A TYPOLOGY OF TEMPORARY MOBILITY PATTERNS AND REPORTING OF USUAL RESIDENCE[1]

Nancy Bates and Eleanor Gerber, U.S. Census Bureau
Nancy Bates, Census Bureau, 433 Washington Plaza I, Washington, DC, 20233

Key Words: Census coverage, household rosters

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. Since the decennial census and other census surveys are household-based, an accurate count requires that all eligible persons within each household be included. Most census surveys begin with a roster question designed to list all "usual residents" of a household. In formal census terms, usual residence refers to "the place where the person lives and sleeps most of the time."

Research evaluating the quality of census data suggests that coverage error is a problem. In 1990, the Post Enumeration Survey (PES) and demographic analyses estimated that the net national undercount was approximately 2 percent (Hogan, 1993; Robinson, Ahmed, Das Gupta and Woodrow, 1993). Other research suggests that the undercount in current census surveys is even larger than the decennial census (Shapiro, Diffendal, Cantor, 1993; Chakrabarty, R. 1992; Hainer, Hines, Martin and Shapiro, 1988).

Coverage research also indicates that persons who are undercounted are not randomly distributed among the population. Instead, certain social and demographic characteristics tend to typify persons commonly missed. For example, males are missed more often than females, and blacks and Hispanics are undercounted disproportionately compared to whites (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;1993; Ellis, 1993).

Additionally, research by Fein and West (1988) and Shapiro, Diffendal and Cantor (1993) suggests that failure to count all persons that should be counted within a housing unit is a larger component of total coverage error than failure to count persons as a result of missing an entire housing unit. It has been suggested that two processes may account for these within-household misses. First, deliberate concealment of persons within households may be taking place, and second, the census definition of whom to count may sometimes be misunderstood because it is ambiguous or incongruent with the household respondent's perception of who should be counted.

This paper concentrates on one dimension 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 they make, and the amount of time spent there. This analysis examines whether or not mobility may be associated with factors 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 a person as a "usual resident" and, consequently, someone they would or would not include on a census report.

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 for all persons associated with a household. Through a series of extensive roster probes, the LSS included "core" household residents but also brought in many persons having a less permanent presence. Persons with a more tenuous attachment were brought in by asking probes about persons who had spent the night there during the reference period[2], anyone who was considered a household member even if they were staying elsewhere, and anyone who considered the residence their permanent address or a place they received mail or phone messages (see Sweet, 1994 for more on the probes used).

The LSS was conducted by the Research Triangle Institute between May and September of 1993 with approximately 1000 households (referred to as sampled housing units or SHU's). Interviews were conducted in person and by phone with a final response rate of 79 percent. The LSS sample was stratified to oversample for high and medium minority areas (i.e., greater than 80% black or hispanic and between 40% and 80% black or hispanic) and areas containing renters (i.e., greater

than 40% renters). Standard errors were produced 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, 1989).

The LSS gathering detailed data on temporary mobility. A separate questionnaire included questions about attachments to other residences, names and types of places stayed overnight and the reasons for going. Persons administered the individual questionnaire were asked to fill out a day-by-day event calendar indicating exactly where they had stayed every night during the reference period. The interview criteria for the individual questionnaire resulted in a base of persons having a greater-than-casual association with the interview household.

Our typology of temporary mobility was created using two dimensions of overnight movement outside the SHU. 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 SHU that a person might have attachments to. The second dimension taps the frequency of movements outside the SHU by counting the number of times a person left for a period of one or more nights. For example, if a person left to spend 3 days at a girlfriend's, then moved from there to a relative's for one night before returning, that person would be assigned as having 2 places with 2 moves. Conversely, if a person left to stay overnight at a friend's then returned to the SHU and then two weeks later returned to the same friend's home for a second visit, that person would be assigned 1 place with 2 visits. The first example exemplifies a potential bias in this method, that of counting each unique place visited during one extended trip outside the SHU 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 SHU as a separate move.

A single mobility measure using various combinations of the number of places and number of moves was constructed. In all, seven categories were created with efforts made to identify different patterns of movement by separating out those making repeat visits to the same places. The first category contains persons who stayed all nights of the reference period at the SHU and represents persons with no temporary mobility (see table 1). The second category consists of persons who reported one visit to one place. Category 3 reflects persons making 2-3 trips to the same place while category 4 contains persons making 4 or more overnight trips to the same place. Categories 3 and 4 (and in particular category 4) were believed to illustrate a more patterned mobility by characterizing individuals making repeat visits back and forth to a single place. Such movement presumably captures attachment to a second nearby residence such as college, a girlfriend/boyfriend's, or a relative's. The next level, category 5, introduces more variety with 2-3 places visited and 2-3 trips. Category 6 reflects 2-3 places visited with 4 or more visits, again indicating a pattern of repeat visits to the same place or places. At the high end of the mobility "scale" were those reporting 4 or more visits to 4 or more places during the reference period.

DEMOGRAPHIC CHARACTERISTICS OF TEMPORARY MOBILITY TYPES

Table 1 presents the frequencies for our mobility typology. Recall that our data represent a sample of persons determined to have more than a casual association to the interview household.

Slightly more than half of the persons administered the individual questionnaire reported no mobility outside the SHU 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 SHU to one place (26 percent, overall). Three percent reported making between 2-3 visits to 1 place, while seven percent reported a more repetitive pattern of 4 or more visits to a single place. As mentioned previously, we hypothesize that this latter group contains persons having a strong attachment to a second residence, illustrated by frequent trips back and forth between the SHU and one other place. The two highest levels of mobility (2-3 places w/4 or more visits and 4 or more places w/4 or more visits) were the most infrequently reported categories with close to 2 percent falling into each.

We next examined selected demographics of the mobility typology. Breakouts by sex suggested a higher propensity for mobility for males than females. Approximately 60 percent of the males reported at least one visit outside the SHU which was significantly higher than females at approximately 33 percent (table 2). This trend toward higher temporary mobility for males is consistent with gender differences in geographic mobility, reported by Hansen (1993), who attributed higher male mobility to larger numbers of males in the military and male immigrants.

Age by mobility was next examined. Young adults between 18 and 29 appeared to have the most mobility (close to 70 percent of the 18-29 age group spent at least one night away from the SHU) but this was not found to be significantly different from the other age groups.

Our analysis indicated no significant mobility differences by race either. However, a replication of this analysis with a larger sample would be helpful to explore whether a relatively large concentration of blacks in the 2-3 place/4+ visit category (8%) and Hispanics in the 2-3 place/2-3 move group (18%) are anomalies due to sampling variability or real trends that would be replicated (data not shown). Ethnographic data on black communities might suggest that the concentration of blacks in the "floater" group represents movement among kin-network households often comprised of extended families whose members reside in multiple nearby dwellings and whose composition changes quickly (Hainer, 1987; Stack, 1974). Similarly, the concentration of Hispanics in the 2-3 place/2-3 visit group may reflect Hispanic males performing migrant work with teams that travel from site to site and/or mobility between family tie households in immigrant communities.

Table 3 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 individual LSS sample met the HTE criteria, but an examination of this group's mobility reveals very different patterns than non-HTE individuals. First, the HTE group appears more mobile to begin with -- over sixty percent indicated spending at least one night someplace other than the SHU compared to around 47 percent for non-HTE's. Second, the distribution of mobile categories differs significantly for the HTE's. The majority of non-HTE's who are mobile are concentrated in the "1-shot" category whereas mobile HTE's are more evenly spread out with particular concentration in the repeat movement category involving 1 place and many visits (19%) and the categories involving 2-3 places and between 2-3 and 4 or more visits (16% and 18%, respectively).

MODELING OF USUAL RESIDENCE AND MOBILITY

Our final section attempts to model statistically the household respondent's definition of usual residence to explore whether mobility impacts the householder's conceptualization of residence. The term "usual resident" was used throughout the LSS questionnaire and was defined as "the place where [the person] lives and sleeps most of the time." This definition acts as a guide for census respondents and comes directly from the census questionnaire. Since the LSS was a personal visit or phone interview, we do not know precisely how each household respondent might have characterized the persons listed from the LSS roster had they been filling out a real census form. However, the LSS attempted to simulate this measure by asking the household respondent whether they considered each person rostered to be a usual resident of the SHU. While this method is not a perfect replication of how the householder might have behaved, it provides an approximation of who, out of all those rostered during the LSS, might normally have been included or excluded on a census form or current survey.

The assignment of usual residence by the householder (usual resident of SHU? yes/no) served as the response variable. Predictor variables tested in the models included age, sex, race, time away and our mobility typology. Our first step was to compare those having no mobility to those having spent at least one night away from the SHU. This dichotomous measure established first whether temporary mobility was a significant predictor of residency status regardless of the mobility pattern exhibited. This "first-cut" comparing no mobility versus some mobility was necessary because approximately 50 percent of the sample fell into the first category of no mobility and second, because this large group was extremely skewed toward the "usual resident" category of the response variable. Retaining all levels of the typology at this point would have resulted in a large number of zero fitted cells.

Results from a model containing the main effect of the dichotomous mobility measure, controlling for sex, yielded a relatively good "fit" of the data (neither race nor age improved the fit of the model). Parameter estimates indicate that those having no temporary mobility were more likely to be classified as usual residents than those having some mobility (jackknife X^2 for overall goodness of fit=.28, d.f.=2, p=.27).

Having established that mobility was significantly related to residency status, we next examined whether the pattern of temporary mobility was a predictor. Because the distribution for our response variable was very lopsided (overall, only 5 percent of those having some mobility were considered non-usual residents), the data became too sparse to model all six of the mobility

pattern categories once the demographic and time variables were included. Consequently, categories 2 and 3 (1 place 2-3 visits and 1 place 4+ visits) were combined for this stage of the modeling. The models revealed significant main effects for temporary mobility controlling for age and sex. Also significant was an interaction between usual residence, sex and mobility.

Four of the five mobility coefficients were found to be significant but the relationship does not appear to be linear. The categories of 1 place, several visits and 2-3 places, 4+ visits exhibited a different pattern than the other groups. Both had significant negative associations with usual residence meaning that the odds of being defined a usual resident were decreased for both groups. Another striking finding was in the most mobile category with persons reporting 4 or more places and 4 or more visits. This group had a significant positive relationship meaning that the odds of being classified as a usual resident were increased despite the high level of temporary mobility. This is consistent with an analysis of the type of place visited and reasons for going. For the most mobile group, close to half of the types of places visited were described as hotels/motels and one-quarter cited the reason for making their visit as job related. This suggests that householders have a particularly strong concept of the "home base" for these individuals despite the amount of time they may spend away from it.

Sex did not have a significant main effect, but had a marginally significant interaction with mobility. Evidence of this surfaces for the 2-3 places, 4+ visit or "floater" category where male floaters were less likely to be categorized as usual residents than female floaters. The marginal distribution for this category indicates that 37% of the males were classified as non-residents compared to 17% of the females. One hypothesis is that male floaters tend to circulate more between the homes of non-relatives compared to females. Upon further investigation, some support for this hypothesis was found. Male floaters who reported visiting a house or apartment described over one-quarter of the places visited as "a friend's" and close to three-quarters as being a relative's or their own. This compares to female floaters who characterized closer to 14% as belonging to a "friend" and approximately 85% as their own house or a relative's.

A second round of models added the amount of time spent away during the reference period. Time spent away from the SHU was split into two categories: less than half and equal to or greater than half the reference period. The main finding was that, regardless of the amount of time spent away, type of mobility still remained a significant predictor of usual residence. However, time away had by far the largest effect with a strong positive association. This means that for our temporarily mobile population, those away less than half the reference period were significantly more likely to be considered usual residents than those away half of the time or more.

An interaction between usual residence, mobility and amount of time spent away was detected indicating that the amount of time spent away appears to affect usual residence status for some types of mobility but not for others. Interaction coefficients were positive for those visiting 1 place on one occasion, those making repeat visits to the same location, and those in the floater category. For these groups, being away less than half of the reference period significantly increased the odds of being considered a usual resident at the interview household. This suggests that those maintaining a strong presence in two households will be considered usual residents at the place where they spend the majority of time. However, for the 2-3 places/2-3 visit category, the coefficient was negative essentially canceling out time's main effect and suggesting that time spent away (as defined here) has no association with usual residence assignment. A similar trend was evident for the most mobile group as well. For these groups, then, factors other than time may be more important in the cognitive process of determining where a person "resides".

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. Two dimensions were used to build a typology of temporary mobility: the variety of places visited and the frequency of visits made. From these, a categorization of patterned and less-patterned mobility types were created.

Our sample of persons having a more-than-casual association to households indicated a fair amount of temporary mobility over a 2-3 month period. Approximately one-half made at least one overnight trip away from the place they were interviewed. Interesting demographic differences were noted in the mobility levels. Young adults (18-29) were the most likely to

report some level of mobility although the difference was not large enough to be statistically different from other age groups. The "hard to enumerate" (HTE) group (black/Hispanic males between 18 and 29) were found to exhibit different mobility trends than non-HTE's. This group had the tendency to cluster in the repeat-visit category of 4 or more visits to a single place, and the 2 categories indicating multiple visits to between 2 and 3 places. The latter categories may exemplify residential movement between kin-network households commonly comprised of extended relatives such as cousins, uncles, grandparents, etc.

Log-linear modeling was used to examine temporary mobility and usual residence status among those having at least some level of temporary mobility. It revealed that even when controlling for age and sex, mobility still played a significant part in determining residency status. Specifically, we found that both the lowest and highest mobility categories (1 place visited 1 time, 4 or more places visited 4 or more times) had a significant positive association with being defined a usual resident while the repeat pattern categories (1 place, 2 or more visits / 2-3 places 4 + visits) had the opposite effect -- a decreased likelihood of usual residency assignment. We interpret this to mean that the relationship between temporary mobility and the probability of defining someone as a usual resident is not directly linear and negative i.e., the greater the amount of temporary mobility the less 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 highest variety of places visited and the most number of visits may, nonetheless, have less residential ambiguity than the person visiting only one other place but making many repeat visits.

Also noteworthy is the association of the demographic variables. Neither race nor age, for example, were found to be significant predictors of usual residence status. Sex, while it had no main effect, was found to interact with type of temporary mobility: the odds of being categorized as a usual resident were decreased for male "floaters" compared to females. This is hypothesized to reflect females tendency to "float" more between the homes of relatives while males may circulate more among non-relative's.

Finally, of the variables we examined, length of time away was found to have the largest effect in predicting usual residence. Not surprisingly, spending more than half of the reference period at the interview household had a strong positive association with being defined a usual resident there. However, even when length of time away was controlled, type of mobility still remained a significant predictor and the strength and direction of the estimates remained as they were before adding time's effect.

Our exploration of temporary mobility represents a new research direction for the study of within-household census and survey coverage error. It allows us to distinguish different patterns of temporary movement, characterize what they represent, examine demographic differences between them, and explore their relationship with assignment of usual residence. And while admittedly in the early stages, temporary mobility looks promising as an avenue to better understanding what contributes to within- household coverage error.

NOTES

[1] The opinions expressed in this paper are those of the authors and do not necessarily reflect the opinions of the U.S. Census Bureau. The authors wish to acknowledge Elizabeth Sweet, Robert E. Fay, Elizabeth Martin, Laurel Schwede, Michael Witt, the Census SAS support division, and the LSS working group for their help with this research.

[2] The length of the reference period varied with the date of the interview. Reference periods began on the first day of the month, two months prior to the interview month and ended on the day of the interview.

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.

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

Fay, Robert (1989). "CPLX: Contingency Table Analysis for Complex Sample Designs. Program Documentation." Unpublished document. U.S. Bureau of the Census.

Fay, Robert (1985). "A Jackknifed Chi-Squared Test for Complex Samples," Journal of the American Statistical Association, Vol. 88, No. 423.

Fein, D.J. and Kirsten West (1988). "Towards a Theory of Coverage Error: An Exploratory Assessment

of Data from the 1986 Los Angeles Test Census." Proceedings of the IV Annual Census Bureau Research Conference, 1988.

Griffin, Debbie and Chris Moriarity (1992). "Characteristics of Census Errors," U.S. Bureau of the Census, 1990 Preliminary Research and Evaluation Memorandum No. 179.

Hainer, P., C. Hines, E. Martin and G. Shapiro (1988) "Research on Improving Coverage in Household Surveys." Proceedings of the IV Annual Census Research Conference, 1988.

Hainer, P. (1987) "A Brief and Qualitative Anthropological Study Exploring the Reasons for Census Coverage Error Among Low Income Black Households," report submitted to the U.S. Census Bureau, April, 1987.

Hansen, Kristin (1992). Geographical Mobility: March 1991 to March 1992. Current Population Reports, Population Characteristics P20-473. U.S. Department of Commerce.

Hogan, Howard (1993). "The 1990 Post-Enumeration Survey: Operations and Results," Journal of the American Statistical Association, Vol. 88, No. 423.

Robinson, J.G, B. Ahmed, P. Das Gupta, and K.A. Woodrow (1993). "Estimation of Population Coverage in the 1990 United States Census Based on Demographic Analysis," Journal of the American Statistical Association, Vol. 88, No. 423.

Shapiro, G., G. Diffendal, and D. Cantor (1993). "Survey Undercoverage: Major Causes and New Estimates of Magnitude," Proceedings of the Annual Census Bureau Research Conference, 1993.

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

Sweet, Elizabeth M. (1994). "Roster Research Results from the Living Situation Survey," a paper presented at the Census Bureau's Annual Research Conference, Rosslyn, VA.

Table 1 - Typology of Temporary Mobility

CATEGORY:	Weighted %	s.e	Sample N
1) No mobility	52%	(14.0)	716
2) 1 Place, 1 Visit	26%	(10.4)	314
3) 1 Place, 2-3 Visits	3%	(1.5)	72
4) 1 Place, 4 + Visits	7%	(3.4)	114
5) 2-3 Places, 2-3 Visits	7%	(2.3)	105
6) 2-3 Place, 4 + Visits	2%	(0.9)	76
7) 4 + Places, 4 + Visits	2%	(0.9)	54
	100%		1,451

Table 2 - Temporary Mobility By Sex of Respondent

	SEX		
MOBILITY	MALE	FEMALE	TOTAL
No mobility	40%	67%	52%
1 Place, 1 Visit	35%	16%	26%
1 Place, 2-3 visits	4%	2%	3%
1 Place, 4 + visits	10%	4%	7%
2-3 places, 2-3 visits	6%	7%	7%
2-3 places, 4 + visits	3%	2%	2%
4 + places, 4 + visits	1%	3%	2%
	N = 653	N = 798	N = 1,451

Jackknife chi-square = 1.65, p = .04, d.f. = 6

Table 3 - Temporary Mobility By Hard-To-Enumerate (HTE) Status

	HTE STATUS		
MOBILITY	NON-HTE	HTE	TOTAL
No mobility	53%	38%	52%
1 Place, 1 Visit	27%	6%	26%
1 Place, 2-3 visits	3%	2%	3%
1 Place, 4 + visits	7%	19%	7%
2-3 places, 2-3 visits	6%	16%	7%
2-3 places, 4 + visits	2%	18%	2%
4 + places, 4 + visits	2%	1%	2%
	1375	76	1,451

Jackknife chi-square for distribution of mobile categories = 1.34, p = .07, d.f. = 5