

## A Multi-mode CATI-Web Survey Experience with Blaise

*Craig Ray (Westat, USA)*

### 1. Abstract

In 2005, Westat developed and implemented a multi-modal (CATI and web) household interview that collected nationally representative data on the public's need for, access to, and use of cancer-related information. The survey instrument was developed with Blaise software for both the web and the computer-assisted telephone interviewing (CATI). To support the survey, Westat deployed a complex management system to control and track survey responses. This paper discusses the system's implementation, including the technical approach, software development process, technical considerations such as security, potential obstacles, and experiences gained.

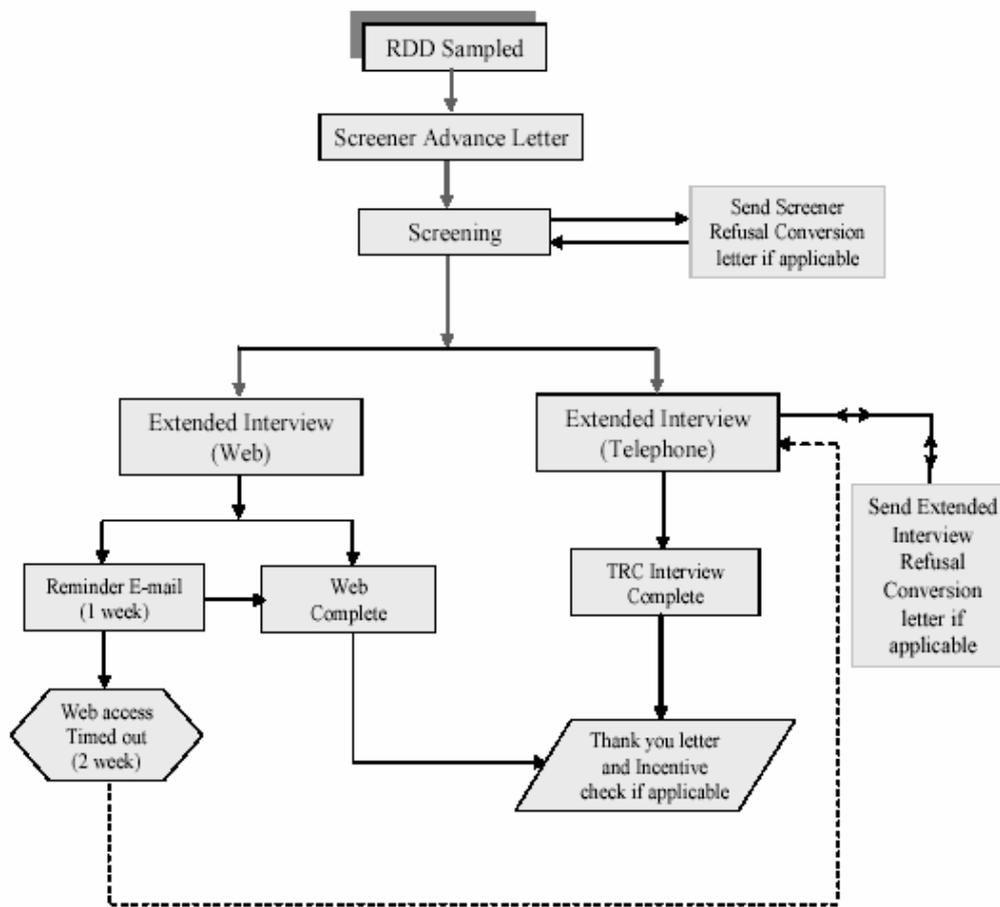
### 2. HINTS study protocol

The Health Information National Trends Survey (HINTS), sponsored by the National Cancer Institute (NCI), collects nationally representative data about the use of cancer-related information in the U.S.

For the second cycle of HINTS, NCI was interested in exploring the efficacy of using a web version of the questionnaire along with the primary CATI interview. A representative sample was drawn by random digit dial (RDD). All sampled phone numbers were randomly placed in a two-by-two experiment for an extended interview. The cells of the experiment indicated the mode of interview and an incentive amount and consisted of CATI/\$5, CATI/\$15, CATI-web choice/\$5, and CATI-web choice/\$15. For sampled phone numbers for which an address match was obtained, Westat mailed an advance letter containing a two dollar bill as an incentive to participate in the study. Each sampled phone number was screened via CATI and upon completion of the screener, an algorithm sampled one member from the household for participation in the extended interview. If the sampled person qualified for and chose web interviewing, we sent an e-mail or letter that contained the web site's URL and their unique username and PIN. Otherwise, the CATI interviewer immediately attempted to complete the extended interview or set an appointment for a later time. Web cases that did not complete the process within one week were sent a reminder letter, and after two weeks were transferred for CATI processing of the extended interview. For those who completed the extended interview, we sent a 'thank you' letter containing the promised incentive payment of either \$5 or \$15.

Figure 2.1 illustrates the basic study operational flow.

Figure 2.1 – HINTS II operational flow



### 3. Technical architecture

Figure 3.1 highlights the technical architecture of the entire system. The dual modality made the overall system complex. Westat deployed a number of technologies that were all controlled by the central Study Management System and Integrated Database. The system consisted of the following components:

**RDD sample selection:** We developed RDD sampling programs to select a nationally representative sample of randomly selected phone numbers, exclude non-residential numbers, and find matching addresses against national databases.

**Telephone Research Center:** Westat’s Telephone Research Center (TRC) is equipped with a suite of software tools that assist the team of CATI interviewers. The survey instrument was developed in Blaise for Windows and a sophisticated scheduling component managed the CATI cases.

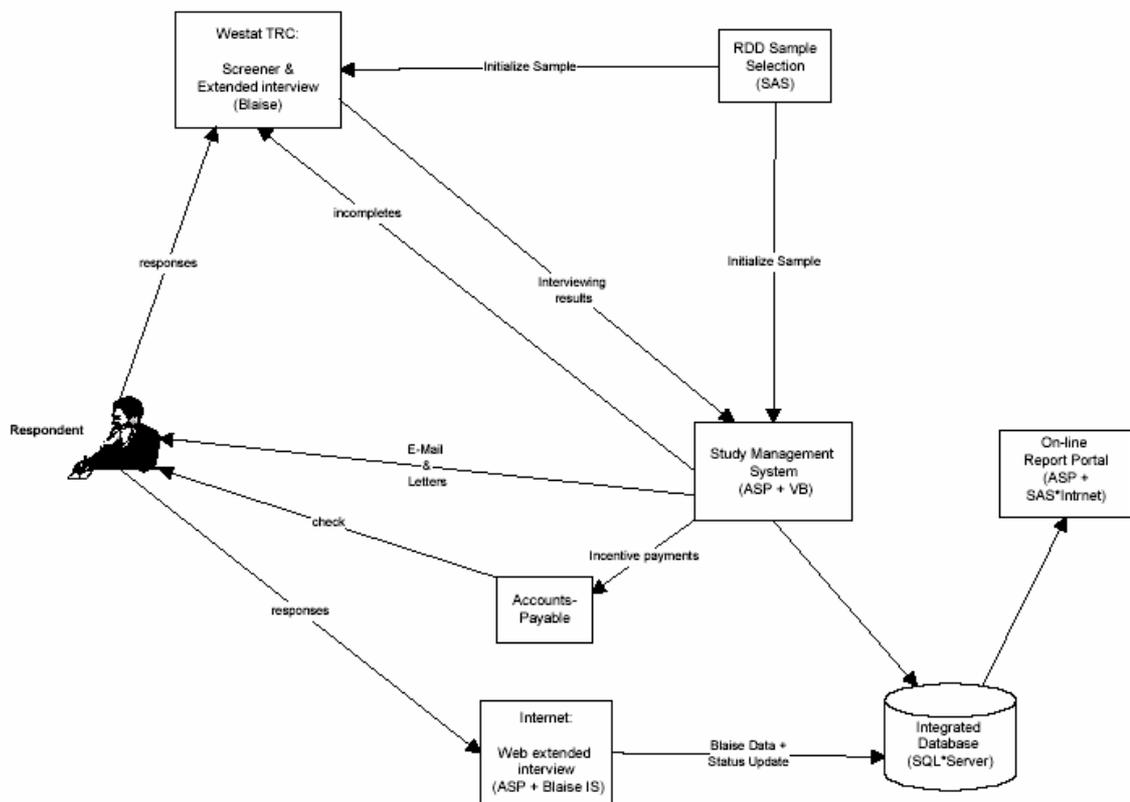
**Study Management System (SMS):** The overall study management system controlled the flow of cases through the phases of the study. The system consisted of a series of programs developed in Visual Basic (VB) for Windows applications and Active Server Pages (ASP) for an intranet site. The study management system was responsible for loading the sample, maintaining the central database, interfacing with the TRC system and Accounts Payable system, sending all household and respondent e-mail and letters, and providing an interface for the internal help desk staff.

**Integrated database:** We implemented the central database with SQL Server which contained the central repository for all cases.

**Web extended interview:** The web extended interview consisted of a respondent home page developed with ASP and instrument developed with Blaise IS software. The respondent was directed to the URL of the respondent home page, which prompted for a login ID and password (authentication) and launched the Blaise IS instrument.

**On-line report portal:** We implemented central case management reports within Westat's on-line report portal, which is implemented with ASP programs interfacing with SAS/Intrnet software. The team developed reports with SAS, which were implemented within the portal. The SAS programs extracted data from the integrated database in real-time using SAS/Access to OLE DB.

Figure 3.1 – HINTS Technical Architecture



#### 4. The choice of Blaise

We considered several competing technologies for programming the computer assisted interview, but several factors made Blaise the obvious choice.

- The extended interview was lengthy and complex. Blaise is unique among computer assisted interview (CAI) development tools in its ability to handle instrument complexity. The survey instrument consisted of 16 sections and required constructs such as:
  - question order randomization,
  - question assignment randomization,
  - 'check-all-that-apply' questions,
  - text fills,
  - unit/quantity questions, and

- complex question routing.
- The extended interview had to be multi-modal. We expected to achieve economies of scale by using the same programs in both the TRC and the web environments.
- The extended interview had to operate in the CATI environment. The Westat CATI development team had already implemented many complex Blaise instruments. Moreover, the existing TRC technical infrastructure is fully integrated with Blaise.
- The extended interview had to be rendered as a self-interview via the internet. Because of the instrument complexity, a general purpose web development language, such as ASP, was clearly not an option. Among candidate web CAI development tools, none other than Blaise was able to express the complexity required in this survey. Moreover, key members of Westat's web development team were experienced Blaise programmers

Given these factors, Blaise was clearly the best choice of technology. However, at the time the team programmed HINTS instrument, Blaise IS was in beta release. Blaise IS had not yet been deployed for production data collection. The plan described in the following sections was developed through discussion and close interaction with the client and project team in an environment where risks, costs, benefits, and capabilities were understood and considered at all phases of deployment.

## 5. Instrument development

Ideally, Westat would have developed one Blaise instrument to run in both the CATI and web environments. However, the most prudent course was to focus initial efforts on the development of the CATI instrument. Then as a contingency, if the project suffered unanticipated problems deploying the web version, data collection could be accomplished strictly in the phone center and still accomplish the primary project data collection objectives. As a result, we decided to initially develop and test the CATI instrument and after the programs were deemed suitably mature, transfer the Blaise programs to a Blaise IS developer to customize for the web. The approach had the obvious disadvantage that it required us to maintain two versions of the programs, versions that were very close to identical. After the transfer, any changes to the instrument had to be programmed and tested in both versions. Nevertheless, the project team accepted this drawback.

The effort to recast the CATI instrument to a web instrument was relatively simple. Most of the work consisted of:

- Recasting question texts from interviewer-administered wording to self-administered wording,
- Defining and applying user-interface settings with the Blaise mode library,
- Working with the Blaise IS workshop to adapt the interview XSL stylesheet to implement specialized user-interface elements,
- Deploying the instrument to contain only one question per screen. This was considered an important study consideration; the web version simulated the CATI version because the respondent could not 'look ahead' to future questions, and

- Customizing standard Blaise IS ASP pages that handle authentication, respondent access, general information links, frequently asked questions (FAQs), etc.

In general, we found Blaise IS system exhibited significant advantages in terms of its robust development process and supporting tools. Programming the instrument, refining the ‘look-and-feel’ so that it was suitable for everyday web users, as well as testing, revision, and implementation all met or exceeded our expectations.

However, because Westat developed and implemented the web version using a beta release of Blaise IS, as expected the implementation encountered several problems with the software. To correct the problems, Statistics Netherlands frequently released new versions of Blaise IS. For each new release, we needed to reinstall the software and recreate the specification file. Sometimes that just meant using the specification interface to check and uncheck boxes or change text. The instrument specification accesses many files and we could not be certain which files were modified for the release. Therefore, Westat began the process anew, each time reapplying the customizations to the files contained in the new release. For example, Westat modified the Starter page, Receipt page, and Abort page manually. Because we did not know with certainty what items changed, the team reapplied the customizations each time.

## 6. Web interface to Blaise

The HINTS web self interview was an officially sponsored government data collection targeted at everyday web users. Ideally, the respondent home page would have the ‘look and feel’ of an official government web site, be intuitive, give assurances of privacy and security, and provide suitable study background. While Blaise IS generates a default starter page, the study required a highly customized, intuitive, content-rich home page. Developing the HINTS respondent home page required a substantial development effort.

Figure 6.1 – HINTS Respondent Home Page

**NATIONAL CANCER INSTITUTE** Cancer Control & Population Sciences

Health Information National Trends Survey (HINTS)

**Log in and Complete the Survey**

Username:

Password:

**Find Out More about HINTS 2**

- [HINTS Brochure](#)
- [Frequently Asked Questions](#)
- [Survey respondent instructions](#)
- [Confidentiality statement](#)
- [HINTS Home](#)

**Contact Us About the Survey**

E-Mail: [hints2info@westat.com](mailto:hints2info@westat.com) (8:30am to 5pm, EST)  
Telephone: 1-888-314-1133 (9am to midnight, EST)

Health Information National Trends Survey **hints2**

Welcome to the HINTS 2 survey home page. Thank you for agreeing to participate in the HINTS survey. Your answers, combined with those of other survey respondents, will help the National Cancer Institute improve the way it distributes information about cancer prevention to people in the United States. Your participation in the study is important to its success!

Figure 6.1 depicts of the respondent home page for HINTS. We sent a URL for this page via e-mail or U.S. mail for those who qualified for and agreed to complete the extended interview on the web. There are several notable features on the page.

- **‘.GOV’ URL:** Westat servers hosted the web site. However, the respondent was sent a URL to a related HINTS .GOV web site (a subdirectory off the main [www.CancerControl.cancer.gov](http://www.CancerControl.cancer.gov)). Westat worked with the government client to have that page redirect to the Westat web site. Having the respondent link to a ‘.GOV’ site helped assure respondents that this was an official government research project.
- **Site theme:** The team used colors and graphics to match the general government HINTS web site.
- **Authentication and access control:** The respondent home page has an area for each user to enter username and password. The web page checks the respondent’s entry against the integrated SQL Server database (authentication). If the username and password are valid, a record of the login is recorded in the database. The page then determines whether to direct the user to the survey and if so, the respondent is directed to the Blaise IS interview. However, for any of the following reasons a respondent will not be granted access to the interview and a suitable message is displayed in bold red:
  - The user entered an invalid ID or password.
  - The respondent already completed the extended interview.
  - The respondent did not complete the interview within the two week time frame and the case was transmitted back to the TRC for completion (this avoids the conflict of interview being completed simultaneously in both the TRC environment and on the web; only one environment is the ‘owner’ of the case at any time).
  - The respondent has logged in within the previous 30 minutes. We programmed the message to prevent the same user from logging in twice in separate browser windows or from two users from logging in simultaneously. Simultaneous access of the same case could lead to the user becoming confused, or to inconsistent or inaccurate results.

When the respondent is granted access to the interview, Blaise IS launches the instrument in a separate browser window. The Respondent Home Page browser window is closed which avoids the possible confusion of having multiple windows open. In the event that this is a resumption of a partially completed interview, the respondent is automatically directed to the first previously unanswered question on the survey route.

- **Study background:** The Respondent Home Page contained links to frequently asked questions, a study brochure, HINTS government home page, and a confidentiality statement.
- **Contact information:** The contact information included a phone number for and link to generate an e-mail to the Westat help desk.
- **Database interface:** Upon authentication and after access was granted the respondent home page contained the interface code with the integrated SQL Server database and the Blaise database. For a new case, the system

instantiated the Blaise record and, upon completion of the session, wrote status information to the database.

## 7. Blaise IS extended interview

Westat gave great consideration to make the web extended interview intuitive and easy to use and found the features of Blaise and Blaise IS very helpful.

The instrument began with a quick training section that included sample questions with instructions on how to respond and navigate through the survey. The survey seamlessly followed the training section. In order to simulate the CATI environment, during which the respondent is not able to ‘look ahead’ to future questions, we decided to have the web extended interview render as a single question per page. The undesirable consequence was that for respondents with slow, dial-up connections, the more frequent communication with the web server resulted in an increased length of time to complete the survey.

Figure 7.1 – Sample web extended interview question rendering

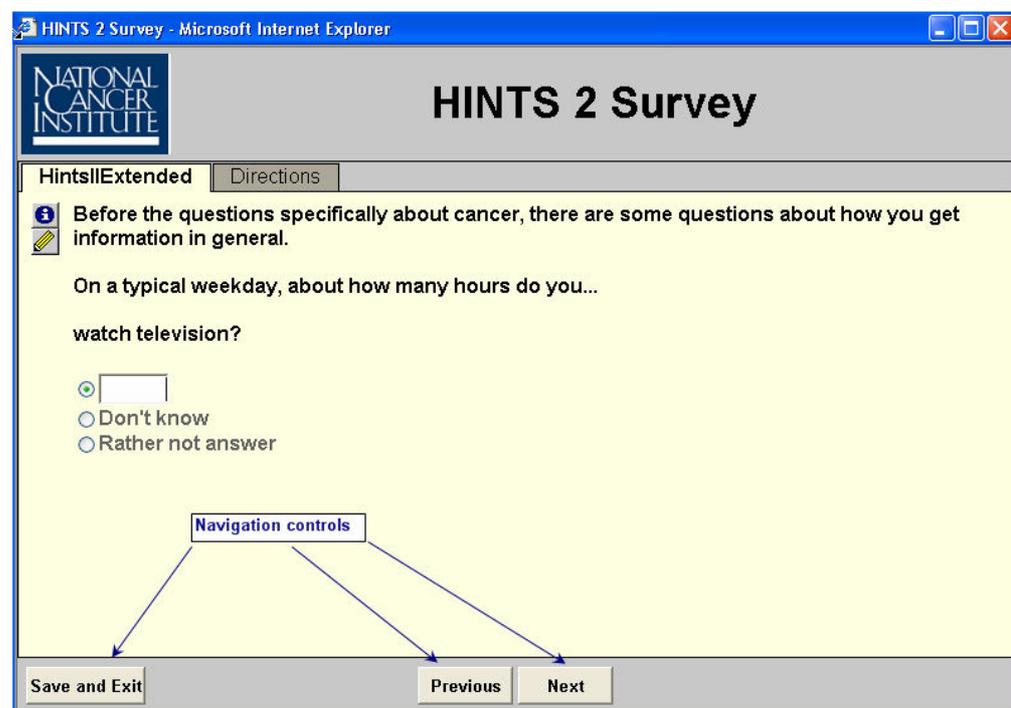


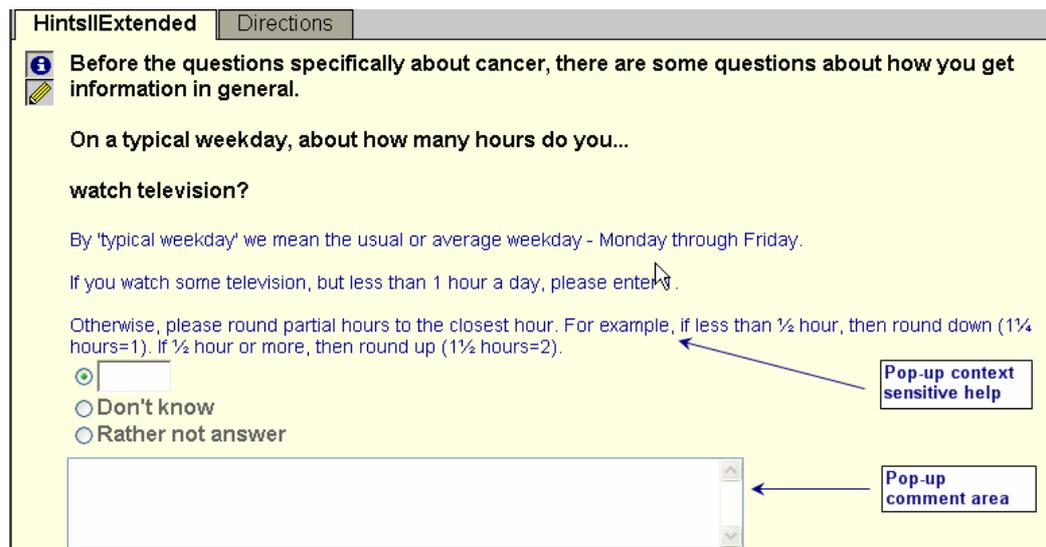
Figure 7.1 illustrates a sample HINTS Blaise IS screen. Blaise IS attempts to launch in a separate Browser window. This permits the software to control the browser appearance, most importantly, hiding all tool and navigation bars. By hiding browser features as <Back> and <Favorites>, it is more difficult and less intuitive for the user to be tempted to navigate to another web site. Rather, the buttons at the bottom of the screen for <Next> question, <Previous> question, and <Save and Exit>, provide all the navigation the user needs to complete the interview.

Westat enabled “don’t know” (DK) and “refuse” (RF) for most of the questions. We chose to use a slightly different font on HINTS so the options would not be as prominent. The font and placement of DK and RF were controlled by editing the style sheet within the specification file.

Respondents obtain context sensitive help when pressing the  button. We implemented 'help' as a second language within the Blaise code. Furthermore, the respondent may make a standard Blaise comment for any question by pressing the  button, which results in a standard browser text area to appear. Figure 7.2 illustrates both features.

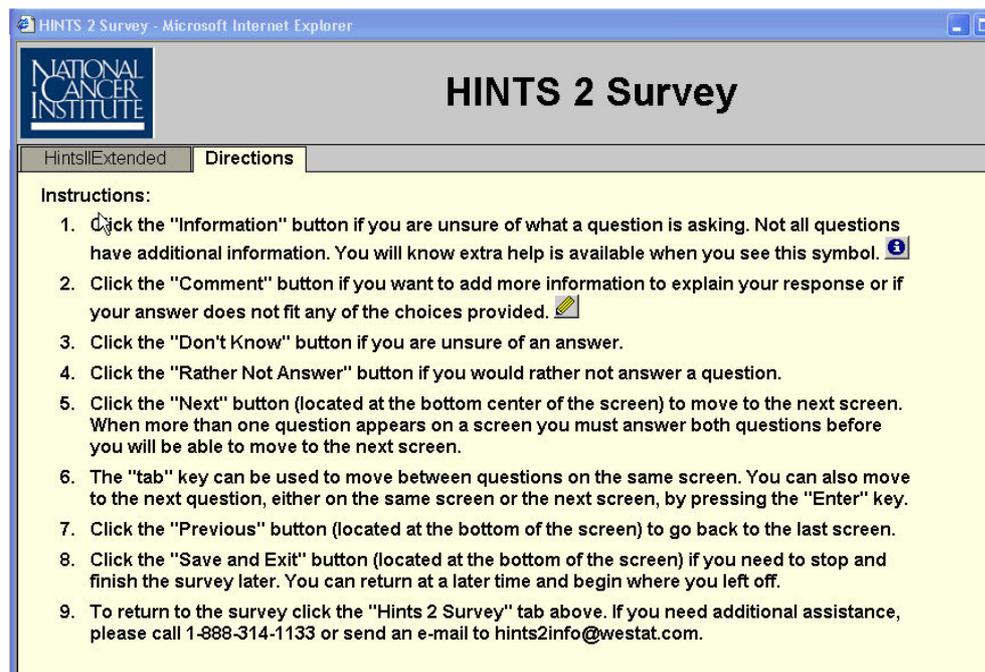
A final note about the web-rendered Blaise instrument is what *isn't* there. A Blaise IS instrument may be configured with a standard 'progress bar.' However, because the survey is relatively lengthy and being administered to volunteers among the general public, Westat determined that the slow progress of the 'progress bar' might be discouraging to the respondent. Therefore, we disabled it.

Figure 7.2 – Blaise IS rendering of comment area and context-sensitive help



Overall on-line help was always accessible to the respondent by clicking on the 'directions' tab. The on-line help feature, illustrated in Figure 7.3, was implemented as a Blaise parallel block.

Figure 7.3 – On-line help in Blaise IS



## 8. Blaise data storage

The simplest approach for storing Blaise data is in a single Blaise database containing all cases. Unfortunately, this option would require the Blaise database to be located on the relatively insecure internet-accessible web server. Because of our need to assure privacy and security, we implemented a more sophisticated approach. Westat deployed a technique that has become routine for many Blaise for Windows implementations – creating a separate Blaise database for each subject and storing the Blaise database in the larger SMS database. The Blaise database is packaged as a WinZip file and stored in a BLOB field in the SMS database (SQL Server data type Image). To support database communication, Westat developed a database access middle layer implemented as a COM DLL. All ASP programs called appropriate middle layer methods to read and write to SQL Server.

After a respondent successfully authenticated, the system determined whether it was a restarted case. If so, the existing Blaise database was retrieved from the SMS database and ‘unzipped’ on the web server, before launching Blaise IS. If it was the respondent’s initial login (a new case) then a new Blaise database was created and the appropriate data preloaded using the Blaise Component Pack (BCP).

When the respondent terminated the session, either completing or suspending the interview, the system extracted the status of the case (for example, ‘complete’ or ‘partial complete’) from the Blaise database, created a WinZip file from the Blaise database, then called the appropriate function within the middle layer to update the SMS database.

Abandoned web sessions presented a tricky problem. An abandoned session occurs when, for example, a user closes the browser, powers down the computer, or navigates to another web site prior to either completing the interview or pressing the ‘Save and Exit’ button. For an abandoned session, the program to update the SMS database is never triggered. To resolve this, Westat implemented a ‘sweeper’ program, developed as an ASP program, which was manually run daily. The program scanned the web site for abandoned sessions, and for each one, performed the same functions as ordinarily executed for a normally terminated session.

## 9. Data security and privacy

Westat is committed to maintaining the security of our computer systems and the data we collect. Security is particularly important in the web environment which by its nature is more open to attack. In addition, we are equally committed to privacy of data - minimizing access to the survey data or associating survey responses with an individual. The development team took the following precautions to protect the security of the data and help maintain respondent privacy.

- Access to the web survey was only permitted after the entry of a username and four digit PIN.
- The web site was accessed by Secure Socket Layer (SSL), the industry-standard 128-bit encryption method. SSL encrypts data between the client computer and the web server.
- The web session time-out interval was set to 60 minutes. After the session times out, the respondent must re-enter their username and password. This

feature helps reduce the possibility that an unintended person can view or alter survey responses if the respondent temporarily leaves the computer unattended.

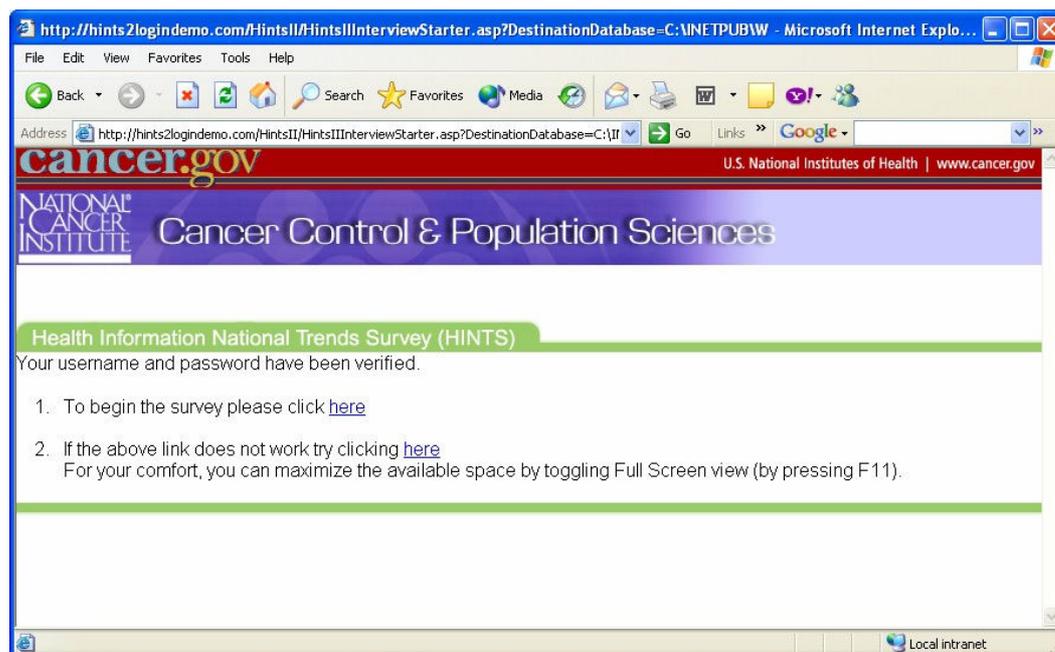
- Generally, the Blaise data was stored on the web server (the least protected area of the Westat network) only for the duration of the survey. Upon the end of the web session, the survey data was stored in the password-protected SQL Server database in a separate zone in a WinZip file.

## 10. Blaise IS challenges

We experienced a few miscellaneous challenges presented by the deployment of Blaise IS for web interviewing.

- **Pop-up blockers:** Blaise IS ideally launches in a separate browser window. However, when the respondent has an activated pop-up blocker, by default, Blaise is prevented from opening a new window. The standard Blaise IS implementation detects a pop-up blocker and displays a special screen which provides the user with alternatives for bypassing the pop-up blocker or opening Blaise in the same window. For a general population of computer users, the screen may cause confusion and for some may result in the respondent's inability to participate in the survey. Westat altered the standard Blaise screen in an attempt to make launching the instrument more seamless. We added our standard project banners and made no mention of 'pop-up blockers' in the text. Figure 10.1 illustrates the Westat customized screen that is rendered when a pop-up blocker was detected. Option 1 provides a 'link' as opposed to a 'button' as an alternate way of launching a new browser window. Many pop-up blockers will launch a new window based on a link but not a button. If the respondent is still not able to access the survey, Option 2 launches the instrument in the same browser window. The standard browser navigation remains visible but we provide a gentle suggestion for the respondent ('by pressing F11') which would hide the standard browser navigation.

*Figure 10.1 – Special screen when pop-up blocker is detected*



- **Browsers other than Internet Explorer (IE):** Because the HINTS survey was completed by a randomly chosen population, Westat could not control the type of browser that would be used. Blaise IS was designed to work well with most standard browsers, including Internet Explorer, Firefox, AOL, Netscape Navigator, and the Mac browser. Prior to the final HINTS deployment, Westat tested Blaise IS with many of the leading browsers. We discovered several severe flaws in the rendering of the interview in non-IE browsers. When Statistics Netherlands was able to reproduce the flaws, they quickly addressed the major problems and released an upgraded version of the software. This corrected most of the problems. Further Westat testing revealed just a few minor cosmetic issues in some non-IE browsers, but we determined that none would hamper a respondent's ability to complete the survey.
- **Scalability:** Before launching the system, Westat performed a stress test of Blaise IS to determine if there was a degradation of system speed with many simultaneous users. The test was conducted with a beta release of the software and with one Blaise database for all cases on the web server. We had 15 people from within the company access the HINTS instrument at the same time. The system performance slowed dramatically as people went farther into the interview. After about 15 minutes, the system's response time was aggravatingly slow, most of the time more than 20 seconds; many of the responses 'timed out' (response time out was set at 30 seconds). However, based on the anticipated survey volume, we estimated that simultaneous use would not approach this volume and generally, the performance would be acceptable. We are in the process of evaluating alternate configuration settings, as well as new features in more recent releases of Blaise IS, in the expectation that these will significantly improve scalability.

## 11. Central Study Management System

The central Study Management System (SMS) controlled and tracked responses for all cases through all phases of the study. The SMS consisted of several computer components that interfaced with the central SMS database.

- **Notifications:** The team developed several programs in Visual Basic to generate e-mail and letters to communicate with the respondents. The programs interfaced directly with Westat's e-mail servers to send them immediately. For letters, the programs produced ASCII delimited files which were processed into letters using Microsoft Word Mail/Merge capability. The team prefers this approach (as opposed to embedding the content within programs) because the content of the letters can be maintained as standard Word documents, which are more easily maintained.
- **Help desk:** Westat staff required a tool to support all study operations and to answer respondent questions and concerns. The team deployed an intranet site developed in ASP to support all contacts with the respondent. The web site provided the following features:
  - Flexible respondent search on any combination of name, status, phone number, and e-mail address,
  - Status history of the case,
  - Review of the notifications (e-mail and letters) sent to the respondent and the ability to request new notifications,
  - Username and password lookup, and
  - Address, phone number, e-mail address lookup and update.

- **Interface with the TRC:** The SMS interfaced with the TRC via file based communication. To support central reporting, the TRC provided the central management system with data about completed screeners and extended interviews. The SMS provided the TRC web cases that did not respond within the designated period. The team developed Visual Basic programs to generate and process the files.
- **Interface with Accounts Payable:** Some of the respondents who completed the extended interview received an incentive payment. We developed a Visual Basic program to interface with the standard Westat Accounts Payable system. The program extracted records from the central database and created a standard ASCII file to pass to the Accounts Payable department.
- **Reporting:** Westat developed several reports to analyze response rate and help control the study operations. The reports were developed in SAS and deployed within an automated web report portal environment. The web report portal is an ASP internet site that enables programmers to deploy SAS reports in SAS/Intrnet without having to develop web programs or configuring SAS/Intrnet. Within the report portal, the user is able to choose between HTML, PDF, RTF, and Excel for output format. The SAS programs access the integrated SMS database in real time, using SAS/Access to OLE DB.

## 12. Future considerations

The development of the HINTS study was Westat's first use of Blaise IS. We expect improvements in both the technology and our use of it. These items bear monitoring for the future:

- **Blaise OLE DB Interface:** With the Blaise OLE DB Interface (BOI), Blaise can store data directly into a database in interview mode. This has great promise for the future and may simplify the technical model used for the HINTS study. Survey data would no longer reside in a separate file (a Blaise database) during the interview. By interfacing directly with SQL Server, the survey data is always current in the database. The complex infrastructure (described above) to detect the end of a web session, update the SMS database with the Blaise data as a WinZip file in a BLOB field, and update status information in the database will no longer be required.
- **Blaise IS Scalability:** The results of the stress test conducted by Westat were a cause for concern. Blaise IS performance was adequate for the simultaneous use required for HINTS. Nevertheless, a development team should proceed cautiously for a new study that anticipates greater simultaneous volume. Statistics Netherlands has been aware of the Westat stress test results, which was conducted while Blaise IS was still a beta release. They have made subsequent improvements to the initial production release (version 4.7) and have announced further improvements for the upcoming version 4.8 release. Westat plans to conduct further scalability testing.
- **Common Blaise Code:** For practical reasons, Westat deployed two separate versions of the Blaise programs for the two environments, CATI and web. Having one common set of programs that operate in both environments is a better development model. The majority of the Blaise code is identical between the environments. Once we have more experience with Blaise IS, Westat will evaluate this approach for future multi-mode surveys.

### **13. Conclusion**

The HINTS study protocol consisted of a large multi-mode survey and a complex management system to support the survey and operations. Blaise proved to be an excellent choice for development of the instrument. Substantially the same Blaise programs were deployed in both the CATI and web environments. Blaise has been used many times in our CATI environment and has met all our expectations. Moreover, the Blaise suite of tools consists of many tools that facilitate its integration with a large system. There were a few challenges using Blaise IS, but none proved to be major obstacles for the HINTS study. We gained valuable experience using Blaise for multi-mode web surveys. Westat looks forward to future enhancements in the Blaise IS technology to combine with the HINTS experience to implement future studies.

### **14. References**

O'Reilly and Ray (2005): Web Data Collection with Long and Complex Questionnaires, Proceedings of the Federal Conference on Statistical Methodology.



## **Session 2.3: Multi-mode**

### **Disparate Modes and Their Effect on Instrument Design**

*Mark Pierzchala*

*(Mathematica Policy Research, USA)*

### **Questionnaire Design in Blaise for a Multimode Survey**

*Hilde Degerdal & Jan Haslund*

*(Statistics Norway)*

### **Distributed CAPI Interviewing with Blaise® IS for the Web for the Adolescent Medicine Trials Network for HIV/AIDS Interventions**

*Rick Mitchell*

*(Westat, USA)*

### **Blaise IS and Accessibility**

*Jim O'Reilly*

*(Westat, USA)*

