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### **Automating Telephone Surveys: Using T-ACASI to Obtain Data on Sensitive Topics**

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# Automating telephone surveys: using T-ACASI to obtain data on sensitive topics

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## Abstract

This paper describes a new interview data collection system that uses a personal computer equipped with a telephone interface card. This system, telephone audio computer-assisted self-interviewing (T-ACASI), offers the economy of telephone interviews while providing the privacy of self-administered questionnaires. We describe T-ACASI design considerations and operational characteristics. In addition, we present data from recent studies indicating that the T-ACASI system is stable, robust, and suitable for administering relatively long and complex questionnaires on sensitive topics, including drug use and sexual behaviors associated with HIV and other STDs. © 2000 Elsevier Science Ltd. All rights reserved.

*Keywords:* T-ACASI; Telephone interviews; Surveys; Sensitive topics

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## 1. Introduction

Surveys constitute an important source of information on a range of topics, including HIV and other public health problems of importance. Because surveys can produce timely information from relatively large samples, the resulting data are often of interest to a range of people. For example, personnel charged with setting public health policy need to know the dimensions and distribution of a problem in order to target resources appropriately. Researchers need to know about the antecedents and correlates of the health problem to design more effective intervention programs. But the empirical foundation of research and policy is only as strong as the data on which it rests. Therefore, it makes sense to understand factors that affect data quality of health-related surveys (Miller, Turner & Moses, 1990, Chapter, 6).

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There is a growing body of evidence indicating that the level of privacy provided during interviews affects the quality of data. Interview modes that afford increased privacy result in increased completeness of reporting of sensitive and illegal behaviors from several populations, including adolescent males, women of childbearing age, and the general population (Miller, Gribble, Rogers & Turner, 1999; Rogers, Forsyth, Miller, Smith & Turner, 1996; Shober, Caces, Pergamit & Brandon, 1992; Turner, Lessler & Gfroerer, 1992; Turner, Ku, Sonenstein & Pleck, 1996; Turner, Miller & Rogers, 1997; Turner et al., 1998).

Recent advances in survey technology provide new interview tools to collect data under private conditions, thus making them suitable for studies of sensitive topics, such as sexual behavior, drug use, and violence. One of the first technologies developed was an audio computer-assisted self-interviewing (audio-CASI) system, which is implemented through laptop computers and used in face-to-face surveys. In audio-CASI, respondents listen to digitally recorded questions and response categories through headphones and enter their answers using the keyboard. Audio-CASI technology thus allows surveys to be conducted in complete privacy (O'Reilly, Hubbard, Lessler, Biemer & Turner, 1994; Turner et al., 1992, pp. 303–305). This new technology offers a number of important methodological advantages in addition to privacy:

1. Audio-CASI can be used with any respondent who can hear. The audio component eliminates the requirement that subjects be literate.
2. Audio-CASI can be programmed in any spoken language and has been used in multilingual surveys administered by monolingual interviewers (Hendershot, Rogers, Thornberry, Miller & Turner, 1996; Turner, Rogers, Hendershot, Miller & Thornberry, 1996).
3. Audio-CASI standardizes the presentation of questionnaire items; every respondent hears the questions in exactly the same manner.
4. Like other computer-assisted interview technologies, audio-CASI provides automated skip patterns, branching through complex questionnaires without burdening the respondent. In addition, it provides automated consistency and range checks and produces clean data files.

Audio-CASI systems have been used in several recent national surveys. The findings from these surveys indicate that audio-CASI elicits more complete reporting of sensitive and illegal behaviors than interviewer-administered questionnaires (IAQs); (Miller et al., 1999) and paper-and-pencil self-administered questionnaires (PAPI SAQs) (Turner et al., 1998).

Until recently, it has not been possible to provide these methodological advantages in telephone surveys. Computer-assisted telephone interviewing (CATI) systems have been available for some time, but these systems still require an interviewer to read questions and to elicit responses from participants. Thus, CATI systems cannot afford the level of privacy of either audio-CASI or PAPI SAQs, a deficiency that may be particularly important in surveys of sensitive behaviors. One of the first telephone-based data collection systems that attempted to take the interviewer out of telephone interviews is the Interactive Voice Response (IVR) method. IVR has

historically been used to collect limited amounts of data from large numbers of people by recording verbal responses provided by respondents to pre-recorded questions. However, most IVR surveys have used short, structured questionnaires that take less than 5 min to administer, and this method cannot provide automated skip patterns.

In a recent volume of this Journal, we described the development of a new Windows-based audio-CASI system (Cooley & Turner, 1998). This paper describes the development of a new telephone audio computer-assisted self-interviewing (T-ACASI) system that is derived from this audio-CASI platform.

T-ACASI shares many of the advantages provided by other CATI systems. These advantages include the ability to administer relatively long and complex questionnaires, to automatically execute skip patterns, to embed edit logic, and to produce a clean data file at the end of the interview. However, unlike other CATI systems, T-ACASI interviews can be conducted in complete privacy. After transferring a respondent to the T-ACASI system, the interviewer is disconnected. This leaves only the participant on the line with the computer, thus eliminating the need to report any sensitive information to another human being.

## **2. History of T-ACASI development**

Early experimentation with telephone-based automated data collection systems was begun at the Bureau of Labor Statistics (BLS) during the late 1980s under the rubric of Touch-Tone Data Entry (TTDE) surveys (Clayton, 1991; Clayton & Harrell, 1989; Werking & Clayton, 1990; Werking, Tupek & Clayton, 1988; Werking, Clayton, Rosen & Winter, 1988). In the early 1990s, the Research Triangle Institute (RTI) adopted an analogous TTDE procedure to randomize subjects enrolling in clinical trials. Such early systems are still used by BLS in monthly data collection for the large Current Employment Survey. Methodological research indicates that error rates using TTDE technology are low (Phipps & Tupek, 1990) and that TTDE has considerable advantages over other methods in terms of cost and timeliness of data collection (Werking & Clayton, 1990). However, like the aforementioned IVR system, these initial TTDE applications were limited to relatively simple data collection tasks, typically questionnaires involving only five to 10 items and requiring no skip patterns or other tailoring of the survey instrument (Weeks, 1992). For example, the Current Employment Survey requires only 1 min and 45 s on average to complete. Moreover, surveys employing these systems have focused on specific respondent populations and subject matter, largely limited to the collection of nonsensitive commercial and technical data provided by trained, literate respondents.

There remained a need for a telephone-based data collection system capable of administering more complex questionnaires to diverse populations. Scientists at RTI had developed a fully functioning audio-CASI system in 1991 that was useful in large field surveys and held promise for the development of a new telephone-based system (Duffer, Lessler, Weeks & Mosher, 1996; O'Reilly & Turner, 1992; O'Reilly et al., 1994; Turner et al., 1992, pp. 304–305; Turner et al., 1998). In early 1995, a

DOS version of the audio-CASI system was adapted for a telephone environment. We wanted to provide the advantages of the audio-CASI system used in face-to-face interviews to participants in an AIDS-related telephone survey. Thus, we sought to adapt the recently developed audio-CASI system to a telephone environment rather than invent an entirely new system. The result is a software platform that fully integrates audio-CASI and touch-tone telephone technology in a manner that can be implemented on a wide variety of hardware. The hardware requirements for T-ACASI include many audio-CASI elements but add a series of telephone interface boards to a standard personal computer. The telephone board is able to place and answer telephone calls. Telephone boards are readily available and often used for such things as voice mail boxes and conferencing systems.

Like audio-CASI, T-ACASI is an evolving technology. In the fall of 1996, the DOS version of T-ACASI was converted to Window NT. The Windows NT version of T-ACASI provides an important advantage over the DOS version. In the Windows NT version, more than one interview or application can be conducted simultaneously using the same hardware, thus providing the opportunity for reducing total hardware costs for a T-ACASI project.

### **3. Design features**

Architecturally, our T-ACASI system is a direct outgrowth of the audio-CASI system. We specifically sought to preserve key audio-CASI design features in the T-ACASI system. Such features include the aural presentation of questions and response categories, respondents' use of keys or buttons to enter responses, programming of questionnaires to support automatic execution of skip patterns, as well as range and other edit checks.

The first steps in developing an audio-CASI or T-ACASI application are the scripting and programming of the questionnaire. During this phase of development, the questionnaire language is tailored for the targeted sample. For example, separate items can be constructed for male and female respondents using gender-specific language. Similarly, skip patterns and range checks are specified. By allowing respondents to skip out of sections that are not relevant to them, the time and the cost associated with that interview are decreased. By specifying range checks for each item, data quality is improved because invalid responses are dramatically decreased, if not eliminated. A script is then prepared for the questionnaire. A reader records all introductory material as well as each item and associated response categories. Each recorded item produces an audio file, which becomes an integral building block of the final programmed questionnaire.

In T-ACASI interviews, live interviewers are used to make the initial contact with households, screening them for eligible subjects, and recruiting an eligible respondent. In T-ACASI interviews, the role of the interviewer is limited but not eliminated. The interviewer may ask an initial set of nonsensitive questions prior to beginning a T-ACASI practice session with a respondent. The practice session allows the interviewer to familiarize a respondent with T-ACASI operations. To

begin the practice session, the interviewer initiates a three-way call, linking the participant, the interviewer, and the T-ACASI system. During the practice session, both the interviewer and the respondent can hear the recorded questions and associated response categories. The interviewer can enter the responses provided orally by the respondent, explaining which key on the touch-tone telephone was used to complete that item<sup>1</sup>. Part of the practice session includes an item where the interviewer presses an inappropriate key, triggering an out-of-range or failed edit response signal. The practice session is usually completed after four or five questions. At that point, the interviewer hangs up, and the respondent completes the questionnaire alone and in private.

For the remainder of the T-ACASI interview, only the respondent hears pre-recorded questions and response categories over the handset of the telephone. Operationally, the laptop keyboard used in the audio-CASI system is replaced by the keypad on a touch-tone telephone in T-ACASI. Once the respondent presses a button on the key pad to indicate a response, the T-ACASI computer automatically executes a validity check to ensure that the response is within the range specified in the programmed questionnaire. That program also checks for skip patterns to ensure that the next appropriate question is presented to the respondent.

A feature that distinguishes T-ACASI from audio-CASI operations is the need to design questionnaires that fit an 'audio only' environment. Unlike audio-CASI where respondents hear questions through headphones and see them on the computer screen, T-ACASI respondents can only hear questionnaire items. This environment is further limited by the 12-button keypad on touch-tone telephones. In T-ACASI, the respondent listens to questions and response categories through the handset of a conventional touch-tone telephone.

Open-ended questions present significant challenges to T-ACASI data collection efforts. For the most part, T-ACASI questions are associated with a finite number of response categories, each of which is assigned a number. Responses are indicated by pressing the touch-tone buttons on the telephone keypad associated with appropriate response category. However, some questions require a numeric response. In AIDS surveys, for example, respondents are often asked how many sexual partners they have had in the past year. In T-ACASI, the pound or "#" key can be used to delimit numeric responses. After entering the number of sexual partners, the respondent presses the # key. The T-ACASI program recognizes the # signal as a terminator for a numeric response field and moves on to the next questions. By using a delimiter system, the T-ACASI system allows answers with varying numbers of digits. Our experience to date suggests, however, that some respondents may get confused when asked to enter a single key response as well as a numeric response plus a delimiter key in the same questionnaire.

In audio-CASI, several F or function keys are programmed to perform specific tasks, such as backing up to the previous question, replaying the current question, and indicating a "Don't Know" or a "Refuse to Answer" response. Because there

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<sup>1</sup> Alternatively, respondents can press keys and receive instructions and help from an interviewer, as needed.

are no F keys on a touch-tone telephone keypad, an alternative strategy unique to T-ACASI was devised. In T-ACASI, these special features are invoked by pressing the “\*” key on the touch-tone telephone keypad. This produces a menu of options, a recording of which is read to respondents. For example, respondents who press the \* key are told that pressing the *B* or 2 key on the touch-tone pad will enable them to *Back up* to the previous question, and the *L* or 5 key lets them *Listen* to the current question again. Pressing *D* or the 3 key allows the respondent to answer “*Don’t Know*” to a question, and pressing *R* or the 8 key results in a *Refuse* to answer response. To speak to a live interviewer for assistance, respondents are told to press the zero or Operator key. Table 1 summarizes the functions of the special keys used in the T-ACASI procedure.

If the T-ACASI system detects a 30-s delay between the completion of audio presentation of a question and the entry of a response, the following procedures are automatically executed. The respondent will hear a recording to remind him or her that the computer is expecting a response. Then the question will automatically be read again. After three such reminders, the T-ACASI system hangs up and informs the interviewer or Help Desk that an interview has been interrupted and the respondent disconnected. The T-ACASI system relays the case identification number as well as other contact information to the Help Desk so that the respondent can be re-contacted. (We have found that call-waiting telephone service is a common source of suspended interviews.) If the respondent can be recontacted and agrees to continue the interview at that time, the call is reconnected to the T-ACASI system at the point in the questionnaire where the break off occurred. If the respondent cannot be immediately recontacted or persuaded to continue at that time, the case is placed in a scheduling queue for a future recontact or refusal conversion attempt.

When the T-ACASI interview is completed, respondents in most studies will be automatically transferred back to an interviewer or the Help Desk for close out. In some studies, respondents are asked to complete a brief follow-up interview to capture their reactions to the T-ACASI interview. The Help Desk interviewer then closes out the interview using procedures that are standard to all telephone interviews.

We have extended T-ACASI by adding a hardware interface to handle both incoming or call-in functions and outgoing or call-out functions. In a call-out survey, a human telephone interviewer calls the respondent and subsequently transfers

Table 1  
T-ACASI special keys

Key	Action
*	Invoke menu
B or 2	Back up to previous question
D or 3	Don’t know
R or 7	Refuse to answer
L or 5	Listen to current question again
Zero or 0	Operator or live interviewer assistance or HELP
#	Delimit numeric response

the call to the T-ACASI system, as described above. In a call-in survey, the respondent initiates the interview by calling a number that is answered by the T-ACASI system. The call-in feature allows respondents to complete an interview at a time that is convenient for them.

#### 4. Field experiments

##### 4.1. Overview

We have conducted three studies that have used T-ACASI to collect survey data. A fourth and more ambitious T-ACASI survey is being fielded in the summer of 1999. A discussion of these studies is presented to highlight operational and performance experience with T-ACASI. Information on mode effect on survey measurements and the substantive findings of these studies are presented elsewhere (Gribble, Pollack, Catania & Turner, 1999; Turner, Miller, Smith, Cooley & Rogers, 1996).

##### 4.2. *The Cook and Wake County Study*

The initial test of T-ACASI occurred in the summer of 1995 using a sample of households with listed telephone numbers in Cook County, Illinois and STD patients recruited in Wake County, NC. We embedded an interview mode experiment into a small telephone survey of risk behaviors associated with HIV and other STDs (Turner, Miller et al., 1996).

This study used a slightly modified version of the questionnaire from the National AIDS Behavioral Survey (NABS) (Catania et al., 1992). The NABS survey was previously administered by telephone to a national sample of 10,630 adults in 1990. The version used in the Cook and Wake County Study consisted of 83 questions covering a wide range of HIV risk behaviors. To accommodate a cross-over design, the questionnaire was divided into four sections. In Section 1, telephone interviewers screened households for eligible subjects and recruited one subject per household. Section 1 concluded with a practice session to teach respondents how to use the T-ACASI system. Sections 2 and 3 were comprised of sensitive items related to HIV transmission. Section 4 consisted of questions on mode preferences and problems that occurred during the interview as well as the interview close-out. A standard CATI application was used to collect data in Sections 1 and 4. Respondents were randomized to one of two modes for Sections 2 and 3. Half of the participants completed Section 2 in T-ACASI and Section 3 with an IAQ. The other half received Section 2 as an IAQ and Section 3 in T-ACASI. By design, each respondent completed sensitive sections of the interview in both IAQ and T-ACASI modes.

Operationally, this experiment was a success. Essentially all (99%) screened households with eligible subjects had touch-tone telephone service, although the proportion of households with rotary service was higher among older, ineligible subjects (Turner, Miller et al., 1996). Overall, T-ACASI proved to be stable and reliable. Initially, there were some problems with disconnected interviews. Pilot tests of the



system had been conducted linking the computer center's internal PBX telephone system to the T-ACASI system. Our internal PBX system proved to be significantly quieter than phone systems used by the telephone survey unit and respondents. However, once the T-ACASI telephone card was calibrated to sound levels occurring outside of the private branch exchange (PBX) environment, the unintentional disconnects decreased markedly.

When questioned about their experiences with T-ACASI and standard telephone interviewing, respondents reported that T-ACASI was better at protecting privacy, provided a more comfortable environment for answering sensitive questions, and was more likely to elicit honest reporting of sexual and drug use behaviors (Turner, Miller et al., 1996). However, participants also indicated that interaction with a human interviewer was more interesting and easier than using T-ACASI.

#### *4.3. The Urban Men's Health Survey (UMHS)*

Based on the success of the Cook and Wake County Study, we received funding to work with Joseph Catania and collaborators at University of California San Francisco to embed a T-ACASI mode experiment in their UMHS, (Catania et al., 1998). Data collection commenced in the fall of 1996 and was completed in early 1998.

The UMHS mode experiment did not use the cross-over design of the Cook and Wake County Study. Rather, UMHS respondents were randomly assigned to an interview mode (interviewer-administered CATI or T-ACASI) for one sensitive portion of the UMHS questionnaire. The T-ACASI component of the UMHS questionnaire was considerably longer than the questionnaire used in the Cook and Wake County Study. Depending on the skip patterns triggered, respondents could be asked a potential maximum of 284 questions. Respondents took a median of 32 min to complete the T-CASI section of the UMHS survey.

In the UMHS, 429 interviews were completed in T-ACASI. (1960 were completed in standard IAQ-CATI mode.) The UMHS protocol specified recontacting any participant who did not complete the questionnaire. The purpose of recontact was two-fold: to find out why the interview was suspended and to try to gain the cooperation of the respondent to complete the interview. The time between suspended interview and recontact varied greatly across cases and was sometime lengthy. Therefore, each recontacted subject who agreed to complete the interview was re-administered the T-ACASI practice session to ensure that they were familiar with T-ACASI operations.

Compared with the Cook and Wake County Study, we experienced higher rates of break-offs in UMHS. A total of 697 respondents were randomized to T-ACASI, of which 83 would not or could not be interviewed and 48 were not successfully transferred to the T-ACASI system. It is perplexing why the refusal rate among gay men was so much higher than in the other study. However, the refusals comprise both those who did not want to participate in the study and those who did not want to be randomized to T-ACASI. Among the 566 who began the T-ACASI interview, approximately one-quarter resulted in a break-off ( $n=137$ ). More than a third of incomplete cases had at least one sensitive section completed before the break-off

occurred ( $n=47$ ). The remaining cases broke-off during the first sensitive section ( $n=90$ ). Overall, approximately 75% of the respondents that completed the practice session in Section 1 of the questionnaire finished the entire questionnaire without breaking-off. Thus, of the 566 UMHS participants randomized to T-ACASI, 429 completed interviews (76%) were obtained. On the basis of these results, we conclude that it is possible to use T-ACASI in large national surveys, even ones employing large survey instruments. There is, however, a pressing need to better understand and to reduce the rate of respondent break-off.

#### *4.4. The Maryland Breast Cancer Feasibility Test*

A short study was undertaken to demonstrate the feasibility of using T-ACASI to collect interview data from a population that included older women for a research grant application. This feasibility study used a quota sample of 300 women between the ages of 18 and 74 who resided in the state of Maryland. We used a sampling frame of listed telephone numbers in Maryland. We oversampled census tracts that had higher than average rates of African-American residents.

A short, 40-question instrument was used. On average, women could complete it in approximately 10 min. During the implementation of this feasibility study, we developed a new, automated process for tracking cases. This process was facilitated by having the CATI and T-ACASI interview systems linked on the same local area network. After the interviewer keyed the case identification (ID) number into the CATI platform during screening, the ID was automatically linked to the record generated by T-ACASI. Because no additional keying of ID information was required to link CATI and T-ACASI data records, we eliminated error associated with re-keying IDs and reduced interviewer labor.

Again, this study was a success operationally. Only 3% of the households were excluded because they lacked touch-tone telephone service. We completed interviews with 287 women. The vast majority (97.2%) reported that they had no problems using the telephone to answer questions. The resulting data were remarkably complete, even for the most sensitive questions. For example, only three women (1.0%) refused to answer a question on a history of induced abortion, and two refused to answer questions concerning their history of sexually transmitted diseases. Not only were participants capable of using the T-ACASI system, but the majority indicated that T-ACASI was better than a live interviewer for protecting participants' privacy (86.5%) and eliciting honest answers (89.5%).

#### *4.5. The AIDS Behavioral Study (ABS)*

The ABS T-ACASI experiment will be fielded during the summer of 1999. This study uses an improved telephone card that permits multiple applications to share the same telephone card resources. Up to eight T-ACASI interviews can be conducted using a single T-ACASI computer. The ABS research incorporates a randomized mode experiment in which the T-ACASI platform will collect data from half of the anticipated 3000 respondents. A total of 185 questions are included in the instrument.

## 5. Conclusion

Audio-CASI and T-ACASI provide similar benefits with respect to privacy. Thus, both hold promise for increasing the completeness of reports of sensitive behaviors. However, T-ACASI affords additional advantages. Like other forms of telephone interviewing, T-ACASI does not require sending interviewers into the field to screen households, identify eligible subjects, and conduct interviews. However, unlike other forms of telephone interviewing, T-ACASI can afford privacy to all respondents. The T-ACASI system, as it is currently configured, uses the same procedures for developing, programming, and implementing a questionnaire as the laptop-based audio-CASI system. Thus, once programmed, a questionnaire can be implemented through either platform. Furthermore, preliminary data from several recent studies indicate that respondents prefer T-ACASI to live telephone interviewers when answering sensitive questions (Turner, Miller et al., 1996). We hope that ongoing and future T-ACASI surveys will provide additional information on the impact of this new interview mode on the quality of survey data and the costs associated with using it.

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