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Temporary Mobility and Reporting of Usual Residence

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ABSTRACT

Temporary mobility is hypothesized to contribute toward within-household coverage error since it may affect an individual's determination of "usual residence" – a concept commonly applied when listing persons as part of a household-based survey or census. This paper explores a typology of temporary mobility patterns and how they relate to the identification of usual residence. Temporary mobility is defined by the pattern of movement away from, but usually back to a single residence over a two-three month reference period. The typology is constructed using two dimensions: the variety of places visited and the frequency of visits made. Using data from the U.S. Living Situation Survey (LSS) conducted in 1993, four types of temporary mobility patterns are identified. In particular, two groups exhibiting patterns of repeat visit behavior were found to contain more of the types of people who tend to be missed during censuses and surveys. Log-linear modeling indicates that temporary mobility patterns are a significant predictor of usual residence, even when controlling for the amount of time spent away and demographic characteristics.

KEY WORDS: Temporary mobility; Usual residence; Household rosters; Coverage.

1. INTRODUCTION

The fundamental challenge in any census of population is the accurate and complete count of every person within that population. Consequently, the extent to which people are missed or undercounted during a census is arguably the most important measure by which it is evaluated. Most censuses and household-based surveys begin with a roster question designed to list all "usual residents" of a household.

Research evaluating the quality of census data suggests that coverage error is a problem. In 1990, the U.S. Post Enumeration Survey (PES) and demographic analyses estimated that the net national undercount was approximately 2% (Hogan 1993; Robinson, Ahmed, Das Gupta and Woodrow 1993). Other research suggests that coverage error in current surveys (such as the U.S. Current Population Survey) is even larger than undercoverage occurring during decennial censuses (Shapiro, Diffendal, Cantor 1993; Chakrabarty 1992; Pennie 1990; Hainer, Hines, Martin and Shapiro 1988). Research by Fein and West (1988) and Shapiro *et al.* (1993) suggest that failure to count all persons within a housing unit is a larger component of total coverage error than failure to count persons as a result of missing a housing unit. Others report that within-household omissions account for about one-third of all census omissions (Ellis 1994; Fay 1989a).

Coverage research also indicates that persons who are undercounted are not randomly distributed among the population. For example, blacks and Hispanics are undercounted at a higher rate than non-Hispanic whites (4.6% and 4.0%, respectively, compared to 0.7%; Hogan 1993). Persons who reside in multi-unit structures (such as apartments) and those who rent are also more likely to be missed (Griffin and Moriarity 1992; Moriarity and Childers 1993; Ellis 1993).

This paper concentrates on a dimension long hypothesized to contribute to within-household coverage error. This dimension focuses on temporary mobility into and out of a residence over a period of time. Specifically, we examine movement in terms of the number of places a person may visit, the number of visits he/she makes and the amount of time he/she spends there. This analysis examines whether or not mobility may be a factor influencing coverage and indeed be a good indicator of household attachment. We hypothesize that a person's level of mobility tends to influence a household respondent's decision when defining that person as a usual resident and, consequently, someone he/she would or would not include on a census report.

2. BACKGROUND

The movement from one geographical location to another is usually signified by a change of address, movement of possessions and so on. This type of mobility is commonly referred to as geographic mobility. In addition to geographic mobility, there exists a more subtle form of mobility that is not so clearly defined – temporary mobility. Defined here, temporary mobility refers to the temporary and sometimes patterned movement away from a residence and encompasses both long and short, frequent and infrequent overnight stays. This type of mobility has been described as "one of the key features of irregular and complex households" (de la Puente 1993). One example of this is found in Haitian immigrant communities where typical household structure consists of a relatively

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permanent "nuclear core" and a more mobile "fluid periphery." The fluid periphery consists of related and non-related newcomers, staying for short periods of time, and members of the household who visit Haiti on a regular basis and can be away weeks or months at a time (Wingerd 1992).

Temporary mobility is not limited to special communities. Many examples can be found in the wider community, including mobility associated with long term business or vacation travel, attendance at college, custody situations, and persons who maintain a presence in one or more households over a given period of time. This mobility in the fluid periphery, or temporary mobility, differs from geographic mobility because it consists of movements away from, but usually back to, a single residence over time. Members of this fluid periphery present conceptual difficulties for respondents in identifying which members to include in a census or survey. Movement of these persons may not involve a permanent change in address, and thus can blur the concept of who is defined as living or staying at a given address.

Given that there is little literature on temporary mobility, studies on geographic mobility and household structure provide a good starting point for forming our hypotheses about temporary mobility. According to the March 1994 Current Population Survey, young adults between 20-24 are reported to have the highest rates of geographic mobility, with one-third having moved between March 1993 and March 1994. Differences by race are also evident with a higher rate of mobility among blacks and Hispanics (19.6% and 22.4%, respectively) compared to whites (16.0%, see Hansen, 1994). Finally, tenure is also closely correlated with geographic mobility – renters were four times more likely than homeowners to have moved between 1993 and 1994. Obviously, these geographic movers share many of the same characteristics as some undercounted populations.

The kind of mobility with which we are concerned may also be a reflection of socioeconomic status. Temporary mobility, transitory situations, and peripheral connection to households can represent a means of adjusting for a lack of resources (Lipton and Estrada 1993). Hudgins and Holmes (1993) suggests that the undercounting of young black males is a result of their social and economic marginality evidenced in part by a lack of stable residences and relatively permanent mailing addresses. One facet of this may involve temporary movement to extended families or "kin" networks in order to receive family or financial assistance. This phenomenon of extended or kin networking among blacks has also been documented extensively by ethnographic studies (Martin and Martin 1985; Stack 1974; Hainer *et al.* 1988). These living arrangements suggest nontraditional (or at least non-nuclear) household formations which could contribute to coverage error, especially if a person participates in kin networks by moving back and forth among them.

Finally, Montoya (1992) describes a very different household composition that is characteristic of some recent Hispanic immigrant communities. Like kin-network households, they contain people who come and go, however, the members are "loosely tied, ephemeral, and alienated" and often composed of young migrant men who work and sleep in different shifts and have virtually no social ties with one another. Several other ethnographers have identified similar households in other Hispanic communities across the United States (Velasco 1992; Mahler 1993; Romero 1992.) They found that census coverage in such households was often restricted to those individuals who were actually present when the enumerator arrived.

3. METHODOLOGY

Data for this analysis come from the Living Situation Survey (LSS), a survey specifically designed to gather information about household membership, social attachments, mobility and the assignment of usual residence. The LSS was a voluntary survey conducted by the Research Triangle Institute (RTI) and sponsored by the U.S. Census Bureau between May and September of 1993. The sample was stratified to oversample for high and medium minority areas (*i.e.*, greater than 80% black or Hispanic, between 40% and 80% black or Hispanic) and areas containing renters (*i.e.*, greater than 40% renters). To increase the efficiency of the sample design, RTI used housing unit data previously collected from a multistage probability sample used in the 1992 National Household Survey on Drug Abuse (NHSDA).

The first portion of the LSS interview was conducted in-person with the most knowledgeable household respondent, in most cases, the householder (by U.S. Census Bureau definition, this refers to the person in whose name the house is owned or rented). These householders provided a roster and then answered demographic questions for themselves as well as all other listed persons. Through a series of 13 extensive roster probes, the questionnaire rostered "core" household residents but also included many persons having a less permanent presence. Persons with a more tenuous attachment were brought in by asking probes about who had spent the night there during the reference period, who was considered a household member even if they were staying elsewhere, and who considered the residence their permanent address or a place they received mail or phone messages (see Sweet 1994). (The length of the reference period varied depending upon the date of the interview. References periods began on the first day of the month two months prior to the interview month and ended on the day of the interview. Accordingly, interviews conducted toward the end of the month had a longer reference period than interviews conducted near the begining). In total, 999 households were interviewed nationwide. Using the broad rostering technique, a total of 3,549 people were listed.

The next step in the survey was to weed out rostered individuals determined to be only "casual visitors" to the

household. Individuals were defined as casual visitors if: 1) their usual residence was considered by the householder to be someplace other than the sample housing unit *and* 2) they had stayed at the household for one week or less during the reference period. This screening process identified persons from the broad rostering technique who had only a casual attachment to the household. Of the 3,549 persons rostered, 712 were considered to be casual visitors. (Of the 712 casual visitors, 77% were related to the household respondent, 93% were non-Hispanic, 84% were white and 58% were female). For several reasons, casual visitors were ineligible for the remainder of the questionnaire. First, we assumed that casual visitors do not meet the Census Bureau definition of a usual resident at the interview household and second, excluding this group from the bulk of the questionnaire greatly reduced the time and resources required to carry out the survey.

After follow-up for converting refusals and other non-interviews, the final response rate for the household-level portion of the interview was 79.5%. (Follow-up actions included sending refusal conversion letters, having field supervisors call directly, make repeat visits, and re-assign interviewers. Respondents were contacted an average of 1.9 times; nonrespondents an average of 5.9 times). Considering the population, this was considered to be an acceptable rate of response. Nonetheless, since we suspect that nonresponse is highly related to coverage issues such as mobility, it is likely that this level of nonresponse has some effect upon our estimates. More discussion on this is included in the description of the individual questionnaire below.

The next part of the survey was a self-reported individual-level questionnaire. This part of the survey contained questions about temporary mobility as well as self-reported demographics. Respondents were asked if they had stayed overnight at any other place beside the interview household during the reference period. If so, interviewers used a calendar to record each place and the dates stayed. Interviewers also gathered information about the type of each place stayed, the individual's attachment to each place, and the reason(s) for going there.

Each of the householders answered the individual-level questionnaire for himself/herself. Additionally, all rostered persons who had stayed away for eight or more nights during the reference period answered the individual-level questionnaire. All persons identified as college students and persons with no usual residence were also eligible for an individual interview. Finally, the individual questionnaire was also given to a simple random 10% sample of LSS households. Within these households, individual interviews were attempted with each person on the roster, *with the exception of casual visitors.* This somewhat complex selection criterion resulted in a base of persons representing people with a greater-than-casual association to the interview households, all of whom are included in the analyses reported below (N = 1,451).

The individual-level portion of the questionnaire had a response rate of 85.3%. The majority of individual interviews were conducted in-person (96%) and most of the adult interviews (89%) were self-reported while all interviews with children were conducted by a knowledgable proxy. Because the householders answered basic living situation questions and demographic questions for *all* rostered individuals, we had some means for examining the characteristics of the approximately 15% who were selected for the individual questionnaire but did not respond. We found no significant sex or age differences between nonrespondents and respondents but we found that a disproportionate percentage of nonrespondents were black. We also found that nonrespondents were more likely to have spent more than one week away from the interview household than respondents. These findings shed some light on how representative our individual sample is both demographically and with respect to temporary mobility. Because nonrespondents were reported to be away more than respondents, we suspect the potential 'selectivity' bias may have underestimated our mobility measures.

Household and individual-level weights were applied to adjust for the oversampling, the selection criteria for the individual-level survey and for nonresponse (see Lynch, Witt, Branson and Ardini 1993). All analyses were conducted using Contingency Table Analysis for Complex Sample Designs (CPLX), a computer variance estimation program designed to adjust for the LSS's complex sample design effects (see Fay 1989b; 1985).

3.1 Typology of Temporary Mobility

The typology which we present is empirically based. That is, the particular groupings of visits and destinations was derived analytically and not theoretically. Therefore, the categories we identify do not represent groups of persons with identical characteristics or in identical circumstances. Rather the typology should be regarded as an attempt to represent the complex underlying reality involved in mobile living situations. It is our hypothesis that such mobility has an affect on the strength of the social tie between an individual and a particular household, and that these ties influence the judgment of the household respondent in deciding who is a usual resident of the household. Time away, number of visits and number of destinations are an indirect measure of the strength of such ties.

Our typology of temporary mobility was created using two dimensions of overnight movement outside the interview household. The first dimension taps into the variety of places a person visited over the reference period. This provides some idea of how many places other than the interview household that a person might have attachments to. The second dimension taps the frequency of movements outside the interview household by counting the number of times a person left for a period of one or more nights.

The use of these factors as a measure of the strength of attachment to a household is confirmed by ethnographic descriptions of highly mobile living situations. The pattern of movement represented in our typology reflects many different social processes, such as dispersed attachment to extended kin households (Stack 1974; Dressler, Hoeppner and Pitts 1985), immigration patterns (Wingerd 1992), and adaptation to poverty (Hainer 1987; Valentine and Valentine 1971).

The LSS included several exploratory open-ended questions designed to examine respondents perception of the reasons for their mobility. The questions asked the reasons for going and reasons for return for particular trips. We had hoped that these questions would provide us with a more direct assessment of the underlying social patterns that cause temporary mobility. Unfortunately the answers to these open ended questions were difficult to code without making unwarranted assumptions, largely as a result of the way in which they were expressed. As a result, we did not incorporate these reasons when formulating the typology.

Each "move" was defined as a stay made outside the interview household for at least one night. For example, if a person left to spend three days at a girlfriend's, then moved from there to a relative's for one night before returning to the interview household that person would be assigned as having two total places with two total visits (one visit apiece). Conversely, if a person left to stay overnight at a friend's then returned to the household and then two weeks later returned to the same friend's home for a second visit, that person would be assigned one place with two total visits (two repeat visits). The first example exemplifies a potential bias in this method, that of counting each unique place visited during one extended trip outside the interview household as an independent move (such as a vacation with multiple destinations). On the other hand, this method also captures the movement of "floaters" by counting each separate place visited during one move away from the household as a separate move.

A single mobility measure using various combinations of the number of places and number of moves was constructed. In all, five categories were created with efforts made to identify different patterns of movement by separating out those making repeat visits to the same places. Our first category depicts persons who stayed all nights of the reference period at the interview household and represents persons with no temporary mobility (the "Non-mobile"). The second category consists of persons who, according to the calendar, reported only one visit to one place (the "1-shots"). The "Boomerangs" reflect persons making repeat visits to one place only. The "No-repeats" are characterized as persons who traveled to more than one place, but never the same place twice. And finally, the "Floaters" stayed overnight at several different places, making repeat visits back to at least one of these places (see table 1).

Table 1
Temporary Mobility Typology

Number of Places Visited	Number of Visits				
	0	1	2	3	4
0	Non-mobile				
1		1-Shots	Boomerangs	Boomerangs	Boomerangs
2			No Repeats	Floaters	Floaters
3				No Repeats	Floaters
4					No Repeats

4. CHARACTERISTICS OF MOBILITY TYPES

Table 2 presents the weighted frequencies for the mobility typology. Slightly more than half of the persons administered the individual questionnaire reported no mobility outside the interview household during the reference period. The largest concentration of persons who were mobile fell into the 1-shot category, that is, they reported making only one move outside the interview household to one place (26%, overall). Eleven percent comprised the Boomerang category reporting a more repetitive pattern of two or more visits to a single place while 7% reported the less patterned, yet highly mobile "No repeat" category. The Floaters comprised the smallest group with 4%.

Table 2
Typology of temporary Mobility by Sex and Hard-To-Enumerate (HTE)* Status (Weighted % and standard errors)

MOBILITY TYPE	Total Weighted Percent (s.e. in paren.)	SEX		HTE STATUS	
		MALE	FEMALE	NON-HTE	HTE
Non-mobile	52% (14.0)	40% (13.7)	67% (13.6)	53% (14.3)	38% (7.8)
1-Shots	26% (10.4)	35% (13.9)	16% (7.0)	27% (10.6)	6% (2.9)
Boomerangs	11% (4.0)	15% (5.7)	6% (2.9)	10% (4.1)	21% (9.1)
No Repeats	7% (2.9)	6% (2.4)	8% (4.3)	7% (3.0)	6% (5.4)
Floaters	4% (1.0)	4% (1.3)	3% (1.3)	3% (0.9)	29% (9.9)
Unweighted N	1,451	653	798	1,375	76
Jackknife chi-square**		$X^2 = 2.03, p < .05,$ $d.f. = 4$		X^2 for distribution excluding non-mobile category =2.14, $p < .05, d.f. = 4$	

* The hard-to-enumerate group includes black and Hispanic males aged 18-29.

**See Fay 1985 for documentation of Jackknife chi-square test for complex samples.

Tables 2 also illustrates selected demographics for the five mobility categories including gender breakouts which illustrate a higher mobility propensity for males than females. Approximately 60% of the males reported at least one visit outside the interview household, which was significantly higher than females at approximately 33%. This gender difference in temporary mobility is much more pronounced than in geographic mobility where the difference between the male and female move rate is only around 1% (17% of the male population moved between 1993 and 1994 compared to 16% for females, see Hansen 1994). This suggests that temporary mobility is more common than geographic mobility and that the demographic characteristics associated with it are different as well. Military travel could explain the gender differences in temporary mobility, as could travel for business with males having a higher active-duty/population ratio and employment/population ratio compared to females (U.S. Department of Labor 1994).

The right side of Table 2 integrates several demographic characteristics to create a subgroup known to have high rates of undercount in previous censuses. This group is comprised of males between 18 and 29 who are black or Hispanic. This subgroup is sometimes referred to as the "hard-to-enumerate" or HTE population. Only a small percentage of the LSS sample met the HTE criteria, but an examination of this group's mobility reveals very different patterns compared to the non-HTE group.

First, the HTE group appears more mobile to begin with – over 60% indicated spending at least one night someplace other than the interview household compared to less than 50% for non-HTEs. Second, the distribution of mobile categories differs significantly by HTE status. The majority of non-HTEs who are mobile are concentrated in the 1-shot category whereas the HTEs who are mobile are more concentrated in the repeat movement categories (Boomerangs and Floaters with 21% and 29%, respectively).

We also examined the distributions for temporary mobility by race (white, black, Hispanic, and other) and age (0-17, 18-29, 30-49, 50+). Overall, temporary mobility did not vary significantly by either, yet some interesting trends were noticeable. A relatively large concentration of Hispanics were found in the No-Repeat category (19%) and blacks in the Floater group (9%). A higher percentage of blacks were Non-mobile (66%) compared to whites (52%), in spite of the fact that blacks have higher rates of geographic mobility than whites. Finally, young adults between 18 and 29 appeared more mobile than other age groups (close to 70% of this age group spent at least one night away from the interview household) and a disproportionate percentage of this group were Floaters (14%). The lack of statistical significance among some of these trends may be an artifact of sample size. Alternatively, temporary mobility may be sufficiently different from geographic mobility such that it does not share the same characteristics of traditional 'movers'.

Another important variable hypothesized to correlate with the pattern of temporary mobility is the amount of time spent away on visits. The U.S. Census Bureau residence rules vary in the use of time as a criterion for usual residence. For example, persons who work in another city during the week but return home on weekends are to be counted at the place where they "live and sleep" the majority of the time – in this case, at the place they live during the week. However, a child living away at boarding school is to be counted at the parent's residence even though he/she probably spends the majority of time at the school. Likewise, a person staying at a group quarters on Census Day (*e.g.*, a college dorm or a jail) is counted at that place, regardless of their living situation the rest of the year. Gerber (1994) found that respondents also use time to varying degrees when defining household rosters – in certain situations, she found no clear relationship between being rostered and the amount of time spent at a place. Instead, things like household membership and relationship seemed to factor more heavily in the decision-making process.

Nonetheless, it makes intuitive sense that the amount of time spent away plays some part in the householder's determination of where to count someone. In order to see how our mobility categories varied in term of length of time spent away, the sum of the total number of nights spent away during all visits in the reference period was divided by the total number of nights in the reference period and then expressed as a percentage. Table 3 presents this time measure expressed in terms of being away more or less than half of the reference period.

Table 3
Time Spent Away from the Interview Household during the Reference Period (Weighted % and standard errors)

Away 50% of time or more?	1-Shots	Boomerangs	No Repeats	Floaters	Total
No	94% (4.4)	73% (11.5)	98% (1.4)	63% (10.3)	88% (3.6)
Yes	6% (4.4)	27% (11.5)	2% (1.4)	37% (10.3)	12% (3.6)
Unweighted N	314	186	101	134	735

Jackknife chi-square = 1.71, $p < .05$, $d.f. = 3$

Both the Boomerangs and Floaters were more likely than other groups to spend half or more of the reference period someplace other than the interview household. This supports the notion that the repeat visit patterns underlying these two groups are associated with an increase in total time spent away. It also suggests a higher degree of residential ambiguity especially for the Floaters. Since members of this group report visits to at least two places in addition to the interview household, it is unclear whether

those away more than half the time are spending a majority of time at any one place. If time spent at each place is roughly equal, it is easy to imagine Floaters not being rostered at any of them or at more than one of them. Conversely, by definition we can assume the Boomerangs who were away more than half the reference period spent the majority of their time at the only other place they reported visiting. Assuming time plays a role in defining a sense of household membership, then presumably, the Boomerangs have a better chance of being counted because the majority of their time is being spent at the other place.

5. USUAL RESIDENCE AND MOBILITY

We next explored whether temporary mobility has an impact on the household respondent's determination of a person as a "usual resident". On the 1990 U.S. census form, respondents were instructed to list persons at the place where the person lives or sleeps most of the time. The LSS asked household respondents whether they considered the interview household to be the "usual residence, that is the place where [you/NAME] live(s) and sleep(s) most of the time". They were also asked to report whether "[you/NAME] have a usual residence somewhere else?" While this method is not a perfect replication of a census roster it provides an approximation of who, out of all those rostered during the LSS, the householder might naturally have included or excluded on a census form or current survey.

Table 4 presents a cross-classification of usual residence assignment by mobility status. A combination of the usual residence questions resulted in four classification possibilities: usual residence at the interview household only, usual residence at someplace other than the interview household only, usual residence at both the interview household and another place, and usual residence at no place. (The category of "no place" was extremely small (less than 1%) and was combined into the category of "other place"). Assuming that answers of "other place" equate to being left off the census form, we see that overall, only around 4% of persons with a greater-than-casual association to the interview households might have been left off. Overall, the distribution of usual resident classifications significantly differed according to mobility type.

As might be expected, nearly all of the persons who spent every night at the interview household during the reference period were considered usual residents there (rounded to 100%). The most obvious deviation among categories is noticeable for the Boomerangs and Floaters. Between 20-25% of the people in these two groups were characterized by household respondents as usual residents someplace other than the interview household. This looks very different from both the 1-shots and No-repeat groups, where only 2% and 5%, respectively, were considered usual residents someplace else. These results suggest that the latter two groups typify mobility associated with pleasure or business but for persons with a firm tie to the household while the Boomerangs and the Floaters are more likely to include persons with a less-established association to the household. For this reason, and the fact that a sizable percentage of the HTE population were found in these two categories, the Boomerangs and Floaters arguably have the more interesting coverage implications and raise several questions. For example, do these persons get counted at one place, all places or no place? Additionally, where should they be counted?

Table 4

Where Does Household Respondent Consider Person to be a "Usual Resident" ? (Weighted % and standard errors)

Where Usual Resident ?	Non Mobile	1-Shots	Boomerangs	No Repeat	Floaters	Total
Interview HH Only	100% (0.2)	97% (2.0)	71% (12.1)	95% (4.2)	70% (10.0)	95% (1.7)
Some Other Place	0% (–)	2% (1.8)	25% (11.0)	5% (4.2)	20% (9.4)	4% (1.5)
Both Places	0% (–)	1% (0.4)	4% (2.1)	0% (–)	10% (7.3)	1% (0.5)
Unweighted N	716	314	186	101	134	1,451

Jackknife chi-square = 2.79, $p < .05$, $d.f. = 8$

That a relatively large percentage of the Boomerangs and Floaters are considered residents some place other than the interview household suggests the potential for undercounting. On the other hand, 10% of the Floaters are defined as usual residents at both the interview household and another place suggests potential for overcoverage. The weighted number of Boomerangs and Floaters in these uncertain residency situations (usual residents elsewhere or at both places) represent approximately 4% of the total population. From this more global perspective, it seems that a non-trivial segment of the population is at risk of some type of coverage error.

6. MODELING OF USUAL RESIDENCE AND MOBILITY

Our final section statistically models the household respondent's determination of usual residence. This analysis goes beyond the descriptive findings of the typology to explore whether mobility impacts the householder's conceptualization of residence. The assignment of usual residence by the householder served as the dependent variable in a series of models. The dependent variable consisted of two categories: 1) usual resident at the interview household and 2) not a usual resident at the interview household. Persons considered to have a usual residence at both the interview household and another place were put

into the first category. Predictor variables included age, sex, race, time away, and the mobility typology. The final models reported in Table 5, all of which include terms for the interaction of the independent variables, are equivilent to logit models for usual residence.

The first model tested mobility as a dichotomous measure: those with no mobility (the Non-mobile) and those having spent at least one night away from the interview household (the 1-shot, No-Repeat, Boomerang and Floater categories combined). This model established first whether temporary mobility was a significant predictor of residency status regardless of the mobility pattern exhibited. This "first-cut" was necessary because approximately 50% of the sample fell into the Non-mobile category and second, because the Non-mobile group was extremely skewed toward the usual resident category of the dependent variable. Consequently, models that attempted to include all five categories of the mobility typology were misspecified due to a large number of zero fitted cells.

Results from the model with the dichotomous mobility measure and sex yielded a relatively good "fit" of the data (Jackknife X^2 for overall goodness of fit = .28, $d.f.$ = 2, p = .27. Neither race nor age improved the fit. Parameter estimates indicated that persons in the Non-mobile category were more likely to be classified as usual residents than those having some mobility (not shown).

Having established that mobility was significantly related to residency status, we next explored whether the pattern of temporary mobility was a predictor. First, we tested an independence baseline model to predict usual residence (U). The predictors consisted of a mobility variable (M), sex (S), and the amount of time spent away (T). The mobility variable was comprised of the four mobile categories (1-Shots, No-Repeats, Boomerangs, and Floaters). Amount of time spent away was split into two categories: less than half the reference period and half or more of the reference period. Race and age were excluded since neither improved the fit of the data.

Table 5
Goodness-of-Fit Tests and Parameter Estimates for Log-Linear Models of the Effect of Sex (S), Temporary Mobility (M), and Length of Time Away (T) on Determination of Usual Residence Status (U)

A. Goodness of Fit Test			
		(U) Usual Residence Status	
Model	*d.f.*	Chi-square [+]	*p*
1. U, SMT	15	4.79	.00
2. US, UM, UT, SMT	10	1.06	.12
3. UTM, USM, SMT	4	0.78	.16
B. Parameter Estimates, Model 3			
	beta	s.e.	std. value
(M) MOBILITY:			
1-Shots	1.08	.40	2.71*
Boomerangs	-1.54	.39	-3.94*
No-Repeats	.83	.58	1.43
Floaters	-.38	.47	-.80
(S) SEX:			
(Males)	.39	.27	1.44
(T) TIME AWAY:			
(> ½ ref. period)	-1.78	.27	-6.52*
(U)*(S)*(M) INTERACTION (Males)			
1-Shots	-.64	.43	-1.48
Boomerangs	.69	.58	1.18
No-Repeats	.85	.62	1.37
Floaters	-.90	.42	-2.14*
(U)*(M)*(T) INTERACTION (> ½ ref. period)			
1-Shots	-.72	.48	-1.50
Boomerangs	-1.20	.54	-2.26*
No-Repeats	1.57	.74	2.12*
Floaters	.36	.41	0.88

[+] Jackknife Pearson chi-square for overall fit.
* Significant at the .05 level.

The baseline model (U, SMT) did not fit the data well so we rejected the null hypothesis that assignment of usual residence is independent of mobility pattern, sex, and amount of time spent away (Jackknife X^2 overall goodness of fit = 4.79, *d.f.* = 15, p = .00, see Table 5). We then fitted a main effects model (2) which includes the additive effects of S, M and T upon U (US, UM, UT, SMT). This model yielded a good fit (Jackknife X^2 overall goodness of fit = 1.06, *d.f.* = 10, p. = .12). Lastly, a model (3) including two interaction terms was also fitted (UTM, USM, SMT). This model assumes interactive effects of T*M and of S*M on U. A comparison between the main effects and interaction model suggested that several interactions were significant and should be retained (comparison Jackknife X^2 = 1.99, *d.f.* = 6, p = .02). Table 5 contains the overall goodness of fit tests along with the parameter estimates from the best fitting interaction model (UTM, USM, SMT – Jackknife X^2 overall goodness of fit = 0.78, *d.f.* = 4, p = .16.)

The parameter estimates from Table 5 illustrate that temporary mobility has a significant main effect on assignment of usual residence in model 3 which controls for sex, amount of time spent away, and several interactions. Two of the mobility categories had significant beta coefficients albeit the directions were opposite. The 1-Shots were significantly more likely to be defined as usual residents (b = +1.08). Conversely, the Boomerangs had a negative parameter estimate (b = −1.54) meaning that the odds of being defined a usual resident were significantly decreased for this group.

Time spent away from the interview household had by far the largest effect on predicting usual residence with a strong negative association (b = −1.78). This means that for our temporarily mobile population, those away half or more of the reference period were significantly less likely to be considered usual residents than those away less than half of the time. Sex did not have a significant main effect, but was involved in a significant interaction. The interaction appears in the Floater group where male Floaters were less likely to be categorized as usual residents than female Floaters (b = −.90). Further investigation revealed few clues to explain this finding. Male and female Floaters differed little in the types of places they visited, their reasons for visiting, and the relation to the householder of places they visited (relative versus non-relative). Perhaps the interaction reflects differences in other social attachments such as presence of children, personal belongings, and/or contribution of resources.

The bottom of table 5 indicates that the interaction between usual residence, mobility and amount of time spent away is rather complex. The amount of time spent away appears to affect usual residence status for some types of mobility but not for others. The interaction coefficient is significant and negative for the Boomerangs (b = −1.20). Thus, the odds of being defined a usual resident are even lower for Boomerangs away half or more of the reference period compared to other groups away for a similar amount of time. This suggests that persons who "boomerang" back and forth between two households will be considered usual residents at the place they spend the majority of time.

However, for the No-repeats, the coefficient is significant and *positive*, essentially canceling out time away's negative main effect (1.57 + −1.78 = −0.21). For this group, the amount of time spent away appears to have no association with usual residence assignment. Apparently, factors other than time may be more important in the cognitive process of determining where these persons "reside." One hypothesis is that No-repeaters are persons who must travel for a living and who, despite their frequent mobility and long periods away, clearly "belong" to a stable residence. This notion supports findings from a vignette study that found respondents did not require a stated rule to be able to correctly identify the usual residence of persons described as being away on business travel. Such persons were "intuitively" perceived to be part of the households from which they were away (Gerber, Wellens and Keeley 1996).

7. CONCLUSIONS

Temporary mobility, as defined in our research, involves long and short, frequent and infrequent, patterned and unpatterned movement away from, but often back to, a single residence. Such mobility has long been hypothesized to contribute toward census and survey coverage error by blurring the concept of who exactly lives or stays at a particular household.

Our sample of persons having a more-than-casual association to households indicated a fair amount of temporary mobility over a two-three month period. Interesting demographic differences were noted in the level of mobility as well as the pattern of mobility reported. The "hard to enumerate" (HTE) group (black/Hispanic males between 18 and 29) were found to cluster in the Boomerang and Floater groups, suggesting a repeat pattern of temporary mobility. We suspect these groups include persons having strong attachments to multiple households, for example an adult son who splits time between a parent and girlfriend's or a young mother who stays periodically at different kin-network households to receive assistance with child care.

Besides the inclusion of the types of persons who tend to be missed in censuses and surveys, other considerations point to the Boomerang and Floaters as being of particular interest. First, compared to the other mobility categories, these groups spent a longer time away from the households in which they were "found" and second, were more often classified as having a usual residence someplace other than the household in which they were found. It is difficult to estimate how much this type of mobility contributes toward undercounting. However, it is very noteworthy that half the HTE population fall in either the Boomerang or Floater group. It seems more than a coincidence that such a large segment of this population belong to one of the two mobility groups most easily labeled "residentially ambiguous."

The log-linear analysis suggests that there is not a clearcut, simple relationship between temporary mobility and assignment of usual residence. We do not find that the greater the amount of temporary mobility the less the chance of being defined a usual resident. Instead, the relationship seems more driven by the pattern of movement. For example, the traveling salesman or truck driver who reports the greatest variety of places visited and the largest number of visits may, nonetheless, have less residential ambiguity than a person visiting only one other place but making many repeat visits. And, in fact, this proved to be the case for the No-Repeats for whom the amount of time spent away had essentially no relation to usual residence assignment.

Our exploration of temporary mobility represents a new research direction for the study of within-household census and survey coverage error. Two recommendations for improving census and survey coverage are offered. First, survey organizations should explore the possibility of directly measuring the association between temporary mobility and incidents of census and survey undercoverage. This could be accomplished by adding questions about mobility to post-census coverage interviews used to estimate the number of people missed or counted in error. If the correlation between coverage error and mobility is significant, then survey methods and procedures could be adjusted to try and reduce it. For example, new roster probes could be added to census forms and nonresponse follow-up interviews, the aim being to find more of the Boomerangs and Floaters. Measures of temporary mobility might also prove to be a powerful predictor variable when statistically modeling the undercount. While admittedly in the early stages, temporary mobility looks promising as an avenue to better understanding household coverage error.

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REFERENCES

CHAKRABARTY, R. (1992). Coverage of the Current Population Survey (CPS) Relative to the 1990 Census. Unpublished U.S. Bureau of the Census memorandum to the record, February 20, 1992.

DE LA PUENTE, M. (1993). Why are people missed or erroneously included by the census: a summary of findings from ethnographic coverage reports. *Proceedings of the 1993 Research Conference on Undercounted Ethnic Populations*, 29-66.

DRESSLER, W., HOEPPNER, S., and PITTS, B. (1985). Household structure in a southern black community. *American Anthropologist*, 87, 835-862.

ELLIS, Y. (1994). Categorical Data Analysis of Census Omissions, Internal Memorandum, Washington D.C: U.S. Bureau of the Census.

ELLIS, Y. (1993). Census Error Study. U.S. Bureau of the Census, 1990 Preliminary Research and Evaluation Memorandum No. 248.

FAY, R.E. (1989a). An analysis of within-household undercoverage in the current population survey. *Proceedings of the 1989 Annual Research Conference*, U.S. Bureau of the Census, 156-175.

FAY, R.E. (1989b). CPLX: Contingency Table Analysis for Complex Sample Designs. Program Documentation. Unpublished document, U.S. Bureau of the Census.

FAY, R.E. (1985). A jackknifed chi-squared test for complex samples. *Journal of the American Statistical Association*, 80, 148-157.

FEIN, D.J., and WEST, K. (1988). Toward a theory of coverage error: an exploration of data from the 1986 Los Angeles test census. *Proceedings of the Fourth Annual Research Conference,* U.S. Bureau of the Census, 540-562.

GERBER, E., WELLENS, T., and KEELEY, C. (1996). Who Lives Here?: The Use of Vignettes in Household Roster Research. Paper presented at the annual meeting of the American Association for Public Opinion Research, Salt Lake City.

GERBER, E. (1994). The Language of Residence: Respondent Understandings and Census Rules. Unpublished report of the Cognitive Study of Living Situations. Center for Survey Methods Research, U.S. Bureau of the Census.

GRIFFIN, D., and MORIARITY, C. (1992). Characteristics of Census Errors. U.S. Bureau of the Census, 1990 Preliminary Research and Evaluation Memorandum No. 179.

HAINER, P. (1987). A Brief and Qualititative Anthropological Study Exploring the Reasons for Census Coverage Error Among Low Income Black Households. Report for the Census for Survey Methods Research, U.S. Bureau of the Census, April 8, 1987.

HAINER, P., HINES, C., MARTIN, E.A., and SHAPIRO, G. (1988). Research on improving coverage in household surveys. *Proceedings of the Fourth Annual Research Conference,* U.S. Bureau of the Census, 513-539.

HANSEN, K. (1994). Geographical Mobility: March 1993 to March 1994. Current Population Reports, Population Characteristics P20-485. U.S. Department of Commerce.

HOGAN, H. (1993). The 1990 post-enumeration survey: operations and results. *Journal of the American Statistical Association*, 88, 1047-1060.

HUDGINS, J.L., and HOLMES, B.J. (1993). The impact of social and economic marginality on the underenumeration of African American males. *Proceedings of the 1993 Research Conference on Undercounted Ethnic Populations*, 153-166.

LIPTON, S.G., and ESTRADA, L.F. (1993). Factors associated with undercount rates in Los Angeles county. *Proceedings of the 1993 Research Conference on Undercounted Ethnic Populations,* 83-102.

LYNCH, J.T., WITT, M., BRANSON, S., and ARDINI, M. (1993). Living Situation Survey: Final Methods Report, Unpublished report, Research Triangle Institute: Research Triangle Park.

MAHLER, S. (1993). Alternative Enumeration of Undocumented Salvadorans on Long Island. Prepared under Joint Statistical Agreement 89-46 with Columbia University. U.S. Bureau of the Census, Washington, D.C.

MARTIN, J.M., and MARTIN, E.P. (1985). The Helping Tradition in the Black Family and Community. Silver Spring, Md.: National Association of Social Workers.

MORIARITY, C.L., and CHILDERS, D. (1993). Analysis of Census Omissions: Preliminary Results. U.S. Bureau of the Census, DSSD 1990 REX Memorandum Series #PP-8.

MONTOYA, D. (1992). Ethnographic Evaluation of the Behavioral Causes of Undercount: Woodburn, Oregon. Ethnographic Evaluation of the 1990 Decennial Census Report #10. Prepared under Joint Statistical Agreement 89-30 with the University of Oklahoma. U.S. Bureau of the Census: Washington, D.C.

PENNIE, K. (1990). Coverage Comparisons Between the 1990 Census and Current Population Survey (CPS). Unpublished U.S. Bureau of the Census memorandum to Preston Jay Waite.

ROBINSON, J.G, AHMED,B., DAS GUPTA, P., and WOODROW, K.A. (1993). Estimation of population coverage in the 1990 United States census based on demographic analysis. *Journal of the American Statistical Association*, 88, 1061-1071.

ROMERO, M. (1992). Ethnographic Evaluation of the Behavioral Causes of Census Undercount of Undocumented Immigrants and Salvadorans in the Mission District of San Francisco, California. Ethnographic Evaluation of the 1990 Decennial Census, Report #18. Prepared under Joint Statistical Agreement 89-41 with the San Francisco State University Foundation. U.S. Bureau of the Census, Washington, D.C.

SHAPIRO, G., DIFFENDAL, G., and CANTOR, D. (1993). Survey undercoverage: major causes and new estimates of magnitude. *Proceedings of the 1993 Annual Research Conference,* U.S. Bureau of the Census, 638-663.

STACK, C.B. (1974). *All Our Kin: Strategies for Survival in the Black Community.* New York: Harper and Row.

SWEET, E.M. (1994). Roster research results from the living situation survey. *Proceedings of the 1994 Annual Research Conference*, U.S. Bureau of the Census, 415-433.

U.S. DEPARTMENT OF LABOR (1994). Employment and Earnings. Bureau of Labor Statistics, January 1994: Washington, D.C.

VALENTINE, C., and VALENTINE, B. (1971). Missing Men: A Comparative Methodology Study of Underenumeration and Related Problems. Report to the U.S. Bureau of the Census, May 3, 1971.

VELASCO, A. (1992). Ethnographic Evaluation of the Behavioral Causes of Undercount in the Community of Sherman Heights, California. Ethnographic Evaluation of the 1990 Decennial Census, Report #22. Prepared under Joint Statistical Agreement 89-42 with the Chicano Federation of San Diego County. U.S. Bureau of the Census, Washington, D.C.

WINGERD, J. (1992). Urban Haitians: Documented/Undocumented in a Mixed Neighborhood. Ethnographic Evaluation of the 1990 Decennial Census, Report #7. Prepared under Joint Statistical Agreement # 90-10 with the Community Service Council of Broward County, Inc. U.S. Bureau of the Census, Washington, D.C.