

Technical notes

2006 NCVS data examined for explanations of anomalies from previous years

The National Crime Victimization Survey (NCVS) is an annual data collection, conducted by the U.S. Census Bureau for the Bureau of Justice Statistics (BJS). As an ongoing survey of households, the NCVS measures crimes of violence and theft both reported and not reported to police. It produces national rates and levels of personal and property victimization.

A number of NCVS estimates for 2006 varied widely from the estimates for previous years. The differences were too extreme to be attributed to year-to-year changes. To look for explanations for the extreme variations, Census Bureau staff examined their data collection and processing procedures, including a review of the sampling and weighting procedures used for the survey. BJS staff also conducted analyses of the data to identify patterns that might suggest possible explanations for the differences.

The Census Bureau's Demographic Statistical Methods Division (DSMD) concluded that NCVS processes and procedures related to the design, collection, processing, and weighting of the data did not erroneously increase the victimization estimates between 2005 and 2006. DSMD determined that methodological changes had contributed to the large differences between the 2005 and 2006 estimates. These technical notes describe the methodological changes to the survey in 2006 and their impact on the victimization rates.

The three major methodological changes in 2006 included:

- introducing a new sample beginning in January 2006, based on the 2000 Decennial Census to account for shifts in population and location of households that occur over time
- incorporating responses from households that were in the survey for the first time (called "bounding interviews") in the production of survey estimates
- replacing paper and pencil interviewing (PAPI) with computer-assisted personal interviewing (CAPI).

Sample redesign

Every 10 years, the Census Bureau conducts the official population census or the Decennial Census of the United States. The most recent sample redesign of the NCVS was based on the 2000 Decennial Census. A redesign was necessary to account for changes in locations and characteristics of households and individuals across the U.S. since the 1990 Decennial Census.

As a standard practice, the Census Bureau updates its sample areas for ongoing household surveys about mid-decade. As areas based on the most recent census data are introduced to the sample area, areas based on the previous census are phased-out. For the NCVS sample redesign, this update entailed introducing new 2000 Decennial Census sample areas while phasing-out 1990 Decennial Census sample areas.

In 2005 and 2006, the Census Bureau introduced the 2000-based sample redesign in the NCVS's continuing and new areas. Continuing areas were areas included in both the 1990-based and 2000-based NCVS samples. New areas were areas included in the 2000-based sample but not in the 1990-based sample. The 2000-based sample was introduced in continuing areas of the NCVS in 2005. Full implementation of the sample redesign began with new sample areas in January 2006.

During 2006 and 2007, the NCVS sample contained both 1990 and 2000 designated sample areas, called primary sampling units (or PSUs). Continuing areas included about two-thirds of the sample areas surveyed in 2006. (See appendix table 1.) Of the new areas included in the 2006 sample, about two-thirds were in nonmetropolitan areas designated by the survey as "rural" areas.

As the new sample was introduced, the outgoing 1990-based portion of the sample was reduced by 16% to offset the inclusion of bounding interviews in the production of survey estimates. This reduction kept the number of interview cases used in the 2006 estimates (approximately 76,000 households) at a level and cost comparable to the previous 2005 estimates (approximately 77,200 households).

Inclusion of bounding interviews

To increase the efficiency and cost effectiveness of the interviewing process, the NCVS uses a rotating panel design. Addresses for households remain in the sample for 3 years, and all residents age 12 or older are interviewed at 6-month intervals, for a total of seven interviews. The production of estimates for the sample of NCVS households includes six rotation groups (i.e., seven interview rotations minus the bounding interview).

Appendix table 1. Percent of NCVS sample in continuing and new areas, by location, 2006

	Continuing areas*	New areas
Total NCVS sample	68%	32%
Total	100%	100%
Urban	38	13
Suburban	55	21
Rural	7	67

*Continuing areas were in the NCVS sample in both 2005 and 2006.

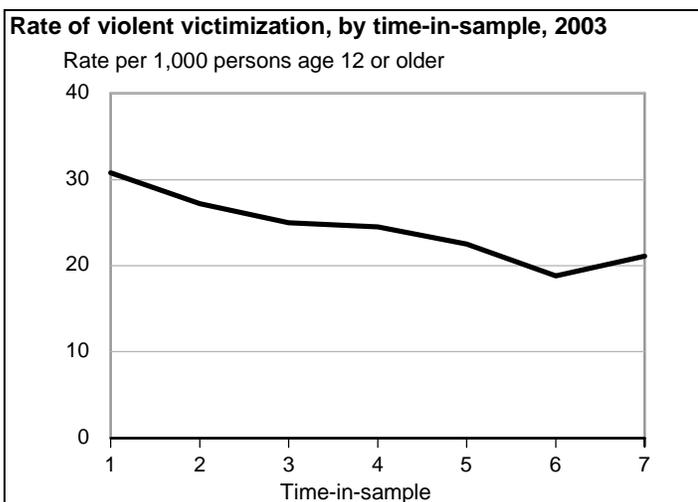
First-time interviews are designated as time-in-sample 1 (TIS-1), second interviews as TIS-2, continuing through the seventh interview as TIS-7. Data collected for the full NCVS sample are balanced across the seven rotations so that about an equal number of households each year receive their first through seventh interviews.

Earlier research conducted during the development of the NCVS (then called the National Crime Survey) found the existence of two time-in-sample effects on survey estimates—telescoping and panel bias. Telescoping affects survey estimates when an individual remembers an event as having occurred at a time other than when it actually did.

Forward telescoping includes events reported as having taken place at a time that was more recent than when they actually occurred. Backward telescoping includes events reported as having taken place at a time that was less recent than when they actually occurred. For retrospective surveys such as the NCVS, forward telescoping is of great concern because of the possibility of over-reporting events during the survey's reference period.

Panel bias (sometimes called respondent fatigue) is the likelihood that the respondent will provide less information for the survey as the number of interviews increases. The longer a household remains in sample, the less likely respondents are to report being victims of crime.

Because of telescoping and panel bias, respondents tend to report more incidents of crime during first-time interviews than in subsequent interviews. A bounding procedure that excludes the first interview at each household from the production of annual estimates was incorporated in the NCVS to help prevent telescoping. This bounding procedure uses the first of seven interviews at each address solely to create a boundary for incidents recalled in subsequent interviews. Excluding the first interview from the production of annual estimates helps to prevent telescoping only.



Appendix figure 1

NCVS procedures are unable to prevent panel bias because it is an acknowledged effect of conducting a panel survey. Provided the sample remains balanced (i.e., the same proportion of households are interviewed during each wave of the survey), the effects of panel bias should change little over time, having no effect on the survey's year-to-year change estimates.

NCVS data for 2003 demonstrate the differential levels of reporting victimizations across the seven TIS interviewing stages (appendix figure 1). In 2003 respondents in households interviewed for the first time (TIS-1) experienced violent victimizations at a rate of about 31 per 1,000 persons age 12 or older. Respondents interviewed for the sixth time had a rate of 19 victimizations per 1,000 persons age 12 or older. This difference is attributable to panel bias.

Excluding TIS-1 bounding interviews in the production of estimates for the 2000-based redesign would have meant implementing the sample redesign in July 2005 and conducting interviews with approximately 24,000 households between July and December 2005. These interviews would have been used solely to bound subsequent interviews at these households.

To remain within the BJS budget, BJS and the Census Bureau developed a truncated implementation plan that eliminated the initial bounding interviews for incoming sample households. The new sample was introduced in January 2006.

An examination of sample data from previous years and alternative methods of integrating first-time interview data indicated that a downward adjustment of these data could be used to adjust for the upward bias associated with using unbounded interviews. Without an adjustment to account for the effects of telescoping, these interviews would result in an over-reporting of crime.

To adjust for using first-time interviews in the production of estimates for the 2000-based redesign, a BJS and Census Bureau methodological working group began the process of developing a weighting adjustment factor in 2004 to mitigate any over-counting of crime. Following an exploration of various adjustment protocols, BJS and Census Bureau staff concluded that the best approach was to build adjustment factors based on 2005 data that used a ratio of TIS-2 through TIS-7 households to TIS-1 crime (appendix table 2).

Appendix table 2. 2005 Bounding adjustment factors, by time in sample

Period	Household adjustment factor	Person adjustment factor
2005 2:1	.78	.81
2005 3:1	.69	.73
2005 4:1	.69	.68
2005 5:1	.65	.56
2005 6:1	.67	.77
2005 7:1	.62	.76

These adjustment factors accounted for both telescoping and panel bias. A household interviewed in 2006 for the first time that had entered the sample as a TIS-5 household had the sample weight multiplied by .65 to account for the difference between a first time and a fifth-time interview. A person interviewed in 2006 for the first time who entered the sample as a TIS-5 interview had the sample weight multiplied by .56 to account for the difference between a first time and a fifth-time interview. Analysis of this adjustment method demonstrated a close fit to actual victimization rates for the year.

Introduction of computer-assisted personal interviewing (CAPI)

In July 2006, NCVS was converted to a fully automated data collection. Computer-assisted personal interviewing (CAPI) replaced paper-and-pencil interviewing. Field representatives used questionnaires loaded into laptop computers to conduct interviews, which could be completed either in person or by telephone.

NCVS data collection was partially automated in 1987 when the Census Bureau began using a combination of paper-and-pencil interviewing (PAPI) and computer-assisted telephone interviewing (CATI). CATI is a telephone survey technique in which the interviewer follows a script provided by a software application. Research has suggested that CATI enhances data accuracy and produces higher and more accurate estimates because the computer-based interviewing process ensures that correct skip patterns are followed so that respondents answer all relevant questions.

For the NCVS data collection, CATI interviews were conducted from two telephone facilities. NCVS households interviewed using CATI were not randomly assigned. They were generally located in primary sampling units (PSUs) with large numbers of sample cases that required more than one interviewer and interviews were easier to complete. These households were characteristically not in rural areas. Cases that could not be completed using CATI were recycled back to the field office for completion by field interviewers.

NCVS surveys conducted using PAPI were more concentrated in rural and urban areas where fewer interviewers were available or where interviews were more difficult to complete. These areas included inner city areas that required multilingual interviewers or areas difficult to enumerate.

Similar to the initial transition from PAPI to computer-based telephone interviewing, the transition from CATI to CAPI was expected to produce higher rates of crime. To avoid

overloading interviewers with additional cases during the conversion to a fully automated data collection, CATI interviewing from Census telephone facilities continued after CAPI implementation. During the first half of 2006, interviewers completed approximately 76% of NCVS interviews using PAPI, while the remaining 24% was completed using CATI. During the second half of 2006, interviewers completed approximately 19% of NCVS interviews using CATI, while the remaining 81% was administered using the new CAPI environment.

Effects of methodological changes on survey estimates

Initial examination of the NCVS estimates for 2006 by BJS and Census Bureau staff uncovered patterns in the data and differences between the 2005 and 2006 estimates that could not be attributed to actual changes in the level of crime. According to the Census Bureau, a close review of the 2006 NCVS estimates detected patterns indicating that changes to the survey had affected the crime estimates with differences too extreme to be attributed to sampling variation.

This conclusion centered on the estimates for rural areas. Eighty-three percent of rural households in the sample were in new areas. There was very little difference between the 2005 and 2006 rates of violent victimization reported for both urban and suburban sample areas. The rate of violent victimization in the rural sample areas increased 62% between 2005 and 2006. The violent victimization rates for 2006 for continuing areas (urban, suburban and rural) were not significantly different from those for 2005 overall (appendix table 3).

The sample size was not sufficient to measure the differences between the rates for continuing areas and the differences for old and new areas for each of the NCVS measured offenses. The year-to-year differences for each offense in old and new areas were nominally greater than for continuing areas.

Changes were not implemented in a way that facilitated identifying and quantifying their effects on survey estimates

The Census Bureau and BJS's review and analysis of the data concentrated on two areas: the transition from paper-and-pencil interviewing to CAPI and the effects associated with implementing the sample redesign. Of the three methodological changes implemented, it was anticipated that including first-time interviews in the production of estimates and converting from PAPI to CAPI would have an

effect on the 2006 estimates. A weighting instrument was developed to adjust and account for the effects of using first-time interviews. Resources were not available for BJS to fund two samples to study the effects of converting from PAPI to CAPI.

The Census Bureau did not find any underlying problems with the sample design, the implementation of the new sample, or the weighting and processing of the new data. The Census Bureau identified a few issues, including the treatment of both out-of-scope and duplicate incidents that might have had some effect on the estimates. These effects were not of a magnitude sufficient to produce the anomalous results for 2006.

Conversion to CAPI

Other surveys, such as the Current Population Survey (CPS), also produced higher estimates of the behavior being measured after migrating to CAPI. CPS estimates of unemployment rates increased following implementation of the CAPI collection methods in 1994.¹

CAPI was not implemented in the NCVS in a way that would enable measuring its impact on survey estimates. The only way that its impact could be assessed was to compare pre- and post-implementation victimization rates. The NCVS sample was not large enough to capture pre- and post-CAPI effects for violent crime rates, but an increase in pre- and post-CAPI rates was evident for property crimes (appendix table 4).

The property crime rate was 150 victimizations per 1,000 households between January and June 2006 when PAPI interviews were used. This rate increased significantly, to

169 victimizations per 1,000 households between July and December 2006, following the implementation of CAPI. Because these estimates are for two separate time periods, it was not possible to separate CAPI effects from actual changes in the rate of property crime.

As observed with the introduction of CATI, a fully automated NCVS data collection showed an increase in the crime estimates. The structured aspect of computerized questionnaire instruments provides little opportunity for interviewers to use their own judgment to interpret, alter, or skip survey questions. In CAPI, questions and skip patterns are programmed into the instrument. This improves the ability of the interviewer to follow the complex skip patterns.

Effects associated with the sample redesign

The Census Bureau used similar variables and processes to stratify both the 1990-based and 2000-based sample redesign. During every redesign, the selection and integration of a new sample requires hiring and training interviewers to administer the survey in new areas.

In January 2006, new interviewers trained during the previous month began collecting NCVS data for the first time. Roughly 7% of all interviews were conducted by new interviewers in 2005 and approximately 28% of the NCVS assignments were completed by new interviewers in 2006. The data collected from new interviewers in these sample areas were included in the estimates. The Census Bureau continues to evaluate the effects of new interviewers on survey data.

Appendix table 3. Criminal victimization rates, by type of crime and sample area, 2005 and 2006

Type of crime	2005		2006		Percentage change old and new areas	Percent change continuing areas
	Old areas ^a	Continuing areas	New areas	Continuing areas ^a		
Violent crimes^b	20.5	21.4	27.2	23.5	32.7%‡	9.8% ^c
Rape/sexual assault	0.2*	0.2	0.5*	0.3	150.0	50.0
Robbery	1.2	3.0	2.5	3.1	108.3	3.3
Assault	18.8	17.5	23.8	19.2	26.6	9.7
Aggravated	4.4	4.3	5.8	5.3	31.8	23.3
Simple	14.4	13.2	18.0	13.9	25.0	5.3
Personal theft	0.5*	1.1	0.4*	0.8	-20.0%	-27.3% ^c
Property crimes	143.0	158.0	165.9	156.7	16.0%	-0.8% ^c
Household burglary	31.7	28.8	34.0	28.3	7.3	-1.7
Motor vehicle theft	4.7	9.7	4.5	10.1	-4.3	4.1
Theft	106.6	119.5	127.3	118.3	19.4	-1.0

‡The difference from 2005 to 2006 is significant at the 90%-confidence level.

*Based on 10 or fewer sample cases.

^aVictimization rates are per 1,000 persons age 12 or older or per 1,000 households.

^bExcludes murder because the NCVS is based on interviews with victims and therefore cannot measure murder.

^cPercent change between 2005 and 2006 in continuing areas is not statistically significant.

¹Ryscavage, Paul (1995). "A surge in growing income inequality?" *Monthly Labor Review*, 118 (8), 51-61.

Further research is needed to examine the effects of methodological changes on the NCVS

CAPI Instrumentation

Limited time and financial resources prohibited the Census Bureau and BJS staff from fully assessing the effects of CAPI on the 2006 NCVS estimates. Without a control group for benchmarking the CAPI effects, the effects could be evaluated through an analysis of the output of the CAPI instrument only.

New versus experienced interviewers

Due to differences between data collected by new versus experienced interviewers, refresher classroom training has been recommended. Research should examine whether a correlation exists between the level of interviewer experience and crime incidents captured. Additional analyses should reveal any interviewer effects in continuing or new sample areas.

New Area Crime Estimates

In 2008, Census Bureau and BJS staff will have the data to more fully assess the effect of the 2000-based new sample areas on crime estimates. Some shifting in the sample percentage in rural areas will provide an opportunity for evaluating characteristics of the new areas included in the 2006 survey.

The effect of differential nonresponse on crime rates

The NCVS nonresponse rate has steadily increased over the past decade. These increasing nonresponse rates may affect the smaller subgroups. Research should examine household and individual nonresponses by demographic and geographic group characteristics and type of sample area to explore the impact of nonresponses on the 2005 and 2006 estimates.

Appendix table 4. Criminal victimization rates, by pre- and post-CAPI implementation, 2006

Type of crime	Total		Pre-CAPI (January-June 2006)		Post-CAPI (July-December 2006)	
	Number	Rate ^a	Number	Rate ^a	Number	Rate ^a
Violent crimes^b	6,094,720	24.6	2,851,690	23.1	3,243,030	26.2 ^c
Rape/sexual assault	272,350	1.1	105,770	0.9	166,570	1.3 ^c
Robbery	711,570	2.9	357,990	2.9	353,580	2.9 ^c
Assault	5,110,810	20.7	2,387,930	19.4	2,722,880	22.0 ^c
Aggravated	1,354,750	5.5	621,600	5.0	733,150	5.9 ^c
Simple	3,756,060	15.2	1,766,330	14.3	1,989,730	16.0 ^c
Personal theft	174,150	0.7	100,880	0.8	73,280	0.6 ^c
Property crimes	18,808,820	159.5	8,799,290	149.5	10,009,530	169.4†
Household burglary	3,539,760	30.0	1,851,000	31.5	1,688,760	28.6 ^c
Motor vehicle theft	993,910	8.4	470,660	8.0	523,250	8.9 ^c
Theft	14,275,150	121.0	6,477,630	110.1	7,797,530	131.9†

†The difference between pre-CAPI and post-CAPI is significant at the 95% confidence interval.
^aVictimization rates are calculated as per 1,000 persons age 12 or older or per 1,000 households.
^bExcludes murder because the NCVS is based on interviews with victims and therefore cannot measure murder.
^cThe difference between pre-CAPI and post-CAPI is not statistically significant.