008). Following the economic downturn of 2008, the 2009 rate was slightly higher: 15 percent of Americans were found to have moved in the previous year. This higher rate raises questions about the effect of the downturn among families living in disadvantaged neighborhoods, which generally experience higher rates of mobility (Coulton et al., 2009).

Attempts to isolate the factors influencing residential mobility have produced mixed results. In terms of socioeconomic status, recent reports attribute declines in migration partly to a rise in dual-career

households but observe that movers today—particularly those who move to a new town or city—are likely to be college-educated and/or pulled by job prospects (Cohn and Morin, 2008). Conversely, South and Crowder (1998b) found that, although higher incomes are associated with a lower propensity to end up in a poorer neighborhood among single mothers who move, none of the following variables produced a statistically significant influence: education, employment status, and receipt of benefits from the now-defunct Aid to Families with Dependent Children (AFDC). Another area of interest pertains to life-cycle characteristics. South and Crowder (1998a) found that residential mobility is lower among married and older people, homeowners, and families with children. Longitudinal data from the Panel Study of Income Dynamics (PSID) provide evidence that divorce among parents increases the probability that children will move to a new neighborhood, and that receiving neighborhoods tend to be significantly poorer for children with divorced parents than for children with stable two-parent families (South et al., 1998). Cohn and Morin's analysis of reasons for living at a current residence supports the expectation that family stability and "staying put" will be correlated; they indicate from their review data from a 2008 Pew Research survey of 2,260 adults that stayers most often report "the tug of family and connections" (Cohn and Morin, 2008: 3). Other social factors, including the race and ethnicity of both the household and neighborhood, have been found to affect migration patterns even after adjusting for other characteristics (South and Crowder, 1998a). The sum of these findings suggests that mobility comprises a complicated set of behaviors that are influenced by a number of primary and intermediary factors.

Administrative Challenges for Longitudinal Studies

Mobility is a major concern for collecting survey data, because it threatens to introduce coverage bias in the results. Tracking individuals from known to unknown locations brings logistical challenges and additional cost (Ansolabehere and Schaffner, 2010; Marshall and Bush, 2010). Survey data collection at the household level proves especially challenging for longitudinal studies, because changes may occur due to births, deaths, marriages, divorces, children leaving home, imprisonment, and countless other situations (Duncan and Hill, 1985; Marshall and Bush, 2010). To define the "household" as a specific combination of individuals is thus inappropriate, leaving most with the option of prioritizing one individual and considering those found to be living under the same roof to comprise a household. Many studies begin by selecting the "head of household" as the respondent and tracking the head and his or her cohabitants over time and space. This definition provides a clean methodological solution but can lead to ill-fitting interpretations in the event that some household members remain constant while others leave, join, or are replaced, and the dynamics among individuals shift. An additional factor pertains to differences in the interpretation of the question, "Who (else) is living here?" (Marshall and Bush, 2010; Martin, 1999). For example, in the Making Connections survey, interviewers were instructed to clarify that individuals who were incarcerated at the time of the interview should be included in the household but adult children living in noninstitutional housing away at school, such as an apartment, should not be included. These guidelines are intended to ensure systematic data collection, but they may not be entirely in sync with every respondent's understanding of his or her household. It is possible that individuals who play an important positive or negative role in the respondent's support network might be omitted under these definitions, or that someone who contributes little or not at all to the daily experiences of the household may be included.

Knowing about changes in household composition is important when seeking to understand patterns of change within a population (Laurie and Sullivan, 1991). Some panel surveys build into the initial study design a method for producing unique personal identifiers so that, as the data are collected, matches are established and subsequent individual links are possible across waves (for example, National Survey of Families and Households; National Longitudinal Survey of Youth, 1997; Living in Ireland Survey). Marshall and Bush (2010) point out that, although identifying households as the unit of analysis in cross-sectional research is straightforward, this straightforward approach is not the case in longitudinal studies. The inevitable changes in household composition pose a considerable challenge to following households over time. The Panel Study of Income Dynamics (Duncan and Hill, 1985) found that, after 1 year, 22 percent of households had some compositional change, after 5 years compositional change grew to 55 percent, and after 15 years it grew to 88 percent (Laurie and Sullivan, 1991). "A system (for creating unique personal identifiers) that is foolproof and straightforward is critical, so as to avoid any possibility that data can become mixed from individual to individual over different waves" (Marshall and Bush, 2010: 67).

Scientific and operational variations, as well as some similarities, exist among studies that track household composition. The National Survey of Families and Households uses a national multistage area probability sample. The survey collected data about the composition of families, family background, and the relationship of household members to each other, including marriage, separation, and divorce histories and adoption, child custody arrangements, and stepfamily relations. To facilitate the examination of family household composition and changes over time, the study assigned a unique household identifier to each member of a household. The sample for the Living in Ireland Survey was drawn from voter registration records; however, all members of a household in which a sample member lived were assigned a unique identifier, and, in subsequent waves, an attempt was made to reinterview all household members. This list included those who moved and those who were newly added to an existing household. The movers kept their original identifiers, and all the people living in their housing unit were interviewed and assigned a unique identifier. The National Longitudinal Survey of Youth 1997 (NLSY97) sample is designed to represent U.S. residents in 1997 who were born during the years 1980 through 1984. The household roster section collected information on all members of a respondent's household, and the nonresident roster portion gathered data on those members of the respondent's immediate family (for example, parents, siblings, spouse, or children) who lived elsewhere. For each household resident or nonresident relative, those rosters collected demographic information, marital status, educational attainment, and employment status. All household members were assigned a unique household identifier. Finally, the initial sample for the Panel Study of Income Dynamics (PSID) consisted of two independent samples: a cross-sectional, national sample (based on stratified multistage selection of the civilian noninstitutional population of the United States) and a national sample of low-income families. Both samples are probability samples. Although these studies have significant differences in sample design and survey content, each keeps track of household members to allow for the measurement of changes in household composition over time.

Current Study

In this article, we describe the methodological challenges associated with defining, tracking, and explaining residential mobility at the household level. Our data are derived from the Making Connections survey, a study of a multisite initiative designed to improve conditions in low-income urban communities. We endeavor to improve on past studies by approaching mobility as a dynamic family process. We use Geographic Information System (GIS) software to track the movement of respondents within and around low-income neighborhoods in U.S. cities from 2002 to 2011. We combine the geographic data with measures of household composition change to illustrate and argue for a two-dimensional approach to studying mobility.

Data

The data for this analysis are derived from the Making Connections survey (http://mcstudy.norc.org), a longitudinal and cross-sectional study conducted in 10 low-income neighborhoods across the United States. The survey aimed to gather household- and community-level data to inform program planning and was part of a larger initiative funded by the Annie E. Casey Foundation. The neighborhoods are located in inner-city areas within metropolitan Denver, Colorado; Des Moines, Iowa; Hartford, Connecticut; Indianapolis, Indiana; Louisville, Kentucky; Milwaukee, Wisconsin; Oakland, California; Providence, Rhode Island; San Antonio, Texas; and Seattle, Washington. The demographic and socioeconomic characteristics of the survey neighborhoods vary considerably. For example, the Denver neighborhood is home to large Latino and foreign-born populations with predominate origins in Mexico and Vietnam. Most are renting and display high residential mobility, including considerable long-distance movement (Bachtell and Latterner, 2011). San Antonio is distinct in that it is almost exclusively Hispanic (90 percent), and respondents report low levels of education (45.6 percent of respondents had less than a high school diploma) and low household incomes (with a median of $18,000). Despite these differences, the sites share three main similarities: they all are located in urban sectors of metropolitan areas, are economically disadvantaged, and are the focus of local community outreach efforts funded in part by the Annie E. Casey Foundation.

NORC gathered baseline survey data between 2002 and 2004 in the 10 sites listed in the previous section, and a first followup effort (wave 2) was completed between 2005 and 2007 at each site. Between 2008 and 2011, NORC completed a second round of followup interviews (wave 3) in 7 of the 10 sites. Interviews for the Making Connections neighborhood surveys were executed in roughly 3-year intervals using a paper-and-pencil questionnaire. The main questionnaire topics include neighborhood connections, community involvement, civic engagement and volunteerism, employment, and income and assets. In addition, a separate set of questions were devoted to the experiences of children living in the household, including topics about childcare arrangements, schooling, participation in extracurricular activities, and health.

The Making Connections survey design is unique because it combines cross-sectional and longitudinal (panel) methodologies. In each wave, NORC employed area probability sampling techniques to select a random set of addresses representative of each target neighborhood. In households with children, interviewers randomly selected one child to be the focal child and chose the parent or guardian who knew the most about the focal child to be the respondent (meaning the selection of the adult respondent was not random, although that of the focal child was random). In adult-only

households, the focal child selection process was omitted and one adult was randomly chosen to be the respondent. In waves 2 and 3, interviewers revisited these sampled addresses in person or by telephone with the goal of collecting data with the current occupants, whether or not they were interviewed in the past. Many times, the occupants had not changed. Other times, new people were found to have moved in. NORC also subsampled new addresses at the start of each followup effort to include buildings that were constructed since the previous wave. This methodology yields a cross-sectional snapshot of neighborhood residents at different points in time. Making Connections is also longitudinal, because NORC (1) reinterviewed families who remained at sampled addresses within target neighborhoods and (2) tracked families with children who moved to a new address either inside or outside of the neighborhood.

A primary benefit of the Making Connections data is that detailed information regarding occupants was gathered in a household roster at three points in time, including the age, sex, and relationship of each person to a focal child in all waves. In waves 2 and 3, interviewers also gathered the relationship of each person to the respondent. A few limitations must also be acknowledged. First, the 7 sites included in our analysis are not representative of poor urban communities nationwide. The Annie E. Casey Foundation, with assistance from local leaders, selected the neighborhoods used for the survey based on the presence of existing grassroots or community organizations whose missions were consistent with the objectives of the Making Connections initiative. It is possible that disadvantaged communities in other cities may demonstrate different patterns of mobility. Similarly, as with any longitudinal study, unmeasured differences due to sample attrition may exist; that is, differences may exist among households that did not participate in later waves of the survey that are not captured in our data.

A final difference between Making Connections and other studies that measure household change in composition, which may also be considered a limitation, pertains to the method by which people were linked across waves. Unlike the National Survey of Families and Households, Living in Ireland Survey, and others mentioned previously, the Making Connections survey design did not include a feature to assign personal identifiers at the time of each interview. After the third wave of data were collected, the research team discussed the importance of understanding household composition down to the individual level and decided to undertake a retrospective matching of people across all three waves of the survey.

Methods

Matching People

In the spring of 2010, NORC developed a detailed process for reviewing the household rosters from all waves completed to date and matching individuals over time. We began the people-matching process by building a dataset, which included information about every individual found in an interviewed household in every site in each of the three waves. We then used Link Plus—probabilistic record linkage software—to compare the names of individuals across waves, identified matches, and generated a unique personal identifier ("PERSONID" hereafter) with a comprehensive list of individuals found in each wave. The PERSONID was set to equal the original household ADDRESSID—an 8-digit number associated with a sampled address inside the Making Connections target neighborhoods—followed by a unique alphabetical letter. We set the parameters for matching based first

on character strings within the first name field, then two numeric fields: age (adjusted for a standard number of years in between waves of data collection) and sex (dummy coded, with 0 = female and 1 = male). The software reports a confidence score for each match—that is, an indication of how likely it is that the individual matched as a pair across records actually represents the same person. Exhibit 1 provides an example of the PERSONID assignment for one fictional linked household, identified with the ADDRESSID of the original household (91105820). In the example, two of the three individuals remain present in all three waves—Clara and Edward, Jr. (91105820A and 91105820C, respectively). The father, Edward, was present in waves 1 and 2 but absent in wave 3. Note that each individual preserves his or her PERSONID across waves.

Exhibit 1

Example of PERSONID Assignment by Link Plus Software for 91105820[a]

PERSONID	Letter	ADDRESSID	Wave	MOVEID	First Name	Age	Sex	Roster
91105820A	A	91105820	1	NA	Clara	42	F	Adult
91105820B	B	91105820	1	NA	Edward	41	M	Adult
91105820C	C	91105820	1	NA	Edward, Jr.	11	M	Child
91105820A	A	91105820	2	Stayer	Clara	46	F	Adult
91105820B	B	91105820	2	Stayer	Edward	46	M	Adult
91105820C	C	91105820	2	Stayer	Edward, Jr.	14	M	Child
91105820A	A	91105820	3	Stayer	Clara	49	F	Adult
91105820C	C	91105820	3	Stayer	Edward, Jr.	17	M	Child

NA = not applicable.
[a] Names and other information have been edited to protect participants' confidentiality.

Roughly one-half of households with children in the Making Connections sample were found to have moved between each wave. In these instances, the original households were deemed to have "spawned" a "new household," because interviews were attempted both at the new residence of the focal child selected in the previous wave (the "mover") and with the new occupants of the focal child's previous address (the "new household"). Movers and new households inherit the ADDRESSID associated with the original household (91105820 in this case), but the fourth digit of their ADDRESSID is adjusted to signal the movement of the focal child and the change in occupancy at the sampled address (without the focal child), respectively. The labels associated with this fourth digit, the MOVEID, are shown in the fifth column. In exhibit 2, we continue the example of the linked household from exhibit 1 but demonstrate the identification of the Rodriquez family as "movers" and the spawning of a new household in wave 3. In this alternative scenario, data were collected in the final wave of the survey from both the Rodriquez family at their new home and an elderly man named John who had moved into the Rodriquez's previous home. Note that the link between all individuals in all waves (what makes this a "linked household") is established with the first eight digits of the PERSONID, the ADDRESSID of the original household.

Further details about the sample design and spawning logic are available at http://mcstudy.norc.org/study-design/.

A small team of coders then imported the output from Link Plus into a customized Microsoft Access database for review and editing. NORC designed a form to display the roster data from all waves for each household affiliated with a given baseline address on one screen (a "linked

Exhibit 2

Example of PERSONID Assignment by Link Plus Software With Spawning for 91105820[a]

PERSONID	Letter	ADDRESSID	Wave	MOVEID	First Name	Age	Sex	Roster
91105820A	A	91105820	1	NA	Clara	42	F	Adult
91105820B	B	91105820	1	NA	Edward	41	M	Adult
91105820C	C	91105820	1	NA	Edward, Jr.	11	M	Child
91105820A	A	91105820	2	Stayer	Clara	46	F	Adult
91105820B	B	91105820	2	Stayer	Edward	46	M	Adult
91105820C	C	91105820	2	Stayer	Edward, Jr.	14	M	Child
91105820A	A	91125820	3	Mover	Clara	49	F	Adult
91105820B	B	91125820	3	Mover	Edward	49	M	Adult
91105820C	C	91125820	3	Mover	Edward, Jr.	17	M	Child
91105820D	D	91145820	3	New HH	John	75	M	Adult

HH = household. NA = not applicable.
[a] *Names and other information have been edited to protect participants' confidentiality.*

household" hereafter). To minimize the risk of misrepresenting a given household as a stable unit or missing an important change among specific members over time, NORC reviewed 100 percent of the linked households.

We isolated patterns among the tough-to-code records and made adjustments to streamline the review process. We increased the confidence threshold for accepting matches identified by Link Plus. False positives proved to be fairly common among very large households and those in which several family members had similar-sounding names (for example, "Marcela" and "Marcy") or an adult and child shared a name (for example, Frank and Frank, Jr.). Minor spelling and keying errors contributed to the false positive rate as well. These challenges were exacerbated among Hispanic households by inconsistent recording of matriarchal and patriarchal surnames. After an initial review, between 5 and 10 percent of the linked households were selected for a secondary review. A final set of quality checks was performed using a series of Microsoft Access queries and Microsoft Excel.

The end product was a person-level data set in which every individual ever found in a surveyed household across all waves occupied a row. The ADDRESSID was included at each wave to provide a link between a given individual and the household survey data to which it should be associated. Also included were fields indicating the individual's age, sex, and position on the household roster at each wave. These fields facilitated the linkage between the person- and household-level survey data and facilitated the aggregation of the former, which would be required for developing more sophisticated measures of household composition change.

Geographic Analysis

We constructed an address-level dataset to investigate geographic patterns of movement among households that participated in the final wave of the survey. The 7 sites represented are Denver, Des Moines, Indianapolis, Louisville, Providence, San Antonio, and White Center (near Seattle). The dataset contains addresses from four different sources. Three of the sources are derived from the household address reported by the respondent at the end of the wave 1, wave 2, and wave 3
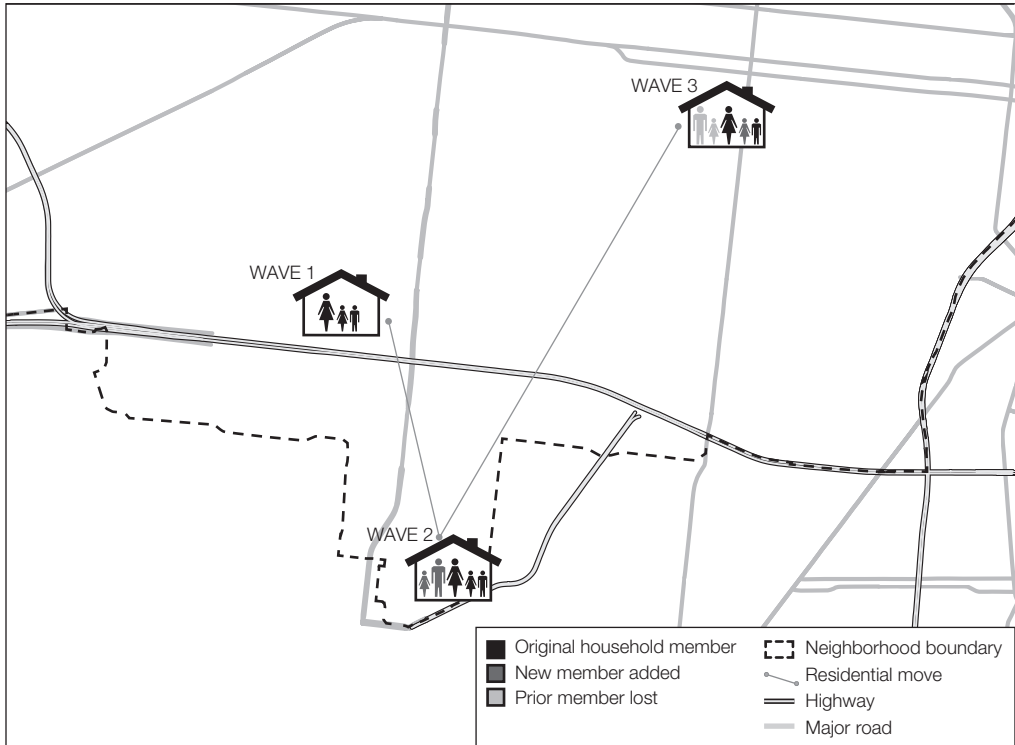
interviews. The fourth source could include up to six additional addresses that represent the places where the respondent lived in between waves 2 and 3 of the survey (or more precisely, since Thanksgiving of 2005 and the date of the wave 3 interview). These six addresses were reported retrospectively during the wave 3 interview and are thus referred to as the "retrospective addresses." Each set of addresses was then interactively geocoded using MapMarker Plus 24.1. The combined dataset includes 15,077 addresses from the wave 1, 2, and 3 series and 2,966 retrospective addresses, for a total of 18,043 addresses. The coordinates from the 18,043 addresses were then transposed in SAS to create a file with longitude and latitude coordinates for each address by the wave 3 case identifier. This approach resulted in a dataset with nine sets of coordinates for each wave 3 household, including a set of coordinates for each of the three waves and up to six retrospective addresses.

In the interest of maintaining a clear methodological focus, in this article we include maps showing mobility in only one site, San Antonio. A few unique characteristics of West Side, the San Antonio survey neighborhood, are worth noting. First, West Side is the largest of the 10 Making Connections-defined survey neighborhoods; it covers 24.4 square miles compared with an overall median of 4.9 miles for the 10 sites (see Coulton et al., 2009: appendix A). Second, the population is almost exclusively Hispanic (with predominate origins in Mexico) and U.S. born. At the city level, Hispanics comprise most of the population, 63 percent, and 46 percent of people age 5 and older speak a language other than English at home (2010 census). These characteristics are greatly exaggerated in West Side, where 89 percent of wave 3 survey respondents self-identified as Hispanic or Latino. Third, the San Antonio site has a high rate of homeownership: 61.3 percent of residents living in census tracts within the survey neighborhood were homeowners, based on American Community Survey 2005–2009 tract-level estimates. Many families who would be priced out of suburban areas are able to afford homes in West Side because of the availability of an ample stock of small, single-family bungalows built before the 1970s. The diverse social, economic, and spatial characteristics of the other 6 sites may yield different patterns of movement that merit separate study.

After geocoding the addresses, we used MapInfo Professional 11.0 to create points out of the coordinates and lines to connect each of the points for each household. This approach resulted in the creation of 45,664 lines, which were then combined into a single file with 2,979 lines representing the moves of individual households over 6 years. Exhibit 3 depicts an example based on real data of a household that was found at three different addresses during the study period. The small dots represent the physical location of the residence at each wave and the person figures inside the houses represent the household composition. Those figures appearing in black represent people who were part of the original household at wave 1. Those figures appearing in dark gray represent individuals added following wave 1 and those figures appearing in light gray are previous members of the household who were lost or who were not present in a later wave. This example demonstrates the importance of linked-person identifiers for measuring compositional change because, if we were to rely solely on variables indicating the number of children in the household, those present at waves 1, 2, and 3 would appear to have remained stable. The linked-person data make it possible to detect the replacement of one child from the original household with a new child at wave 3. Aside from these "mover" households, 2,729 households reported no change of address during the 6-year period and thus are represented in proceeding maps with a single point and no connecting lines.

Exhibit 3

Example of Linking Households to Track Residential Movement and Composition Change

Household Composition Change Analysis

In addition to constructing and analyzing the geographic data, we constructed a series of flags using the linked-person data for the 7 sites that participated in wave 3. The flags enable us to distinguish among households with stable membership over time; those that experienced one or more additions, subtractions, or substitutions of an individual; and those in which the initial residents were entirely replaced by a new set of occupants at up to two points in time (waves 2 and 3). We also calculated continuous measures summarizing the total number of adults and children who were added to and subtracted from the household between waves 1 and 2, 2 and 3, and 1 and 3. These calculations reflect not simply numerical change in the household size, but also the presence or absence of each individual household member in each wave. The maps and tables in the following section report findings from the combined geographic and household composition change data.

Findings

In the following discussion, we use "residential movement" to refer to the geographic relocation of a household from one address to another. We use "household composition change" to account for the addition or subtraction of at least one member between two points in time. We argue that this

latter phenomenon represents an important, if often neglected, aspect of mobility—the transfer of individuals into and out of households. Note that our definition of compositional change is restricted to the addition, subtraction, or replacement of one or more individuals. We do not include natural changes, including the birth of a child to the respondent, minor children moving from the child roster to the adult roster in a later wave, or teenagers age 15 or older leaving the household.

The exhibits in this section display geographic data from sample members in San Antonio. Tables are labeled to distinguish between results for all 7 sites and those only for San Antonio. The results reported in tables are unweighted. Unless otherwise noted, we restrict our analyses to households with one or more children. We again use this distinction to maintain a clean methodological focus on the different measurements of mobility. Adult-only households were not tracked to new locations under the Making Connections sample design. By examining only households with children, we ensure that all observations will have had the same opportunity to change residences and be followed over time. We also omit the retrospective addresses collected at wave 3, representing places where the respondent had lived since Thanksgiving of 2005 to allow for more straightforward comparisons between the geographic and household composition data available for each household. Although the respondents were asked to report up to six retrospective moves, the detailed household roster information was gathered only at the time of the wave 1, 2, and 3 surveys.

Residential Movement Among Sample Members

Residential movement among Making Connections households is frequent, as is commonly observed in populations with high percentages of lower income minority groups and renters. Data from the 2008 Current Population Survey suggest that the percentage of individuals who moved in the previous year was more than five times higher among occupants of rental units compared with those in owner-occupied units (Ruggles et al., 2010). In administering the wave 2 Making Connections survey, NORC found that more than one-half (55 percent) of all households and 61 percent of households with children had moved since wave 1 (unweighted). These moves tended to be short distance: the median distance for all completed child "movers" at wave 2 was 2.4 miles, and 32.6 percent remained in the target Making Connections neighborhoods. The findings in sites like Louisville reflect the situation of residents living in public housing developments undergoing relocation as part of the HOPE VI Program's relocation effort. The demolition of several of these developments contributed to a movement rate of 67 percent among all households and 78 percent among households with children. In addition, individual sample members—particularly children—sometimes returned to previous addresses after moving away. In between waves 2 and 3, 43 percent of respondents in Denver, Des Moines, Indianapolis, San Antonio, and White Center (Seattle) reported having moved at least once in the retrospective address series (Bachtell and Latterner, 2011). San Antonio had the lowest percentage of respondents reporting at least one retrospective address among 5 sites. Only 37.4 percent of San Antonio respondents had moved in the past 3 years, and, among those who had moved, relocation from outside the county was extremely rare (2.4 compared with 11.5 percent among the 5 sites). Also, despite the proximity of San Antonio to Mexico and the predominance of Hispanics in the survey sample, transnational migration accounted for less than 1 percent of the retrospective moves reported by San Antonio respondents in wave 3.

Exhibit 4 displays all residential moves among households with children during the 6-year period, including potential relocation at waves 2 and 3, for households in San Antonio. Each gray line beginning and ending with a small dot represents the path between one address and another for a given household. These lines are connected to show multiple moves made by the same household. The survey neighborhood boundary is shown with black dashes, and highways and major roads are shown with double black and thick gray lines, respectively. This map makes evident the frequent relocation of households within the survey neighborhood, West Side.

Exhibit 4

Residential Moves Among San Antonio Households With Children Over a 6-Year Period

Exhibit 5 reveals that composition changes were far more commonly observed than residential moves among San Antonio households with children over a 6-year period (81.4 and 46.7 percent, respectively). As mentioned previously, our definition of compositional change does not include natural changes, including the birth of a child to the respondent, a minor child moving from the child roster to the adult roster in a later wave, or a teenager age 15 or older leaving the household. An important caveat is that differences in the sample sizes for the various household panels (households with children, households without children, movers, stayers, and so on) may account for some of the magnitude of the compositional change percentages, particularly in the wave 1-wave 3 comparisons. It is possible that those households that could not be located or refused to participate in followup waves of the survey were somehow different from those that were successfully interviewed as part of the wave 1–2, wave 2–3, and wave 1–2–3 panels in terms of household composition. In exhibit 5, we also report the incidence of compositional change among households without children to put

in context the mobility patterns of this subgroup relative to the full sample. We find that households with children in West Side are far more likely to undergo compositional changes than adult-only households. Returning to only families with children in exhibit 6 (and in subsequent exhibits), we find that 44.1 percent of San Antonio households moved one or more times during the 6-year period. Of those households, 26.0 percent moved only once and 18.2 percent moved two times.

Exhibit 5

Residential Movement and Composition Change Among San Antonio Households[a] Over a 6-Year Period

Type of Change	Households With Children		Households Without Children	
	N	%	N	%
Total at wave 1	533	100.0	132	100.0
Residential movement	249	46.7	NA[b]	NA
Composition change	434	81.4	67	50.8

NA = not applicable.

[a] Includes only households that were interviewed at wave 1 and wave 3.

[b] As part of the sample design, only households with children were followed to new locations in followup waves of the survey.

Exhibit 6

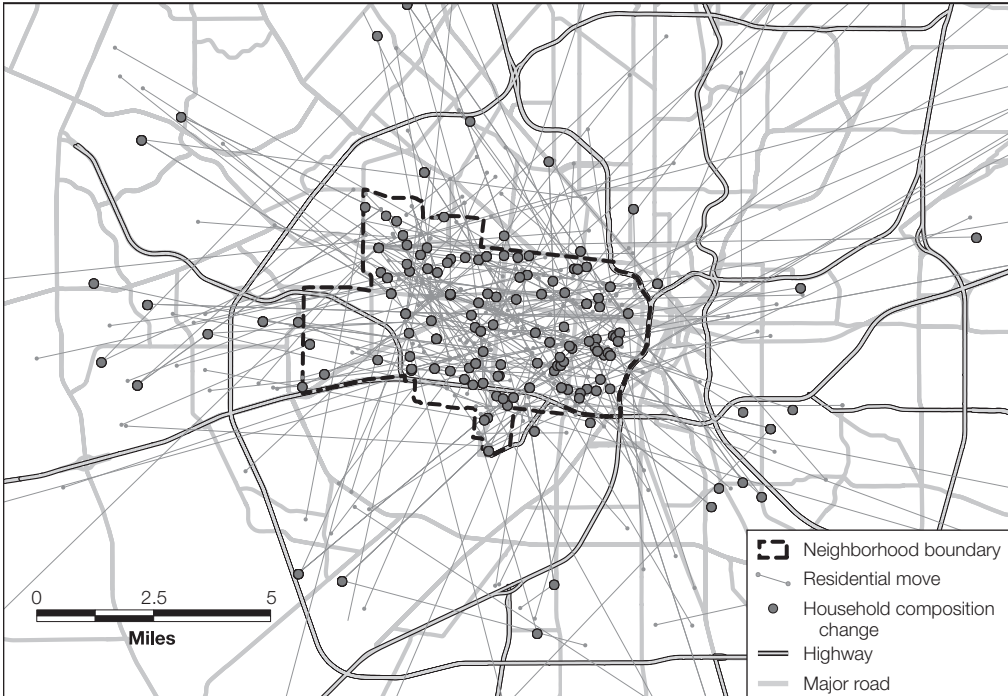Residential Movement Among San Antonio Households With Children Over a 6-Year Period

Number of Moves	N	%
None	366	55.9
One	170	26.0
Two	119	18.2
Total	**655**	**100.0**

Note: Includes households that were interviewed in wave 3 and any combination of waves 1 and 2.

Residential Movement and Household Composition Change

In the next series of maps, exhibits 7 and 8, we demonstrate the distinction between residential movement and household composition change using spatial markers. We again display residential moves among San Antonio residents with children and add a layer to show the locations at which households experienced a change in composition. Exhibit 7 displays the two distinct aspects of mobility over a 3-year period, between waves 1 and 2. Exhibit 8 extends the period to 6 years, between waves 1 and 3.
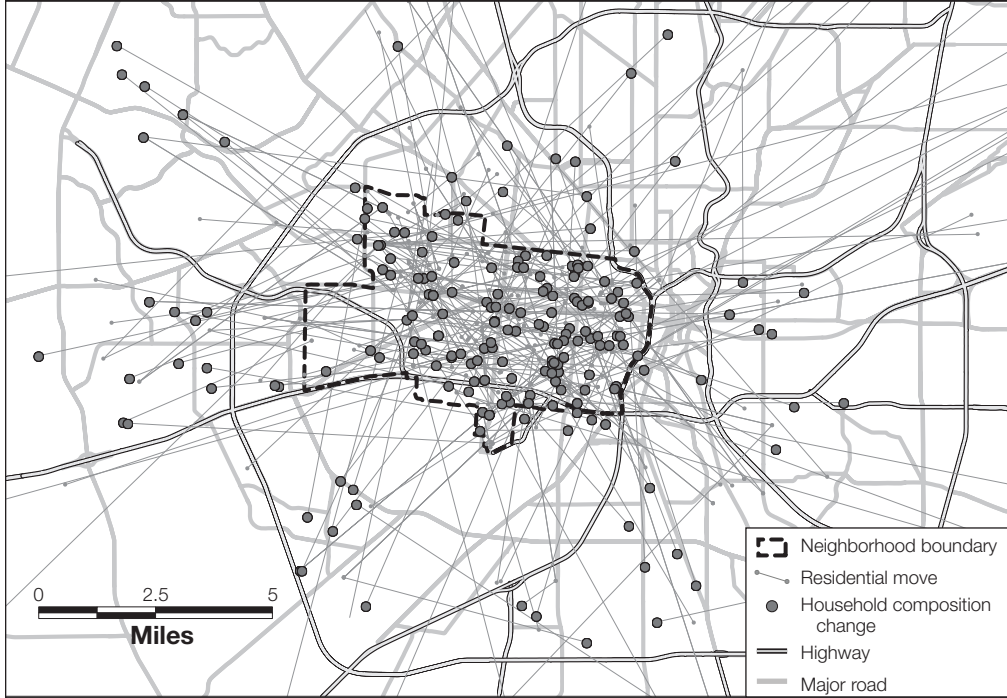
Exhibit 8 reveals that, although residential movement in San Antonio is concentrated within the survey neighborhood, over the 6-year period we see both a slight increase in families experiencing household composition change (87.1 percent between waves 1 and 3 compared with 81.2 percent between waves 1 and 2; see exhibit 9) and the dispersion of the addresses at which this change occurs among households in the wave 1–3 panel. More families who moved at least once during the 6-year period are also experiencing a "shuffling" of individuals in and out of the household. As shown in exhibit 9, families who move are on average 9.4 percent more likely to have undergone a compositional change across the three periods (wave 1 to 2, wave 2 to 3, and wave 1 to 3) than families with no moves.

Exhibit 7

Residential Moves and Household Composition Change Among San Antonio
Households With Children Between Waves 1 and 2 (3-year interval)

Before performing the linkage of people to create the PERSONID data, the mobility of Making
Connections households was tracked using a "MOVEID" variable that was captured at the time of
each interview. The MOVEID data enable us to evaluate the effect of adding household composi-
tion change as a second component of mobility beyond residential movement. Households were
classified as "stayers," "movers," "new households" (or "in-movers"), "aged-out movers," and "fresh
cases." Stayers can be described as the original household (although certain compositional changes
are possible) at a sampled address. These classifications were depicted in the example shown in
exhibit 1. Movers were identified when the family associated with a previous wave focal child
moved to a new address, and the focal child remained under age 18 (see example in exhibit 2).
Conversely, aged-out movers were identified when the family associated with a previous wave
focal child moved to a new address and the focal child turned age 18 or older. New households
(or "in-movers") represent different people living at a sampled address than those who had lived
there in the previous wave (again, see example in exhibit 2). Finally, fresh cases include the oc-
cupants of recently constructed or renovated buildings. The important distinction for the present
analysis is between stayers and movers. All households identified in the latter group will have
undergone residential movement, defined by the physical location of the focal child at each wave.
They may also have experienced a departure of one or more household members, an addition
of a new person or set of people, or both a departure and an addition, but these changes are not
captured in the MOVEID. As reported in exhibit 10, using this one-dimensional approach, we find

Exhibit 8

Residential Moves and Household Composition Change Among San Antonio Households With Children Between Waves 1 and 3 (6-year interval)

Exhibit 9

Household Composition Change Among San Antonio Households With Children Over a 6-Year Period

Change Over Time Period	No Moves		One or More Moves	
	N	%	N	%
Waves 1 to 2				
Total at wave 2	273	100.0	234	100.0
Composition change between waves 1 and 2	178	65.2	190	81.2
Waves 2 to 3				
Total at wave 3	344	100.0	258	100.0
Composition change between waves 2 and 3	223	64.8	171	66.3
Waves 1 to 3				
Total at wave 3	284	100.0	249	100.0
Composition change between waves 1 and 3	217	76.4	217	87.1

Exhibit 10

Comparison of One and Two-Dimensional Approaches to Mobility—Percentage of Households With Children Defined as Experiencing Mobility (7 sites)

	Waves 1-2		Waves 2-3	
	N	%	N	%
One-dimensional—using only residential movement to define mobility	1,817	62.6	2,354	64.6
Two-dimensional—using residential movement and composition change to define mobility	2,320	79.9***	2,851	78.3***
Missed mobility when employing one-dimensional approach	503	17.3	497	13.6

***p < 0.001.

Notes: The numbers for waves 1-2 and waves 2-3 are 2,904 and 3,643, respectively. Significance testing was performed using a one-sample binomial test to assess whether the proportion of households defined as mobile under the two-dimensional approach significantly differs from the proportion defined as such under the one-dimensional approach (0.626 and 0.646 for waves 1-2 and 2-3, respectively).

that 62.6 percent of households with children in our analytic sample from 7 sites between waves 1 and 2 and 64.6 percent of households with children between waves 2 and 3 are classified as having experienced mobility. In the second row, we report the percentage of households with children who are classified as mobile after we combine this information with a measure of composition change. Households that changed residences, changed individuals, or changed both are counted in the second row. Of households with children between waves 1–2 and 2–3, 79.9 and 78.3 percent, respectively, are found to be mobile, using this two-dimensional approach. A binomial test confirms that the differences between these two proportions in each period are statistically significant. When employing the one-dimensional definition of mobility, we fail to account for an additional 17.3 and 13.6 percent of households between waves 1–2 and 2–3, respectively, that experienced a change in composition.

Exhibits 11 and 12 demonstrate the differences in the aggregate sum of residential movement and household composition change over 6 years at the census tract level. In exhibit 11, tracts are shaded to show the percentage of households with children that relocated one or more times during this period. In exhibit 12, tracts are shaded to show the percentage of households with children that underwent any form of compositional change. Households experiencing each type of change were added and then divided by the total number of sampled households residing in a given census tract at wave 1. The increase in the tracts with percentages in the highest category (75 percent or more) and the overall "darkening" of the neighborhood in exhibit 12 support the depiction of households as dynamic collections of individuals and highlight the degree of individual turnover occurring among families in West Side.

Exhibit 13 presents the type of compositional change over time among households with children. The columns to the right isolate the change among only stayers and movers, as defined by the MOVEID variable that was maintained during data collection to assess the movement history of each household. Note again that the sample design for Making Connections requires that households include one or more children to qualify as a mover. These two groups, stayers and movers, are combined in the "All" column. We do not report changes between waves 1 and 3 because the
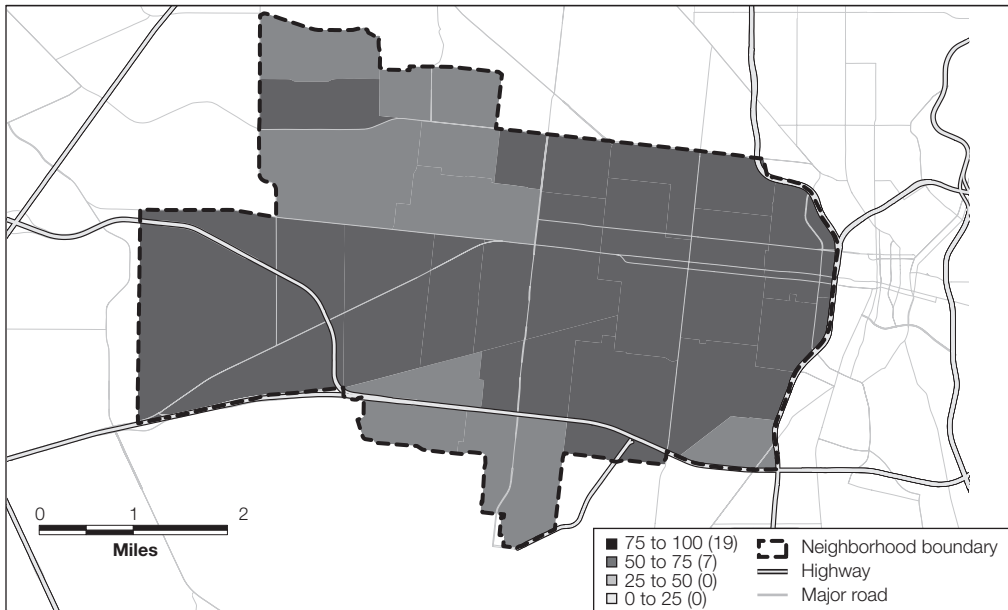
Exhibit 11

Percent of San Antonio Households With Children Experiencing Residential Moves
Over a 6-Year Period: Aggregate for Census Tract Based on Wave 1 Address

Legend:
- ■ 75 to 100 (0)
- ■ 50 to 75 (14)
- ▨ 25 to 50 (10)
- ☐ 0 to 25 (1)
- ⊏⊐ Neighborhood boundary
- ═ Highway
- — Major road

Exhibit 12

Percent of San Antonio Households With Children Experiencing Household Composition Change Over a 6-Year Period: Aggregate for Census Tract Based on Wave 1 Address

Legend:
- ■ 75 to 100 (19)
- ■ 50 to 75 (7)
- ▨ 25 to 50 (0)
- ☐ 0 to 25 (0)
- ⊏⊐ Neighborhood boundary
- ═ Highway
- — Major road

Exhibit 13

Type of Composition Change Between Waves[a] Among Households With Children by MOVEID Subgroup[b] (7 sites)

Change Over Time Period	All[c]		Stayers		Movers[d]	
	N	%	N	%	N	%
Waves 1 to 2						
No change	819	52.1	584	55.5	235	45.1
Added one or more adults	381	24.2	228	21.7	153	29.4
Added one or more children	224	14.2	153	14.5	71	13.6
Lost one or more adults	423	26.9	234	22.2	189	36.3
Lost one or more children	141	9.0	72	6.8	69	13.2
Total	**1,573**	**NA**	**1,052**	**NA**	**521**	**NA**
Waves 2 to 3						
No change	1,332	55.2	651	60.6	681	50.8
Added one or more adults	570	23.6	208	19.4	362	27.0
Added one or more children	305	12.6	144	13.4	161	12.0
Lost one or more adults	632	26.2	214	19.9	418	31.2
Lost one or more children	190	7.9	57	5.3	133	9.9
Total	**2,415**	**NA**	**1,075**	**NA**	**1,340**	**NA**

NA = not applicable.

Note: The total number for all households, stayers, and movers is not equal to the sum of the five preceding rows within each time period because categories are not mutually exclusive. Similarly, percentages do not add up to 100.

[a] Adjusted for new births and teenagers/adult children ages 18 to 30 moving out.

[b] As indicated by the MOVEID value for the later wave in each comparison.

[c] This includes stayers and movers (as indicated by the MOVEID value for the later wave in each comparison).

[d] Households that changed residences between waves 1 and 2 but remained in place between waves 2 and 3 are considered movers.

MOVEID values were generally assigned by comparing the location of the focal child at the current wave with the wave immediately before. Percentages in this exhibit do not add up to 100 percent within each period by group (all, stayers, and movers) because the categories of compositional change are not mutually exclusive. For example, it is possible for a household to have added some adults and lost some adults, added some adults but lost some children, or both. Recall that these results are based on linked person-level data rather than numerical change in household size. When examining both groups, we find that 47.9 and 44.8 percent experienced a change in household composition between waves 1–2 and 2–3, respectively. The most common transfer involves the loss of one or more adults. Of households with children, 26.9 and 26.2 percent lost an adult between waves 1–2 and 2–3. Conversely, nearly one-fourth (24.2 percent) gained an adult after the first wave and 23.6 percent did so after the second wave. Transfers of children were less common, with 14.2 and 12.6 percent of households gaining and 9.0 and 7.9 percent losing a child, respectively.

Unlike our expectation for the mover subgroup, our general expectation for the stayer subgroup going into this analysis was that the individuals residing in these households should be relatively stable over time. By definition, these households are those in which at least the focal child from the previous wave remained present at the followup wave in question. While acknowledging that migrations of other members around these key individuals could occur, we might still hypothesize

that less than one-half would experience a change in composition over 6 years. In fact, both the adult and child populations in stayer households prove more stable than those in mover households. For example, an average of only 20.5 percent gained an adult across the two periods compared with 28.2 percent among movers, and an average of 21.1 percent lost an adult compared with 33.7 percent among movers. Differences in the percentage of children added and lost between stayers and movers are more mixed, with additions being more common among stayers and subtractions more common among movers in both intervals. These data suggest that, although by definition the mover subgroup is subject to residential relocation of children, the population of adults associated with these households is even more in flux. It is also worth noting that, among the more stable group of stayers, a sizeable minority of households with children—an average of 42.0 percent—experienced some shift in membership during the 3-year interval between waves.

Exhibit 14 provides additional detail regarding the magnitude of gains and losses of adults and children over time. Not surprisingly, we find that transfers are generally restricted to one adult or child per household. A modest exception is the loss of multiple adults among movers; 10.2 and 6.8 percent of households with children in this subgroup experienced a departure of two adults between waves 1–2 and 2–3, respectively.

Exhibit 14

Detail of Composition Change Between Waves[a] by MOVEID Subgroup[b] (7 sites)—
Percentage of Households With Children That Gained and Lost Adults and Children

Change Over Time Period	All[c]				Stayers				Movers[d]			
	Adults		Children		Adults		Children		Adults		Children	
	Gained	Lost	Gained	Lost	Gained	Lost	Gained	Lost	Gained	Lost	Gained	Lost
Waves 1 to 2												
None	75.8	73.1	85.8	91.0	78.3	77.8	85.5	93.2	70.6	63.7	86.4	86.8
One	18.8	18.8	10.6	6.7	16.5	17.7	10.8	5.2	23.2	20.9	10.0	9.8
Two	4.5	5.5	2.2	1.5	4.5	3.2	2.0	1.1	4.6	10.2	2.7	2.1
Three	0.8	1.8	1.1	0.5	0.5	1.2	1.2	< 0.5	1.3	2.9	1.0	1.0
Four or more	< 0.5	0.8	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5	2.3	< 0.5	< 0.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Waves 2 to 3												
None	76.4	73.8	87.4	92.1	80.7	80.1	86.6	94.7	73.0	68.8	88.0	90.1
One	17.3	19.3	8.2	5.5	14.5	15.9	8.9	4.5	19.5	22.1	7.6	6.3
Two	5.0	5.0	2.6	1.7	3.7	2.8	2.8	0.8	6.0	6.8	2.5	2.3
Three	1.1	1.4	1.2	0.4	1.0	1.2	1.1	0.0	1.2	1.5	1.3	0.7
Four or more	< 0.5	0.5	0.6	< 0.5	< 0.5	< 0.5	0.6	< 0.5	0.4	0.8	0.7	0.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[a] Adjusted for new births and teenagers/adult children ages 18 to 30 moving out.

[b] As indicated by the MOVEID value for the later wave in each comparison.

[c] This includes stayers and movers (as indicated by the MOVEID value for the later wave in each comparison).

[d] Households that changed residences between waves 1 and 2 but remained in place between waves 2 and 3 are considered movers.

Discussion

In past works, analysts have frequently used household size as a proxy for household composition. In this article, we attempted to demonstrate the importance of considering specific changes in household composition—that is, shifts in the presence of individuals over time—in studies of mobility. Our research among households with children in 7 low-income communities suggests that nearly one-half experienced some change in composition during a 6-year period (exhibit 13). Employing a two-dimensional approach that combines residential movement and compositional change significantly increases the percentage of households identified as having experienced mobility between waves, by a difference of 17.3 percent between waves 1–2 and 13.6 percent between waves 2–3. Our findings also raise substantive questions about the relationships among individuals in households experiencing compositional change compared with those that remain a consistent unit over time. We intend to explore these questions in future analyses by examining mobility among various types of families, including single parents, two-parent families, and extended (multigenerational) families.

The ideal methodological technique for tracking household members in longitudinal studies is to assign personal identifiers at each wave and to adjust for additions, subtractions, and substitutions of individuals in real time. Our work demonstrates that such identifiers can be assigned retroactively, although this option is contingent on the availability of identifying information such as the name, age, and sex of each individual, as well as variables indicating the relationship of each individual to at least one other person in the household (for example, the respondent and/or focal child). The linked PERSONID data allow for a more sophisticated, two-dimensional approach to tracking mobility at the household level that we think better captures the shifting nature of real lives.

Acknowledgments

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