Developing a Sustainable and Flexible Long-Distance Travel Survey

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Abstract

The Bureau of Transportation Statistics (BTS) is responsible for designing the next national survey on long distance travel. Past surveys were conducted in 1977, 1995, and 2001. These surveys were vastly different from each other in scope and methodology. BTS now faces the challenge of designing a long distance travel survey program that will meet the needs of its varied data users, improve on the various shortcomings of previous surveys, be sustainable over time, and maintain at least some comparability with the previous surveys.

BTS identified the five biggest challenges facing this program as 1) ensuring adequate sample size, 2) minimizing nonresponse bias, 3) reducing coverage bias, 4) decreasing underreporting of trips, and 5) addressing other measurement errors. Only by developing a data collection program that addresses the identified challenges and is flexible to new demands, will users be able to rely on the data and use it to measure trends in long-distance travel. BTS is working to address each of these challenges to develop a long-distance travel data collection program in a time of budgetary uncertainty and limited resources.

Introduction

The 2001 National Household Travel Survey (NHTS) was the last time the BTS collected data on long distance travel. The survey combined two previous surveys from 1995. The 1995 Nationwide Personal Transportation Survey (NPTS) asked mainly about all travel from each household member on a randomly assigned "travel day". It employed an RDD sample design resulting in completed interviews from about 26,000 households. The 1995 American Travel Survey (ATS) completed interviews with approximately 67,000 retired CPS households (from a sample size of nearly 80,000) and collected information on trips of 100 miles or more in four quarterly interviews over the course of 1995 to obtain trip estimates for the full year from each household. This survey captured all long distance trips (100 miles or more) for each person that occurred during the course of the year.

The 2001 NHTS interviewed an RDD sample of about 26,000 households about their "travel day" trips using a protocol almost identical to the 1995 NPTS. A trip diary was used to enumerate and collect details about the daily travel trips to help respondent recall, but the diary itself was not collected. Each household was also asked to report their trips of 50 miles or more taken in the four-week period prior to their randomly assigned "travel day". Though data were collected for the entire year, each individual only reported their long distance trips (50 miles or more) for a four-week period.

The change from a full year of long-distance trip reports in 1995 to a four-week reference period in 2001 caused the total number (sample) of long trips to be much smaller in 2001 (over 500,000 trips in the 1995 ATS compared with only about 22,000 trips in the NHTS). This makes estimating trips between specific states and metro areas (travel flows) impossible. Also, the ability to estimate seasonal change in trip making is severely limited.

As a first step in the planning process for the next long-distance survey, BTS reviewed external assessments of the 2001 NHTS including the TRB/CNSTAT Special Report #277 that assessed three specific surveys at BTS including the NHTS, and a report on the travel data program produced by a consultant from the Oak Ridge National Laboratories. BTS formed a working group made up of BTS staff which identified needs and gaps in travel data. Finally, BTS contracted with the Joint Program in Survey Methodology at the University of Maryland to review methodological issues in collecting data about long-distance travel and make recommendations for the next survey. Most of the rest of this paper is devoted to addressing the challenges reported in these reviews and BTS' own internal assessments.

The following sections discuss the five major challenges that BTS has identified as facing the next long distance survey. BTS is very aware that a successful survey program is not based solely on the next immediate survey, but is designed to be flexible and withstand demands across time. BTS hopes that by designing a survey that allows for trends to be estimated and is consistent, current users will be better served and a more extensive user base will find the survey beneficial.

1. Adequate Sample Size

The 2001 design, coupled with the smaller sample of households led to a much smaller sample of long-distance trips. The sample size of long trips in 2001 was only about 22,000 for trips of 100 miles or more, compared with 500,000 in the 1995 ATS. This works out to be about 4 to 5 percent of the trips collected in 1995. This reduction in sample makes virtually all estimates of interstate and metro area flows and other state-level estimates impossible. While other federal surveys serve user's needs by providing national or regional estimates, the nature of the transportation network and long-distance travel makes travel flow information critical to understanding the use of the network and informing decisions about how to best maintain and improve the network. The four-week reference period used in 2001 caused another problem not present in the 1995 data. Since data were not collected from each household about all the trips they took in the entire year of 2001, one cannot say how many *people* didn't take any long trips in 2001. However, for those that reported no long-distance trips in their four-week reference period, data were collected on their most recent trip. These data may help to answer this question.

BTS hopes to go back to interviewing households multiple times (like the 1995 ATS) in the next survey to get all long trips for the year. However, going back to an annual reference period doesn't necessarily mean there will be sufficient sample to support travel flow estimates.

2. Nonresponse Bias

Nonresponse bias can be caused by differences between respondents and nonrespondents and low response rates may make this problem worse. Though this problem is not unique to travel surveys, there may be reasons to think that travel patterns of nonrespondents are different from respondents. The 2001 NHTS had a weighted response rate of 41 percent. While this figure is very high in the world of travel surveys it nonetheless causes BTS concerns.

In addition to basic quality concerns, new OMB requirements for minimum response rates in *federal* surveys. OMB requirements apply to surveys that produce official statistics (like the NHTS). Surveys with expected response rates of 80 percent or more need complete descriptions of how the expected response rate was determined and a detailed description of steps that will be taken to maximize the response rate. Surveys with expected response rates between 60 percent and 79 percent need a discussion of plans to evaluate nonresponse bias, in addition to the above requirements. Followback surveys can be used to quantify nonresponse bias, though they have their own practical constraints. Surveys with expected response rates of less that 60 percent will generally not be approved especially if the information to be collected will be "influential. " However, it may be possible for agencies to justify conducting such an information collection, depending on the purpose of the study, the population being studied, past experience with response rates when studying this population, plans to evaluate nonresponse bias, and plans to use survey methods that follow best practices that are demonstrated to achieve good response rates.

Nonresponse bias is difficult and costly to remedy. Some form of intensive nonresponse follow-up is needed to minimize nonresponse in the next survey. As discussed in the next section, unless this includes personal visit interviews with households that cannot be reached by telephone, the coverage bias present in RDD samples will be compounded with nonresponse bias. In RDD samples, addresses for about one-third of sample households may not be available. It is not possible to follow up nonrespondents for whom one does not have an address. Selecting a random adult respondent from within each household may improve overall response rates since fewer contacts would be needed to secure an interview.

3. Coverage Bias

Coverage bias is caused when members of the population have no chance to be selected to participate in the survey. In RDD sampling, non-telephone and mobile phone-only households are not covered. Non-telephone households that sometimes have telephone service can be covered in RDD sampling by asking interviewed households whether they have had telephone service interruptions in the past, then weighting these households up to compensate for their reduced chance of selection. Research is underway on including cellular phone-only households and on conducting surveys over cellular phones. This has been done in other countries, like Finland, where cellular phone penetration is very high and there are no fees to call recipients.

Data on the extent of under coverage in RDD samples show that about 2.4 percent (2000 Census) of households do not have a telephone. About six percent are cellular phone-only households (Tucker, et al, 2004). Cellular phone-only households tend to be younger, lower income, rent (rather than own) their residence, and have fewer household members (Blumberg, Luke, and Cynamon, 2004).

The number and proportion of cellular phone only households are expected to increase. A recent study by the market research firm In-Stat/MDR estimates wireless only households growing to 30 percent by 2008. If that estimate holds, telephone polls will face enormous challenges in the very near future. Another problem is that cellular phones tend to be associated with individuals rather than households, which causes a problem with the unit of analysis and weights. Also, there are safety concerns with interviewing people over cellular phones (i.e., conducting interviews with people on their cell phone while they are driving their car).

Coverage bias, like nonresponse bias, is difficult and costly to remedy. The National Survey of America's Families (NSAF) used a dual frame design (RDD with a small area frame component) to attempt to address the coverage bias while keeping data collection costs low. NSAF staff commented that this approach was problematic due to the lack of good data for the area frame of nonphone households to be used as control totals in weighting. They ended up not weighting the area frame data separately due to the lack of good control totals. Many large, federal surveys (Current Population Survey, American Community Survey, etc.) use an area-probability frame instead of RDD to address the problem of coverage bias from leaving out non-phone households.

4. Underreporting of Trips

People tend to forget some of their trips, especially non home-based and non-work trips (Badoe and Stewart, 2004). This error of recall may lead to bias in trip estimates. The problem is even worse when trips are reported by a proxy respondent (Bose and Giesbrecht, 2004).

Key NHTS Trip Estimates

Reported by >	Self	Proxy
Mean Trips on Travel Day	4.50	3.70
Mean Long-Distance Trips	0.87	0.72
Mean Walks Trips-Past Week	4.20	3.10
Mean Bike Trips-Past Week	0.22	0.18
Used Transit on Travel Day	4.8 %	3.8 %
Used Transit Last 2 Months	17.3 %	12.6 %

The above table shows that many key estimates of travel are lower when reported by proxy versus by the person who traveled. These differences held even when controlling for differences in demographic characteristics between self and proxy respondents. The table below shows that there are significant differences between self and proxy reports for long-distance trips with round trip distances less than five hundred miles. For distances 500 miles or more, no differences are detectable.

Mean Long Distance Trips by Distance

Reported by >	Self	Proxy
100-299 miles†	4.50	3.70
300-499 miles†	0.87	0.72
500-999 miles	0.60	0.49
1000-1999 miles	4.20	3.10
2000 miles or more	0.05	0.04

† Significant difference between self and proxy reports

Trip data collected using a Geographic Positioning System (GPS) device may help BTS estimate this bias. However, GPS data are expensive to collect and process (reference?). Also using GPS-based data from a subsample of households to make weighting adjustments to the entire sample would severely reduce the effective sample size of the survey.

5. Measurement Error

Even when people remember to report a trip, they tend to forget some trip details. For example, people aren't good at remembering or estimating time spent traveling or miles traveled. Also, proxies may report trips, but may not know details. As is the case above, GPS data may help us estimate the magnitude of these errors, but is costly and cannot be used to adjust estimates without severe affects on sampling error. There are also measurement error issues that arise specifically with the use of GPS-based data.

Kojetin and Miller (1993) found in a study of the Consumer Expenditure Survey that parents were poor proxies for children's spending behavior. Since parents report for virtually all children in the NHTS, this finding may apply to travel behavior as well.

JPSM Study

BTS funded an expert review of the long-distance travel survey by the Joint Program in Survey Methodology (JPSM) at the University of Maryland. In their review, the JPSM made a number of suggestions for the design of the next survey. Those suggestions included:

- Area probability design to improve both coverage and response rates
- Panel design to collect data over a full year from the same households
- Face to face interviewing in round 1 to improve panel response rates
- Prepaid ($5) and conditional incentives ($10) to improve response rates
- Reinterview to assess measurement error
- One month reference period for trips 50 to under 100 miles, three-months for 100 miles or more to improve trip reporting
- Assess comparability to prior surveys
- Sample 1 or 2 persons per household to reduce burden and potentially improve response rates (What effect will subsampling within households have on trend data? What users need data from all household members?)
- If RDD is the only mode used, conduct a two-phase nonresponse follow up to improve response rates
- If using RDD, consider a dual-frame design to address undercoverage bias
- Consider mode switching to improve response rates

In addition, the JPSM review included recommendations to study the effect of the length of the reference period on recall of different kinds/distances of trips and to further examine the quality of proxy data by doing a small scale experimental design carried out independently or as an add-on to the survey.

Resource Limitations

The budget available for the next long-distance travel survey may support only a smaller sample, which means less accuracy (may not support travel flows) and impacts what can be done to improve data quality (increase response rates, measure and/or reduce nonresponse bias, coverage bias, underreporting of trips, and measurement error). In addition, other priorities of users of long distance data may not be met, e.g., cost of travel and data on people with special transportation needs However, BTS is committed to finding the optimal solution given all the practical constraints faced by federal and travel surveys.

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