TECHNICAL PAPERS ON
HEALTH AND BEHAVIOR MEASUREMENT

TECHNICAL PAPER 59

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Reference Citation

Perlis TE, Des Jarlais DC, Friedman SR, Arasteh K., Turner CF. (2004) Audio-computerized self interviewing versus face-to-face interviewing for data collection at drug abuse treatment programs. *Addiction,* 99:885-896.

Audio-computerized self-interviewing versus face-to-face interviewing for research data collection at drug abuse treatment programs

Theresa E. Perlis[1,2], Don C. Des Jarlais[2], Samuel R. Friedman[1], Kamyar Arasteh[1] & Charles F. Turner[3]

National Development and Research Institutes, Inc., New York, NY, USA,[1] Baron Edmond de Rothschild Chemical Dependency Institute, Beth Israel Medical Center, New York, NY, USA[2] and Research Triangle Institute, Bethesda, MD, USA[3]

Correspondence to:
Theresa E. Perlis
Baron Edmond de Rothschild Chemical Dependency Institute
Beth Israel Medical Center
First Avenue at 16th Street
New York
NY 10003
USA
E-mail: tperlis@chpnet.org

Submitted 28 March 2003;
initial review completed 29 August 2003;
final version accepted 12 February 2004.

ABSTRACT

Aims To assess audio computer-assisted self-interviewing (A-CASI) as a mode of data collection with injecting drug users (IDUs) entering two drug treatment programs in New York City. A-CASI has been found to increase reporting of sensitive items among a variety of population subgroups.

Design A field test of A-CASI data collection conducted within an ongoing cross-sectional study of drug use and HIV risk behaviors among IDUs entering drug treatment. Participants were assigned without bias to either a computer-assisted interviewer-administered personal interview (CAPI) or to a mixed CAPI/A-CASI interview. In the latter, 'sensitive' portions (dealing with stigmatized behavior) of the questionnaire were self-administered through A-CASI, while the remaining portions were interviewer-administered.

Setting The Detoxification Program and the Methadone Maintenance Treatment Program (MMTP) at Beth Israel Medical Center in New York City.

Participants Seven hundred and eighty-three IDUs entering drug treatment.

Measurements Odds ratios and adjusted odds ratios (controlling for demographic differences) for comparison of A-CASI versus CAPI responses on 111 sensitive questions.

Findings Twenty-three statistically significant differences (each at $P < 0.05$), all in the direction of more reporting of the behaviors by the A-CASI group. Forty-one per cent of A-CASI participants said they would prefer any subsequent interviews to be fully A-CASI and 46% said they would prefer the mixed CAPI/A-CASI mode.

Conclusions A-CASI was associated with greater reporting of potentially stigmatized drug, sex and HIV risk behaviors on a moderate number of questions. Moreover, a large majority of participants who used A-CASI would like to be assigned to this method of data collection in future interviews.

KEYWORDS Computer-assisted, drug use, interview, methodology, self-report, validity,

INTRODUCTION

Illicit drug use is a highly stigmatized behavior, and researchers in the drug field must always be concerned about under-reporting of drug use in self-report data. There has been a considerable number of studies of the validity of self-reported behavior by drug users (NIDA 1997; Darke 1998; O'Farrell, Fals-Stewart & Murphy 2003) with a general consensus that, if the data are collected under research conditions (informed consent, confidentiality, no penalties for admitting drug use), the data from groups of subjects should be sufficiently valid to

 doi:10.1111/j.1360-0443.2004.00740.x

identify scientifically meaningful relationships among variables, even though individual subjects may not be reporting accurately.

Injecting drug users are at very high risk for infection with HIV through the sharing of injection equipment. Drug users are also at risk for both acquiring and transmitting HIV through unprotected sexual intercourse. Given that HIV/AIDS is a highly stigmatized disease, there is now a parallel concern for the under-reporting of HIV risk behavior in self-report data collected from drug users. In some situations, the HIV antibody test can provide biological validation of self-reported HIV risk behaviors. Groups of IDUs who report high frequencies of risk behavior should have higher levels of HIV infection than groups that report low frequencies of risk behavior, and individual IDUs who report high frequencies of risk behavior should be more likely to seroconvert than individuals who report low frequencies of risk behavior. There is a substantial amount of data showing these expected relationships (Des Jarlais *et al.* 1996a; Des Jarlais *et al.* 1996b; Des Jarlais *et al.* 1999b). There is, however, the phenomenon of 'immaculate infections' subjects participating in cohort studies who become infected with HIV and who report no risk behavior in the research interview (Stall & Ekstrand 1994; Vanichseni *et al.* 2001). In many of these cases, in the post-test counseling session, the subject will recall risk behaviors that were not reported in the previous research interviews (Harrison *et al.* 1996).

Thus, while there is substantial evidence supporting the validity of self-reported drug use and HIV risk behavior among drug users, there is also a need for improving methods for collecting self-report data (Catania *et al.* 1990; Miller, Turner & Moses 1990). Audio-computer assisted self-interview (A-CASI) technology (Turner *et al.* 1992) is a potential method for reducing under-reporting of sensitive behaviors. A-CASI eliminates the need for respondents to reveal sensitive information to a human interviewer. Also, unlike paper self-administered questionnaires, A-CASI does not require that respondents be literate. In A-CASI data collection, respondents listen to pre-recorded questions and response sets through earphones connected to a computer while the identical text is displayed simultaneously on the computer screen. The respondent answers questions by pressing the appropriate key on the keyboard. In an A-CASI interview, subjects' responses are entirely private; they are not revealed to the interviewer.

Studies in general population samples and among specific subgroups (including IDUs) have shown that A-CASI interviewing (Tourangeau & Smith 1996; Des Jarlais *et al.* 1999a; Aquilino, Wright & Supple 2000; Metzger *et al.* 2000; Wight *et al.* 2000; Epstein, Barker & Kroutil 2001; Riley *et al.* 2001; Macalino *et al.* 2002; Newman *et al.* 2002) or paper self-administered questionnaires (Jones & Forrest 1992; Shober *et al.* 1992; Turner *et al.* 1992) lead to higher reporting of sensitive behaviors. No studies, however, have shown significant effects of interview mode for all questions. In addition, contrary to initial expectations, a few studies have found that reporting of certain sensitive information (e.g. psychological distress) was less common when interviews were conducted using A-CASI rather than human interviewers (Newman *et al.* 2002).

Injecting drug users (IDUs) are at very high risk for HIV infection in many different parts of the world, and are often included in HIV risk behavior monitoring systems. The two most commonly used procedures for locating IDU subjects are street outreach recruiting and recruiting at drug abuse treatment or syringe exchange programs. We report here on an experimental comparison of A-CASI with computer-assisted interviewer-administered (CAPI) data collection among IDUs entering two large drug abuse treatment programs at Beth Israel Medical Center in New York City. To the extent that (a) HIV risk behaviors are stigmatized among IDUs and that (b) the greater privacy provided by A-CASI reduces social desirability bias, then we would expect to see a general tendency toward increased reporting of sensitive behaviors among A-CASI respondents. Thus, our hypothesis is that subjects interviewed with A-CASI will display an overall propensity toward increased reporting of risk behaviors compared to those interviewed with CAPI.

METHODS

Overall design

The study reported here should be considered as a 'field test' comparison of A-CASI versus CAPI data collection rather than a pure experiment comparison. This field test was embedded in a larger ongoing study of HIV prevalence and risk behavior of IDUs entering drug abuse treatment in New York City. There was a number of instances in which aspects of a 'pure experimental' comparison of the two data collection methods were sacrificed to maintain the integrity of the larger study. For example, it was not possible to use 'identical' subject recruitment methods at the two drug treatment programs. Rather, subject recruitment methods had to be adapted to the procedures of the two programs. We do believe, however, that this field test of A-CASI is likely to provide better insight into how A-CASI data collection would perform in 'real life' situations of collecting research data from people entering drug abuse treatment.

Participants

Injecting drug users were recruited from new entrants into the Beth Israel Medical Center in-patient Detoxification Program and the out-patient Methadone Maintenance Treatment Program (MMTP) in New York City. Both programs serve adults (at least 18 years of age) in New York City as a whole. Approximately 4000 people are admitted to the Detoxification program each year, and approximately 1000 to MMTP. The A-CASI experimental assessment was embedded into an ongoing study of HIV prevalence and risk behavior among IDUs entering the programs. Thus, we used trained interviewers who had been administering a similar paper-and-pencil questionnaire for some years at the same sites and were familiar with the environment and the patient population. One female African-American interviewer was assigned to the Detoxification program and one female Latina interviewer to MMTP, with no cross-over. The criterion for study participation was any injection drug use during the 6 months prior to interview, regardless of a person's primary route of administration.

Participant selection procedures were necessarily adapted to the specific conditions of the two programs. In the Detoxification program (an in-patient program), the interviewer visited the general admission wards of the program in a set order and examined the intake records to identify patients admitted within the past 3 days. The interviewer solicited study participants among all eligible patients present on the ward. Some patients (approximately 12%) were unavailable for participation due to appointments scheduled by hospital staff (for X-ray, social worker, doctor, etc.). Among patients approached and eligible, willingness to participate was over 95%. Almost half those who refused were feeling too sick from drug withdrawal.

For MMTP recruitment, each day the interviewer reviewed the list of IDUs scheduled for intake at the central intake facility of the methadone program. Each applicant to the Beth Israel MMTP system was required to attend intake sessions at the central facility before being assigned to a clinic convenient to his/her home. The program intake process stretched over many hours involving numerous appointments with MMTP staff interspersed with long waiting periods, and culminating in administration of methadone. Throughout the day the interviewer approached all listed IDUs in the waiting room to ask if they would participate in the study. Approximately 20% of listed patients were not available at any time during the intake process and could not be asked to participate in the study. Of the eligible MMPT patients approached to participate in the study, over 80% of eligible MMTP patients approached agreed to participate in the study. Primary reasons for study participation refusal included having other commitments or fatigue due to the time-consuming intake process. Note that it would not have been good research practice to try to induce subjects who reported having other commitments or already being tired to participate in a long (1 hour) research interview. Such people would be more likely to try to hurry through the research interview, including denying risk behavior in order to then skip questions about the characteristics of risk partners. One individual refused to participate because he did not want to use the computer.

At neither site were the interviewers permitted to deviate from study guidelines in selection of patients to approach about study participation. Thus, while the participant selection at the two programs were not strictly randomized procedures, we believe that the participant selection procedures were not biased at either site.

At each site the study was described fully to each potential participant in turn, and a signed informed consent was obtained from those who agreed to participate.

A total of 783 participants was recruited, 61% from the Detoxification Program and 39% from the MMTP program. Three hundred and sixty-six (47%) participants were assigned to the A-CASI group and 417 (53%) to the CAPI group. Time spent in completion of A-CASI interviews was approximately 15–20 minutes longer than for CAPI interviews, so that number of A-CASI interviews per week tended to be slightly less than CAPI interviews. The overall sample was primarily male (78%), with racial/ethnic composition 49% Latino/Latina, 17% African American and 33% white. (The small number of people claiming 'other' or 'mixed' ethnicity have been grouped together with whites for this report.) Mean age was 37.1 years (standard deviation 9.1). The A-CASI group contained a slightly higher proportion of detoxification patients (65%) than the CAPI group (57%), but the gender and age distribution was similar in both groups. There was some variation in race/ethnicity. In the A-CASI group 16% of participants were African-American, 45% Latino/a and 39% white, compared with 18%, 54% and 28%, respectively, in the CAPI group. This was due primarily to an over-representation of whites assigned to the A-CASI mode in the detoxification program which, to the best of our knowledge, occurred by chance.

Questionnaire

The structured questionnaire contained 634 items covering demographics, drug use, knowledge about and engagement in injection and sexual HIV-risk behaviors, service utilization, health and overdose. (Note that due to question branching and skip patterns no participant was asked all 634 items.) Response sets were primarily (a) dichotomous 'yes/no' type (299 items), (b) one of a

variety of frequency scales (132 items) each with five or six categories including 'none', 'never' or 'not at all', or (c) open-ended requiring entry of a number (107 items).

Experimental variables

The purpose of this study was to determine if A-CASI data collection produced greater reporting of socially stigmatized ('sensitive') behaviors. The questionnaire sections on drug use, HIV injection risk behavior, syringe acquisition and disposal and HIV sexual risk behavior were considered potentially stigmatized or 'sensitive' for the purposes of this study. We recognize that all of the items in these sections are not equally sensitive. For example, engaging in sex with an unpaid partner is almost certainly less sensitive than engaging in sex with a paid partner. Some questions might not be considered 'sensitive' at all in these settings. Recent heroin use is probably not a sensitive behavior among people applying for methadone maintenance treatment. The practicalities of A-CASI data collection, however, require typically that entire blocks of questions need to be put into the A-CASI format. A single laptop computer was used in the interview. It was not practical to conduct an A-CASI interview in which the laptop computer was handed back and forth between the interviewer and subject at an individual question level.

Two computerized versions of the questionnaire were prepared. In one version, the entire questionnaire was administered through computer-assisted personal interviewing (CAPI). The interviewer read the question from a laptop computer screen, the subject responded to the question and the interviewer entered the response into the computer. CAPI permits real-time computer data entry and real-time range and consistency checks on the data.

In the second version, the 'non-sensitive' sections were administered through CAPI and the 'sensitive' sections were administered through A-CASI. In A-CASI interviewing, the subject sees the question on a computer screen and hears the question read through earphones simultaneously. The subject then enters the appropriate response into the computer. The interviewer remains nearby to provide assistance if needed, *but does not observe the responses entered into the computer by the subject*. A-CASI thus permits privacy of responding without requiring that the subject be literate. A-CASI does require prerecording of the questions and a brief training session in which the subjects are taught how to use the computer, including how to change responses and how to return to previous questions.

Both versions of the questionnaire were administered in private rooms within the two treatment programs.

The method of assigning subjects to the two versions of the interview was to rotate the versions by week. In one week the completely CAPI version of the interview was used, and in the following week the version with the sensitive questions in A-CASI was used. While this alternation by week was not a strictly random procedure, we do believe that it produced a non-biased sample. However, due to the need for the computer training session and the lack of keyboard familiarity among some of the participants, the version of the interview with A-CASI questions took approximately 20 minutes longer than the completely CAPI version of the questionnaire. If a subject was supposed to receive the interview with A-CASI questions, but there was insufficient time to administer the A-CASI version, the interviewer was instructed to administer the CAPI version instead. This lack of time problem occurred when the subject had other appointments in the drug treatment program or when the private room was scheduled for other purposes before the interview would be completed.

We also did not have sufficient resources to prepare A-CASI questions in both English and Spanish, but did have a bilingual interviewer in the MMTP program, which had slightly more subjects whose primary language was Spanish. For subjects who had difficulty in completing the A-CASI questions in English, this interviewer would then revert to CAPI interviewing while providing translation into Spanish for the questions that were causing difficulties.

Data analysis

The analyses focused on differences in the reporting of sensitive behaviors when the questions were asked through A-CASI versus through CAPI. Comparisons were confined primarily to dichotomous variables and frequency scale variables, as these accounted for the majority of the response types in the A-CASI sections. Because the frequency scale variables typically displayed highly skewed distributions with many sparse cells, we dichotomized the responses into 'presence' versus 'absence' of the behavior. Additionally, four open-ended numerical items were included as these were screener questions for subsequent frequency scale items. The distributions of these four variables were also highly skewed, thus the responses were also dichotomized into 'any' versus 'none'. Unfortunately, we did not have a large enough sample size for meaningful multivariate testing of these variables to examine variation in frequency of behavior. Re-coding would have been necessary to carry out any multivariate analyses, with the re-code rule dependent on the variable being analyzed. The remaining variable types (date and pure categorical) were of a non-sensitive nature and were not analyzed. Use of dichotomous variables throughout the analysis permitted using a common metric (odds ratio) for comparison of the A-CASI

condition versus the CAPI condition for all the sensitive questions. We used univariate odds ratios to measure differential responses between the A-CASI and CAPI formats and χ^2 tests to test for significance ($P \leq 0.05$). In order to control for possible confounding, multivariate logistic regression was used to obtain adjusted odds ratios (AORs) controlling for dummy variables representing treatment program, gender, race (two variables) and age group (≤30 versus >30). The likelihood ratio test ($P \leq 0.05$) for the models with and without the interview mode variable was used to test for significance of interview mode.

Preliminary testing for interactions between each covariate and interview mode was carried out. For many of the variables it was impractical to test for all interactions simultaneously due to small cell sizes causing quasi-complete separation in the data, thus we employed forward selection of interaction effects, and checked the results with backward selection wherever possible. Because there were five possible interactions (interview mode with treatment program, gender, race = Latino/a, race = black and age group, respectively) to be tested for each model, we set the significance level for inclusion of the interaction term in the model at $P \leq 0.01$. (Thus the probability of falsely detecting at least one significant interaction was 0.049.) Apart from isolated instances of one interaction involving interview mode with gender, and two with age group, the only detectable interaction effect was that of interview mode with treatment program—for each of seven variables across topic areas. Treatment program as a modifier of interview mode effect was of particular interest to us owing to the difference in the patient status at each program (although, as noted below in the Discussion, any treatment program effect could also be an interviewer effect). Thus we reran all logistic regression analyses for outcome variables for which the main effect of interview mode was significant (or borderline) to determine whether inclusion of the treatment by mode interaction significantly improved the model fit using the likelihood ratio test at $P \leq 0.05$. Significance of individual AORs (for $P \leq 0.05$) shown in the tables are based on Wald statistics for the corresponding parameters in the model.

Logistic regression analysis may yield imprecise parameter estimates and associated confidence intervals if the sample size is too small, or more specifically if the number of events (or non-events) per parameter is below 10 (Hosmer & Lemeshow 2000). In specific analyses where this criterion was not met, significant multivariate results are displayed with a notation (#), indicating that these results should be interpreted with caution. In some cases, the entire model was questionable and no multivariate results are provided.

Given the large number of comparisons (111) of items in A-CASI versus CAPI data collection modes, there are two potential analysis strategies. One strategy would be to correct for multiple comparisons and then identify with considerable certainty the specific questions that were associated with differential responding by data collection mode. The second strategy would be to look for a consistent pattern of differences among the variables by assessing the percentage of the variables that showed statistically significant differences between the two interview modes and determining whether all or almost all the differences were in the same direction. This second strategy is more consistent with the decision to use A-CASI in interview studies. Researchers are likely to use A-CASI when they suspect that social desirability bias will affect a broad range of related sensitive questions, rather than when they are concerned that social desirability will have a very strong effect on a limited number of questions. We therefore looked for general A-CASI versus CAPI differences in the propensity to report drug use, injection risk and sexual risk behaviors.

RESULTS

Current (past 6 months) drug use—16 items

Table 1 displays the prevalence and odds ratios for drug use among A-CASI respondents compared with CAPI respondents on the 16 drug use items. Significant ($P < 0.05$) A-CASI effects were observed in five of 13 multivariate models, all in the direction of higher reported use among the A-CASI respondents. Controlling for demographics and treatment program, A-CASI respondents were more likely to report intranasal heroin use and smoking marijuana than CAPI respondents. For injected speedball, injected cocaine and street methadone use, treatment program was an effect modifier; incorporating an interaction term in the model, the adjusted odds ratios for interview mode were significant for MMTP patients but not for detoxification patients.

Current (past 6 months) injection risk behaviors—25 items

Table 2 displays results for the 25 injection risk behavior items. The A-CASI effect was significant for only four variables in 21 multivariate analyses and for two of these the effect was seen among MMTP respondents only. Moreover, the adjusted odds ratios for 'getting used needles from a close friend' were based on subset sizes that may be too small to provide reliable estimates. Although the reliability of the AOR for 'backloading' may also be questionable for the same reason, the corresponding

Table 1 Effect of interview mode on reporting of drug use during the past 6 months.

	CAPI $n = 417$ %	*A-CASI* $n = 366$ %	*Program*[a]			
			OR		*AOR*	*95% CI*
Injected heroin	97	95	0.67		0.62#	0.30,1.27
Injected speedball	35	46	1.63*	MMTP	3.06*	1.78,5.26
				Detox	1.14	0.79,1.65
Injected cocaine	33	39	1.29	MMTP	2.28*	1.30,3.98
				Detox	0.90	0.63,1.31
Injected crack	1	1	0.95		0.85#	0.25,2.88
Injected amphetamine	2	1	0.48		–	
Injected other substances	1	3	3.88*		–	
Intranasal heroin	31	42	1.66*		1.64*	1.20,2.23
Intranasal speedball	9	14	1.66*		1.55	0.97,2.47[b]
Intranasal cocaine	13	18	1.42		1.39	0.93,2.10
Intranasal amphetamine	4	3	0.75		–	
Smoked heroin	5	5	1.08		0.98#	0.49,1.95
Smoked speedball	8	11	1.42		1.24	0.75,2.05[c]
Smoked crack	25	34	1.52*		1.37	0.99,1.91
Used street methadone	34	39	1.28	MMTP	1.88*	1.17,3.03
				Detox	0.99	0.68,1.45
Smoked marijuana	26	36	1.54*		1.58*	1.15,2.17
Other non-injected substances	4	7	1.70		1.64#	0.86,3.12

OR = univariate odds ratio; AOR = odds ratio from multivariate logistic regression controlling for treatment program, gender, race and age (unless otherwise specified). *$P < 0.05$. #Indicates possible imprecision due to number of events (or non-events) per parameter below 10. [a]Where the AORs for each treatment program differed significantly, separate AORs are displayed with the program name alongside. A blank in the column indicates that the A-CASI effect did not differ by treatment program. [b]Could not test for interview mode by treatment program interactions because the odds ratio is infinite for MMTP. Eleven of 128 A-CASI respondents in MMTP reported speedball sniffing compared with 0 of 181 CAPI respondents. In detox alone, the effect of interview mode is not significant (37/236 CAPI, 40/238 A-CASI; AOR = 1.08 NS). [c]Could not test for interview mode by treatment program interactions because the odds ratio is infinite for MMTP. Six of 128 A-CASI respondents in MMTP reported speedball smoking compared with 0 of 181 CAPI respondents. In detox alone, the effect of interview mode is not significant (34/236 CAPI, 35/238 A-CASI; AOR = 1.00 NS).

univariate odds ratio does indicate a significant interview mode effect. An interactive effect of gender with interview mode on reporting of distributive needle-sharing with strangers indicated a possible A-CASI effect among males only, but again subset sizes were too small to provide any conclusive evidence.

Sterile needle acquisition and used needle disposal (past 6 months)—46 items

Included in this section were 12 items on use and sources of new needles (including one item for any life-time syringe exchange use), five items on secondary distribution of needles acquired from syringe exchange, 10 on knowledge of pharmacies that sell syringes without prescription, six on reasons for not buying at pharmacies and 12 items on used needle disposal. Due to space constraints, results are shown in Table 3 for only three of the preceding categories and for the one question on arrest for possession of injection paraphernalia.

Very few participants reported obtaining *no* sterile needles during the past 6 months. Just over 40% of participants reported buying needles from pharmacies, and slightly less reported using syringe exchange, but there were no interview mode differences. However, for six of the eight items on sterile needle sources apart from pharmacy and syringe exchange, the adjusted odds of acknowledging the source were significantly higher among the A-CASI respondents than the CAPI respondents. Although multivariate results for most of the significant items may be imprecise, the fact that the corresponding univariate odds ratios were also significant indicates the presence of a propensity toward more affirmative responding in the A-CASI group. The stem question for these items was 'During the last 6 months, aside from syringe exchange or pharmacies, how else did you obtain new and unused needles and syringes?' and the individual sources were read out one by one. Due to the small proportions of respondents affirming many of the items in the sterile needle source list, and as the responses may be highly intercorrelated, we computed the total number of sources affirmed by each respondent and performed OLS regression to assess the effect of interview mode controlling for the same covariate set as in logistic regression analyses. The interview mode was highly significant ($P < 0.001$), with assignment to A-CASI associated with reporting of more sources. Additionally we conducted a logistic regression to compare the odds of

Table 2 Injection risk behaviors during past 6 months.

	CAPI $n = 417$ %	*A-CASI* $n = 366$ %	*Program*[a] *OR*		*AOR*	*95% CI*
Receptive syringe sharing (RSS)	23	26	1.16		1.06	0.75,1.50
Not always used brand-new sterile needle	82	79	0.85		0.82	0.57,1.17
Not always cleaned skin w/alcohol pad before injecting	84	81	0.84		0.79	0.54,1.15
Received injection from hit doctor	10	17	1.92*		1.69*	1.07,2.65
Drew from shared container	24	29	1.28	MMTP	5.43*	1.74,16.95
				Detox	0.91	0.63,1.33
Shared rinse water	24	27	1.14		1.08	0.77,1.50
Shared cooker	30	37	1.33		1.27	0.93,1.73
Shared cotton	25	28	1.19		1.11	0.79,1.54
Injected in a shooting gallery	14	12	0.83		0.87	0.57,1.33
Distributive syringe sharing (DSS)	19	23	1.25		1.14	0.79,1.63
Shared drugs	36	40	1.18		1.03	0.75,1.43
Injected w/companions at last injection	24	25	1.08		1.00	0.72,1.40
Of those who reported sharing drugs ($n_{capi} = 150$, $n_{acasi} = 146$)						
Backloaded	15	25	1.90*		1.93*#	1.05,3.56
Of those who reported backloading ($n_{capi} = 22$, $n_{acasi} = 36$)						
Backloaded with used needle	91	83	0.50		0.46#	0.08,2.77
Of those reporting receptive syringe sharing ($n_{capi} = 97$, $n_{acasi} = 96$)						
Not always cleaned RSS needle	27	29	1.12		1.03#	0.53,1.99
Obtained needle from primary sex partner	27	29	1.12		0.87#	0.42,1.80
Obtained needle from relative (not sex partner)	8	11	1.44		–	
Obtained needle from close friend	61	61	1.03	MMTP	7.36*#	1.89,28.63
				Detox	0.74	0.35,1.56
Obtained needle from from dealer/drug professional	1	9	9.93*		–	
Obtained needle from stranger	14	16	1.10		1.25#	0.54,2.92
Of those reporting distributive syringe sharing ($n_{capi} = 80$, $n_{acasi} = 84$)						
Gave needle to primary sex partner	26	33	1.40		1.15#	0.54,2.45
Gave needle to relative (not sex partner)	11	12	1.07		–	
Gave needle to close friend	63	55	0.73		0.86#	0.44,1.72
Gave needle to dealer/drug professional	0	1	–		–	
Gave needle to stranger	13	19	1.65		1.47#	0.60,3.62

OR = univariate odds ratio; AOR = odds ratio from multivariate logistic regression controlling for treatment program, gender, race, and age (unless otherwise specified). *$P < 0.05$. #Indicates possible imprecision due to number of events (or non-events) per parameter below 10. [a]Where the AORs for each treatment program differed significantly, separate AORs are displayed with the program name alongside. A blank in the column indicates that the A-CASI effect did not differ by treatment program.

affirming any of the eight sources for A-CASI respondents versus CAPI respondents—the AOR was 1.64 (CI: 1.22, 2.22, $P < 0.001$).

Regarding reasons for not buying needles from pharmacies, three items showed a significant A-CASI effect: one for detoxification respondents only. For four of 11 disposal methods, significantly more of the A-CASI respondents reported using such methods, with a significant A-CASI effect noted in MMTP alone for one of the items. Approximately half the multivariate results for these item sets should be viewed with caution due to small subsample sizes, but corresponding univariate results provide some reassurance concerning the A-CASI effect.

There were no significant interview mode effects on any of the five items concerning secondary distribution of SE needles or the 10 items on knowledge of specific pharmacies selling needles without a prescription (results not shown). The overall finding was one of no differential reporting for either set of items.

Sex behavior—24 items

There were 24 items concerning type of sex partners, risk status of sex partners and engaging in unprotected sex. The only significant multivariate result (albeit subject to small subset sizes) was for reporting of sex with clients of the opposite sex (Table 4). Additionally, for unprotected sex with paying clients of the opposite sex and for any male-with-male sex during the past 5 years, an age group × treatment program interaction was detected, indicating that among older respondents the A-CASI group was more likely to report these behaviors than the CAPI group.

Table 3 Sterile needle acquisition and used needle disposal during the past 6 months.

	CAPI $n = 417$ %	*A-CASI* $n = 366$ %	*Program*[a] *OR*		*AOR*	*95% CI*
Acquired no sterile needles L6M	1	3	4.68*		–	
Tried to buy needles from pharmacy	45	42	0.86		0.79	0.58,1.07
Used syringe exchange	37	38	1.04		1.03	0.77,1.39
Among those w/no SE L6M ($n_{capi} = 262$, $n_{acasi} = 227$)						
Ever in life-time used SE	26	23	0.89		0.86	0.56,1.33
Among those who obtained new needles L6M ($n_{capi} = 414$, $n_{acasi} = 354$)						
Obtained new needles from a medical doctor	4	3	0.80		0.83#	0.38,1.83
Obtained new needles from a drug worker/drug agency	1	5	6.49*		6.32*#	1.81,22.10
Obtained new needles from a mobile van	1	3	5.37*		5.79*#	1.23,27.18
Obtained new needles from non-drug-using family/friends/sex partners	12	20	1.80*		1.91*	1.28,2.87
Obtained new needles from drug-using family/friends/sex partners	17	25	1.63*		1.52*	1.06,2.18
Obtained new needles from a other drug users	3	12	3.95*		3.98*#	2.12,7.47
Bought new needles on the streets	26	29	1.19		1.27	0.92,1.75
Obtained new needles from other sources n.e.s.	5	10	2.28*		2.32*#	1.29,4.17
Among those who did not try to get new needles from pharmacy L6M: reason ($n_{capi} = 229$, $n_{acasi} = 214$)						
Afraid to be identified as an IDU	20	27	1.52	Detox	2.95*	1.48,5.87
				MMTP	0.93	0.47,1.84
Because pharmacies refuse to sell them to drug users	3	10	3.63*		3.55*#	1.47,8.57
No nearby pharmacies that sell without prescription	2	8	4.85*		4.41*#	1.44,13.55
It is illegal	12	16	1.41		1.69#	0.92,3.11
They are expensive	5	7	1.49		1.54#	0.68,3.45
Other reasons	76	72	0.85		0.74	0.46,1.19
Typical needle disposal methods ($n_{capi} = 417$, $n_{acasi} = 366$)						
Replace it at the NEP	23	23	0.98		0.98	0.69,1.37
Put it in a medical waste container	7	9	1.38		1.34#	0.79,2.29
Give it away to someone else	<1	3	6.43*		7.04*#	1.54,32.24
Throw it down sewer/storm drain	12	24	2.36*		2.18*	1.47,3.23
Flush it down the toilet	13	18	1.45		1.45	0.98,2.14
Put it in a soda can/similar container and throw in the trash	10	16	1.75*	MMTP	3.79*	1.60,8.98
				Detox	1.20	0.73,1.99
Break it first, then throw in trash	68	64	0.84		0.87	0.64,1.18
Throw it in the trash without breaking it	15	18	1.28		1.22	0.82,1.79
Return it to the person who gave it to you	2	5	1.98		1.57#	0.69,3.58
Leave it where you shot up	1	3	3.50*		4.02*#	1.27,12.76
Sell it	0	0	–		–	
Other	5	6	1.33		1.37#	0.74,2.56
Any life-time arrest for possession of injection paraphernalia ($n_{capi} = 417$, $n_{acasi} = 366$)	44	51	1.28		1.15	0.85,1.57

OR = univariate odds ratio; AOR = odds ratio from multivariate logistic regression controlling for treatment program, gender, race, and age (unless otherwise specified). *$P < 0.05$. #Indicates possible imprecision due to number of events (or non-events) per parameter below 10. [a]Where the AORs for each treatment program differed significantly, separate AORs are displayed with the program name alongside. A blank in the column indicates that the A-CASI effect did not differ by treatment program.

Summary of findings

Of the 111 comparisons of questions asked in A-CASI and in CAPI modes, there were 23 statistically significant differences. All these differences were in the direction of greater reporting of the behavior in the A-CASI mode. The odds ratios for these significant differences ranged from 1.52 to 7.36. Six of the 23 significant differences were observed in the MMTP setting only, and one was observed in the detoxification program setting only. Because of standard skip patterns in the questionnaire, not all questions were asked of all subjects, so that the statistical power to detect A-CASI versus CAPI differences varied across questions. For a fixed Type 1 error size, a decrease in sample size (due to the question being asked of only a subset of participants) leads to an increase in

Table 4 Effect of interview mode on reporting of sex behaviors during the past 6 months and the past 5 years.

	CAPI $n = 417$ %	*A-CASI* $n = 366$ %	*OR*	*AOR*	*95% CI*
Sexual activity during the past 6 months					
Any sex partners of the opposite sex	71	72	1.08	0.95	0.69,1.30
Of those reporting any opp.sex sex partners ($n_{capi} = 294$, $n_{acasi} = 261$)					
Any opp.sex primary sex partners (PSP)	80	79	0.96	0.93	0.61,1.41
Any opp.sex casual sex partners (CSP)	32	34	1.08	1.14	0.79,1.65
Any opp.sex clients	5	13	2.51*	2.56*#	1.32,4.96
Gave drugs to have sex w/women	7	8	1.20	–	
Gave money/goods to have sex w/women	6	8	1.27	–	
Gave drugs to have sex w/men	0	0	–	–	
Gave money/goods to have sex w/men	0	0	–	–	
Of those reporting prim. sex partners (PSP) ($n_{capi} = 234$, $n_{acasi} = 206$)					
Any unprotected sex with PSP	73	76	1.18	1.14	0.74,1.78
Any PSP ever diagnosed w/HIV	4	4	1.04	–	
Any PSP ever diagnosed w/hepatitis	9	17	1.99*	1.62#	0.86,3.04
Any PSP ever had sex w/(other) men	69	65	0.85	0.91	0.48,1.73
Any PSP ever had sex w/(other) women	31	38	1.37	0.98	0.44,2.21
Any PSP ever snorted heroin	20	18	0.90	0.81	0.49,1.33
Any PSP ever smoked crack	12	14	1.16	0.92#	0.51,1.68
Of those reporting casual sex partners (CSP) ($n_{capi} = 95$, $n_{acasi} = 89$)					
Any unprotected sex with CSP	48	49	1.04	1.09	0.60,1.99
Of those reporting sex with clients ($n_{capi} = 16$, $n_{acasi} = 33$)					
Sold sex for drugs	75	70	0.77	1.12#	0.25,5.12
Sold sex for money/goods	88	88	1.04	–	
Any vaginal/anal sex with clients	94	91	0.67	–	
Any unprotected vaginal/anal sex	38	55	2.00	2.22#	0.58,8.52
Sexual activity in past 5 years: men only ($n_{capi} = 332$, $n_{acasi} = 276$)					
Any sex with men	6	9	1.49	1.38#	0.73,2.59
Of men reporting sex with men ($n_{capi} = 20$, $n_{acasi} = 24$)					
Any unprotected sex	70	58	0.60	0.69#	0.16,3.03
Sexual activity in past 5 years: women only ($n_{capi} = 84$, $n_{acasi} = 86$)					
Any sex with women	34	34	0.96	0.95#	0.49,1.82
Of women reporting sex with women ($n_{capi} = 29$, $n_{acasi} = 29$)					
Any unprotected sex	90	83	0.55	0.43#	0.08,2.28

OR = univariate odds ratio; AOR = odds ratio from multivariate logistic regression controlling for treatment program, gender, race, and age (unless otherwise specified). *$P < 0.05$. #Indicates possible imprecision due to number of events (or non-events) per parameter below 10.

Type 2 error size and decrease in the power to detect an interview mode effect. Thus, the number of variables for which a statistically significant interview mode effect was detected should be considered a lower bound.

On the other hand, some of our 'significant' findings occurred for variables for which the precision of the estimation process in the multivariate model was questionable due to small subset sizes. This could arise because not everyone was asked the question, or it could be due to the small proportion of respondents endorsing or denying the behavior. For example, the set of items on sterile needle sources accounts for six of the significant results, but for four of these the number of respondents acknowledging the source is very low. For some variables, sample sizes were too small to permit any multivariate analysis at all. We note that for all except one of the questionable significant multivariate findings, the corresponding bivariate analysis also demonstrated a significant A-CASI effect of similar magnitude. If we discard the multivariate models for which subset sizes fall below the Hosmer & Lemeshow (2000) minimum we are left with 51 multivariate comparisons. Twelve of these showed significant A-CASI effects overall or in one of the treatment programs. The probability of finding at least 12 significant effects by chance alone (with $P = 0.05$ for each single item test) is less than 0.0001. All these

differences were in the direction of greater reporting of the behavior in the A-CASI mode. The adjusted odds ratios for these significant differences ranged from 1.52 to 5.43. Six of the 12 significant differences were unique to one treatment program (five in MMTP and one in the detoxification program).

Yet another approach is to ignore entirely the values or significance of the adjusted odds ratios, and examine merely the directions of the adjusted odds ratios. If there were no interview mode effect we would expect approximately half the items to have AORs > 1 (higher prevalence among A-CASI respondents than CAPI respondents) and the reverse for the other half of the items. Fifty-nine of the 111 items under study had estimated AORs greater than 1, 32 less than 1, and AORs could not be estimated for 20 items. Among the 91 estimated AORs, the occurrence of 59 AORs > 1 is greater than expected by chance alone (binomial test, $P < 0.01$).

Respondent reaction to A-CASI

Because the A-CASI respondents were exposed to both experimental and interviewer-administered questions they were an ideal group to ask about preferences for interview mode. At interview completion the interviewer asked the participant whether he/she liked using the computer and also asked which mode the participant would prefer if a subsequent interview were to be conducted. Among the A-CASI respondents, 92% said they liked using the computer for at least part of the interview. Forty-one per cent said they would prefer to conduct any future interview in solely A-CASI mode, and 46% said they would prefer a mixed A-CASI/CAPI interview like the one they had just completed.

Interviewer-administered items

As a crude check for existence of response bias differences between the A-CASI and CAPI groups, we examined responses to interviewer-administered dichotomous variables. We hypothesized that, on average, A-CASI respondents should be no more likely than CAPI respondents to affirm behaviors on questions that were administered by the interviewer. The observed number of differences was no more than would be expected by chance alone and there was no directional pattern to the responses.

Interviewer bias

We also examined whether matching of sex of interviewer and sex of respondent influenced response pattern and whether matching of race/ethnicity of interviewer and respondent influenced responding. While having only two interviewers, both female, we found no evidence that match/non-match influenced responding.

DISCUSSION

Reporting of 'sensitive' behavior in A-CASI versus CAPI

Of 111 comparisons, there was clear evidence of statistically significant differential reporting of five drug use items, four injection risk behaviors, 13 needle acquisition and disposal behaviors and one sex item between the A-CASI and CAPI modes. All the 23 differences were in the direction of more reporting of the behaviors when the questions were asked in the A-CASI mode. As not all of these questions may have truly been 'sensitive' in a drug treatment setting, e.g. using heroin among methadone program applicants, our 23/111 significant differences may underestimate the effects of A-CASI in reducing underreporting of stigmatized/sensitive behaviors.

Additionally, as part of our 'field test' approach, we followed standard HIV risk behavior questionnaire procedures, e.g. we asked about condom use with casual sexual partners only among people reporting sex with casual partners. This greatly reduced the numbers of subjects who were asked some risk behavior questions and reduced our statistical power for finding A-CASI versus CAPI differences on these questions.

We did not observe A-CASI versus CAPI differences on key HIV risk behaviors such as receptive sharing (injecting with needles/syringes used by someone else) or distributive sharing (passing on used needles and syringes to someone else). We did, however, observe differences on some questions of potential epidemiological importance. Injecting cocaine (either by itself or as a 'speedball' with heroin) has been associated with HIV infection in a number of studies (Chaisson *et al.* 1989; DeHovitz *et al.* 1994) so these are clearly questions of concern. Engaging in sex with a paying (opposite sex) partner is also potentially very important for spread of HIV between injecting drug users and their non-injecting sexual partners. The data from the ongoing study will be used in evaluating the New York State law permitting pharmacy sales of sterile injection equipment to drug users, so that the A-CASI versus CAPI differences on reasons why a respondent did not purchase at pharmacies may be of importance.

These findings are similar to other studies of A-CASI both with drug users (Des Jarlais *et al.* 1999a; Metzger *et al.* 2000; Riley *et al.* 2001; Macalino *et al.* 2002; Newman *et al.* 2002) and with 'general populations' (Jones & Forrest 1992; Shober *et al.* 1992; Turner *et al.* 1992;

Tourangeau & Smith 1996; Wight *et al.* 2000; Epstein *et al.* 2001) The use of A-CASI is associated generally with greater reporting of sensitive behaviors, although significant differences are usually not found for all variables in any given study, nor have all studies found significant differences. It is very unusual, however, for a study to show greater reporting of a potentially sensitive behavior in the non-A-CASI condition (Newman *et al.* 2002). There are two possible mechanisms through which the A-CASI versus CAPI differences could have led to the differences observed here. First, the greater privacy in the A-CASI condition could have reduced social desirability bias (Crowne & Marlow 1960), leading to greater and more accurate reporting of drug use and risk behaviors. The larger percentage of subjects reporting engaging in commercial sex and using hit doctors in the A-CASI condition may be a result of the greater privacy. Secondly, the simultaneous reading of a question on a computer screen while hearing the question through headphones may have encouraged subjects to pay more attention to specific questions. The greater reporting of reasons for not using pharmacies to obtain sterile injection equipment in the A-CASI condition may be a result of paying more attention to the questions on why pharmacies were not used. Additional research will be needed to separate possible privacy versus possible greater attention effects in A-CASI, and to assess the reliability and external validity of findings on individual items.

There are several limitations that should be considered for this study. First, this study was embedded in a larger ongoing study in which one interviewer was assigned to MMTP and the other interviewer to the detoxification program. For the current study we did not cross over the two interviewers between the two data collection sites, as this would have interfered with the working relationships that had already developed between the interviewers and the staffs of the two programs. The two drug abuse treatment programs have separate operating schedules and regulations, and cross-over would have required each interviewer to undergo training to learn how to negotiate the system at the unfamiliar site, and the development of new relationships with program staff. This would have interfered at least temporarily with the larger study. We did find suggestive differences between the two sites, with more statistically significant differences at the MMTP program. It is possible that people applying for entrance into drug abuse treatment (as at the MMTP site) are more subject to social desirability effects than people already accepted into drug abuse treatment (as at the detoxification program). It is also possible that the site differences we observed reflect interviewer differences. One potential advantage of A-CASI is that the sensitive questions are pre-recorded on the computer, thus all subjects would hear the same voice reading the sensitive questions with the same intonations and inflections.

Secondly, we did not have any direct method of validating the self-reported HIV risk behavior of the subjects, either through a biological marker or direct observation and counting of the behaviors. Thus, we cannot say with absolute certainty that the higher rates of risk behavior reported with A-CASI are more valid than the lower rates reported with CAPI. Nevertheless, both social desirability theory (Crowne & Marlow 1960) as well as the observations of 'immaculate infections' in HIV incidence studies suggest that there is systematic under-reporting of stigmatized behavior and that higher rates of reported HIV risk behavior are more likely to be valid than lower rates.

Thirdly, we transformed ordinal variables and four continuous variables into dichotomous variables for analysis purposes as small subset sizes precluded multivariate analyses of such variables in their original form. However, acknowledgement of 'presence' versus 'absence' of a sensitive behavior is a different issue from acknowledgement of frequent versus infrequent behavior. We simply did not have sufficient power to investigate the latter issue.

The question of whether reporting more drug use at drug abuse treatment intake can be considered socially desirable or socially undesirable behavior deserves additional comment. Clearly, one would need to report some drug use to justify entering treatment. In this study we found uniformly high reporting of heroin use among all subjects. We also found greater reporting of specific drug use (cocaine injection, speedball injection and crack smoking) among subjects applying for methadone treatment in the A-CASI condition. Given that methadone treatment has no pharmacological effect on cocaine use, and that cocaine users are often seen as problem patients by methadone program staff, we would interpret reporting cocaine use among people applying for methadone treatment to be 'socially undesirable'.

The A-CASI respondents liked using the computer, and a large majority would prefer to use the computer for at least some questions in future studies. However, although A-CASI was associated with greater reporting of some HIV risk behaviors, the pattern of differences between the two modes was not so striking as to preclude the use of CAPI or other forms of face-to-face interviewing for many drug use, injection HIV risk and sexual behavior questions for the two drug-abuse treatment populations in this study.

A-CASI requires more subject time to complete an interview. The research on A-CASI to date suggests that it does lead to greater reporting of stigmatized/sensitive

behavior and that this greater reporting is likely to be more valid than lesser reporting of such behaviors. A-CASI may be considered the current 'state of the art' for collecting data on sensitive/stigmatized behaviors such as illicit drug use and HIV risk behavior. We do not yet, however, have sufficient research for cost–benefit analyses of when A-CASI should be used.

Acknowledgements

We would like to thank Carole Johnson, Martha Nelson and Loren Vangelatos for their contributions to this paper. Support for this paper came from grant R01 DA03574 Risk Factors for AIDS among IV Drug Users.

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