Converting the Administration of Health Measures and Bio Specimen Collection from Paper to CAI

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1. Introduction

The Health and Retirement Study (HRS) is a longitudinal panel study that surveys a representative sample of more than 26,000 Americans over the age of 50 every two years. Supported by the National Institute on Aging (NIA) and the Social Security Administration, the HRS explores the changes in labor force participation and the health transitions that individuals undergo toward the end of their work lives and in the years that follow.

In preparation for the 2014 wave of the HRS we successfully converted administration of the series of physical measures, bio sample collection and consent forms from paper to computer assisted (using Blaise). This paper focuses on the conversion process, focusing specifically on the following; usability issues, testing, maintaining continuity of data, acceptance by interviewers and respondents, outcomes and future development.

2. Background

The HRS interview is comprised of an in-depth CAI interview (face to face or telephone), a series of physical measurements, collection of biomarker samples and at the end of the interview a self-administered paper questionnaire is left with the respondent which they are asked to complete and return by mail.

Investigations around the collection of Physical Measures and Biomarker samples on the HRS began with feasibility tests in 1992 and were introduced fully in 2006. Collection of this type of data conducted by interviewers is now becoming more common across social surveys. For the past few waves the type of measures collected on the HRS has remained stable and is comprised of the following:

- Physiological or performance assessments
    - Blood pressure
    - Lung strength
    - Grip strength
    - Balance
    - Walking speed
- Anthropometric measurements
    - Height, Weight, Waist circumference
- Biomarkers samples
    - Saliva
    - Blood (dried blood spots)

Administration of these tests occurs around two thirds of the way through the interview and, until the most recent wave of the study (2014), was administered using a paper booklet. The design of the booklet was improved each wave as we learned more about the type of interviewer instructions we needed to include and as technology advanced – for example, the latest versions used by interviewers included

scannable barcodes which were added to reduce the risk of data entry errors and subsequent linkage issues.

The Physical Measures and Biomarker booklet consisted of 34 pages and included three consent forms (separate consent is collected for the physical measures, blood and saliva sample collection). Eligibility for, or adaptions of the tests are based on age and responses provided in the interview or quality of samples provided in the previous wave. At the beginning of the booklet the physical measurements and Bio (PM and Bio) markers are listed and interviewers transferred information about eligibility from a summary page in the Blaise questionnaire to the paper.

Interviewers then started the section by gaining signed consent for the series of physical measures and proceeded to administer the first set of measures. Each measure in the booklet followed a common format – including a reminder of the equipment required to administer the measure, an introductory paragraph the interviewer read to the Respondent which described the measure, some safety questions and then the step by step instructions. After each measure, interviewers would record any measurement data and then complete observation questions. Following the approved protocol is essential and including the step by step instructions is one of the methods used to ensure consistency between interviewers administration of the measures. Finally, interviewers completed the data entry as a post interview task once they returned home – transferring the data from the paper booklet into the Blaise questionnaire and then mailing the completed PM and Bio booklets, including the signed consent forms, to Ann Arbor to be logged and scanned.

The design of the booklets has developed over the waves as technology advanced and we gained more experience through the quality assurance processes. For example, the version used during the 2012 data collection wave included preprinted serial numbers and barcodes which were scanned into the Blaise questionnaire.

3. Converting from paper to CAI – design goals and objectives

The following section describes the goals we followed during the process of developing and designing the PM and Bio section.

3.1 Minimize Respondent burden

The primary goal of the conversion was that we should not increase the interview length by administering the PM and Bio section using CAI and entering the data at the time of the interview. We needed the design of the section to enable interviewers to administer the section as efficiently as possible and simplify the process where we were able.

3.2 Maintain data continuity

HRS is a longitudinal study so it was essential to maintain data continuity. We could not make any changes which could affect the time series data for respondents or the data structure. The variable names had to remain the same and any additional variables had to be kept to a minimum.

3.3 Single mode for in-person data collection

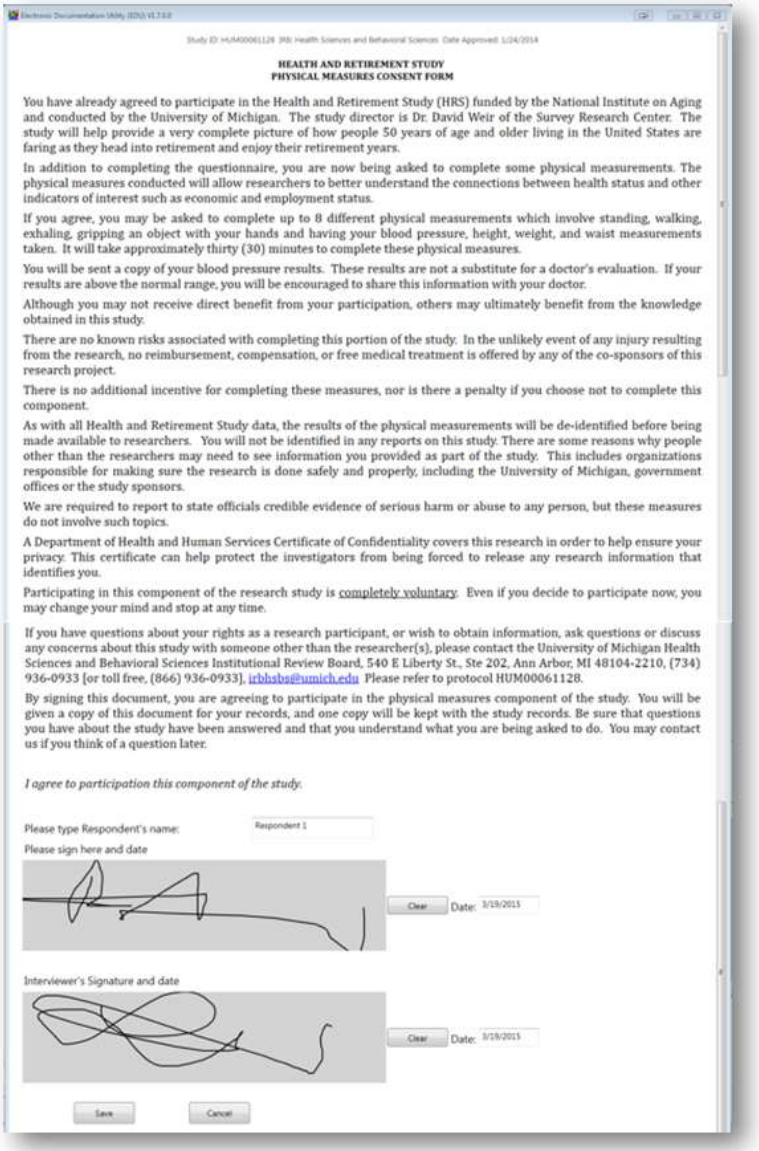
One of the major aims of the conversion was to move all data collection into one mode. Administering the PM and Bio markers in a single mode would save time and money across the survey process. Savings would be realized through a reduction in printing costs, paper handling, post data entry, eliminating the time required by interviewers to prepare mailing the booklets, no postage costs, no booklets to log on arrival at the central office, reduction in storage space required for paper materials and a reduction in the number of cases requiring reconciliation between paper booklet and Respondent.

3.4 Electronic consent administration

Converting the PM and Bio section also provided the opportunity to transition to electronic consent. This would provide the same cost savings around paper handling and reconciliation resulting from moving from the paper booklets. Electronic consent forms would also further improve adherence to protocol and ensure that signed consent was obtained prior to beginning the measurements. One requirement in this transition was not to reduce consent to participate in the measures. There were some concerns that respondents would be concerned about the electronic signatures.

Additionally, a new application of capturing the electronic consent from respondents was created. This application is a standalone C# program that is called via Alien procedure. The procedure then uses Manipula to call the consent applications executable and import information needed (such as the name of the consent file to use, the name to save the sign consent as, etc). Figure 1 below shows an example of the consent form that is administered on the laptop.

Figure 1: Electronic Informed Consent Form



HEALTH AND RETIREMENT STUDY
PHYSICAL MEASURES CONSENT FORM

You have already agreed to participate in the Health and Retirement Study (HRS) funded by the National Institute on Aging and conducted by the University of Michigan. The study director is Dr. David Weir of the Survey Research Center. The study will help provide a very complete picture of how people 50 years of age and older living in the United States are faring as they head into retirement and enjoy their retirement years.

In addition to completing the questionnaire, you are now being asked to complete some physical measurements. The physical measures conducted will allow researchers to better understand the connections between health status and other indicators of interest such as economic and employment status.

If you agree, you may be asked to complete up to 8 different physical measurements which involve standing, walking, exhaling, gripping an object with your hands and having your blood pressure, height, weight, and waist measurements taken. It will take approximately thirty (30) minutes to complete these physical measures.

You will be sent a copy of your blood pressure results. These results are not a substitute for a doctor's evaluation. If your results are above the normal range, you will be encouraged to share this information with your doctor.

Although you may not receive direct benefit from your participation, others may ultimately benefit from the knowledge obtained in this study.

There are no known risks associated with completing this portion of the study. In the unlikely event of any injury resulting from the research, no reimbursement, compensation, or free medical treatment is offered by any of the co-sponsors of this research project.

There is no additional incentive for completing these measures, nor is there a penalty if you choose not to complete this component.

As with all Health and Retirement Study data, the results of the physical measurements will be de-identified before being made available to researchers. You will not be identified in any reports on this study. There are some reasons why people other than the researchers may need to see information you provided as part of the study. This includes organizations responsible for making sure the research is done safely and properly, including the University of Michigan, government offices or the study sponsors.

We are required to report to state officials credible evidence of serious harm or abuse to any person, but these measures do not involve such topics.

A Department of Health and Human Services Certificate of Confidentiality covers this research in order to help ensure your privacy. This certificate can help protect the investigators from being forced to release any research information that identifies you.

Participating in this component of the research study is completely voluntary. Even if you decide to participate now, you may change your mind and stop at any time.

If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher(s), please contact the University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board, 540 E Liberty St., Ste 202, Ann Arbor, MI 48104-2210, (734) 936-0933 [or toll free, (866) 936-0933], irbhsbs@umich.edu Please refer to protocol HUM00061128.

By signing this document, you are agreeing to participate in the physical measures component of the study. You will be given a copy of this document for your records, and one copy will be kept with the study records. Be sure that questions you have about the study have been answered and that you understand what you are being asked to do. You may contact us if you think of a question later.

I agree to participation this component of the study.

Please type Respondent's name: Respondent 1

Please sign here and date

Clear Date: 3/19/2015

Interviewer's Signature and date

Clear Date: 3/19/2015

Save Cancel

Once the consent form is saved in the application, the program saves the signed consent form as a PDF file and writes information about the form to a text file. A secondary Alien procedure is called by Blaise to read this consent information back into the Blaise instrument. This allows the Blaise instrument to know if it is okay to continue administering the current physical measure or bio marker collection.

3.5 Minimize reliance on interviewer decision making

Using paper booklets meant that interviewers had to make decisions or handle routing throughout the PM and Bio administration. Obviously, in CAI the routing, range checks, consistency checks, signals and hard checks could all be handled by the Blaise questionnaire and interviewers would be prompted to take action as necessary. Alleviating the burden and reliance on interviewers is particularly important in the PM and Bio section as they have numerous tasks to perform and it is essential that study protocol are followed. One example of a study protocol which relied on an interviewer taking appropriate action is identifying Respondents with high blood pressure. Interviewers are required to provide a card to the Respondent which recommends that they see a physician if their blood pressure is above a certain level. Further action is necessary if their Blood Pressure is at the level of a possible Hypertensive Crisis, in this situation the interviewer must alert the Respondent and ask if they feel they are able to proceed with the interview. CAI provided the opportunity to provide the alert to the interviewer which reduces the risk of an interviewer not following these critical protocol.

Administering the PM and Bio section using CAI also eliminates the need for interviewers to decide if the Respondent is eligible for certain tests. Again, this allows them to concentrate on following the correct protocol and reduces the risk of administering inappropriate measures. One particularly complicated decision point is the hand strength test where there are four potential paths through the measure depending on the respondents dominate hand or if they have any issue which restricts their use of one hand.

3.6 Data entry at the interview location

Moving data entry from a post interview process to happen within a Respondents home provides an opportunity to resolve any error checks which may be triggered in consultation with the Respondent.

4. Solution and challenges

In the next section of the paper we will describe the design of the CAI PM and Bio section and the challenges we faced during the conversion process.

4.1 User interface

We decided to keep the format of each measure very similar to the structure of the paper booklet. Each section started with a reminder to interviewers about what equipment was needed to administer the section, followed by an introduction or description of the measure to be read aloud by the interviewer, a demonstration, safety/eligibility questions, a setup checklist, the measurement and then post measurement observations. This provided a consistent structure for each measure and some familiarity for experienced interviewers who had used the paper booklets. Using a consistent structure, we hoped, would also contribute to the process being as efficient as possible.

In the CAI version we were also able to provide an on screen cue to indicate where the interview is in the administration process.

A simple header to indicate progress was added to the top of each screen:

Intro – Demo – Safety – Setup – Measure-- Obs

Bolded text indicated where the interview is in the process:

Intro – Demo – **Safety (① of ②)** – Setup – Measure-- Obs

Figures 2 and 3 below provide examples of how this appeared on screen. Throughout the section, we presented headers indicating the current measurement which was also a progress indicator for the interviewer.

Figure 2: Example of Header in the Blood Pressure Measurement

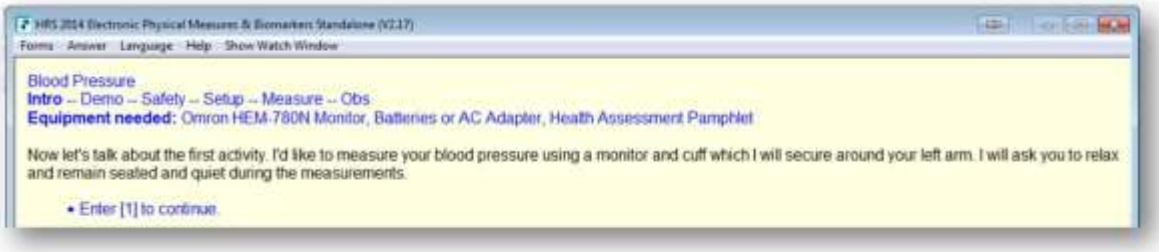
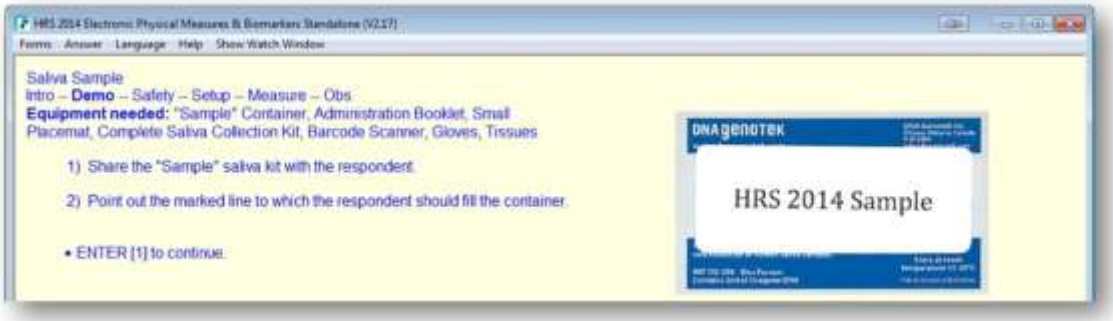


Figure 3: Example of Header and Instructions in the Saliva Sample Collection



4.2 Single mode for data entry and administration

One challenge we faced was to meet the goal of designing a PM and Bio section which could be administered in a single mode. The physical logistics of administering this section was a challenge, particularly for the measures where the interviewer has to move away from where they are seated for the interview to conduct specific measures – such as the height, weight and walking speed measures. For these measures we realized that it was impractical for the interviewer to take their laptop with them as they administer them or for the interviewer to return to their laptop to enter data between measures. We decided that the most efficient option was to provide a booklet for the interviewer to administer the height, weight, waist and walking speed. The data from these measures is then entered at the end of the PM and Bio section before proceeding with the interview. We do not require interviewers to return this booklet to the central office, as they do not record any identifiable information on the form they are allowed to recycle the booklet. Data entry for this portion takes a short amount of time, and interviewers are instructed to pass the Respondent a pamphlet which includes more detail about how the data from these measures are used and they can review the blood pressure results, which the interviewer records in the pamphlet. This also provides a good opportunity for Respondents to take a short break before continuing the interview.

4.3 Use of media

Converting the section to CAI also allowed us to include media – such as videos and photos within the questionnaire both for Respondent and interviewers reference. Photo reminders were placed within the section to remind interviewers of the correct placement of equipment (figure 4). We were able to use videos and photos to demonstrate the measures to Respondents, rather than the interviewer

doing so. Using videos also helped standardize the demos and explanatory introductions provided by interviewers (figure 5). We also used timers – which were videos – to time the correct waiting time between some measures which were repeated multiple times (figure 6). These eliminated the need for interviewers to use a stop watch. The timings were triggered automatically as the data entry for the previous measure was entered, which, again, reduces interviewer burden. The 'stop on key' functionality was disabled which forced the entire video to run before proceeding to the next question.

Figure 4: An Image Used to Aid in the Hand Strength Measurement

Figure 5: Videos to Demonstrate the Walking Speed Measurement

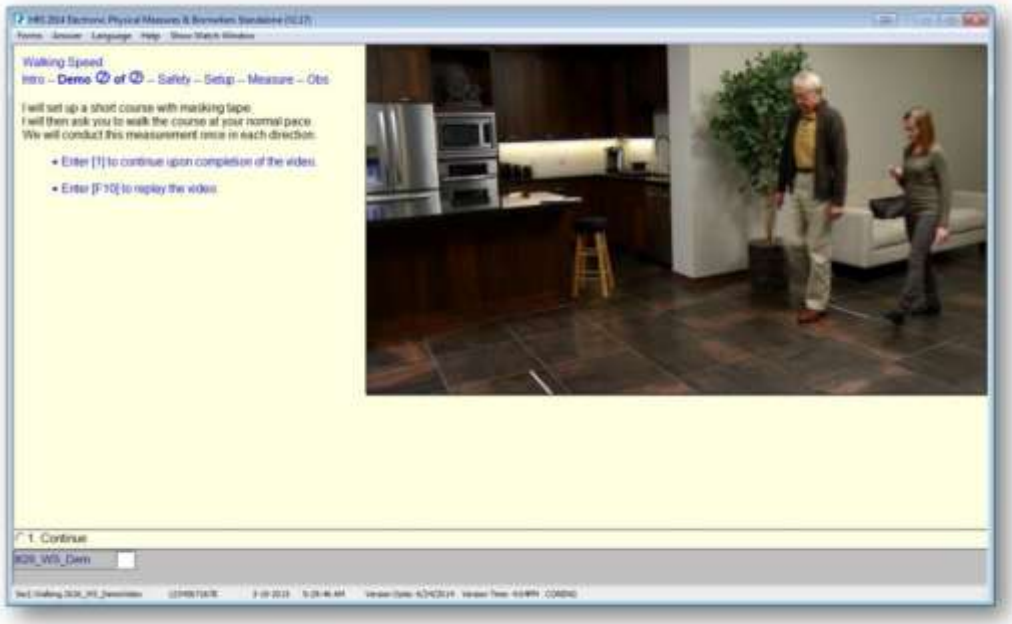
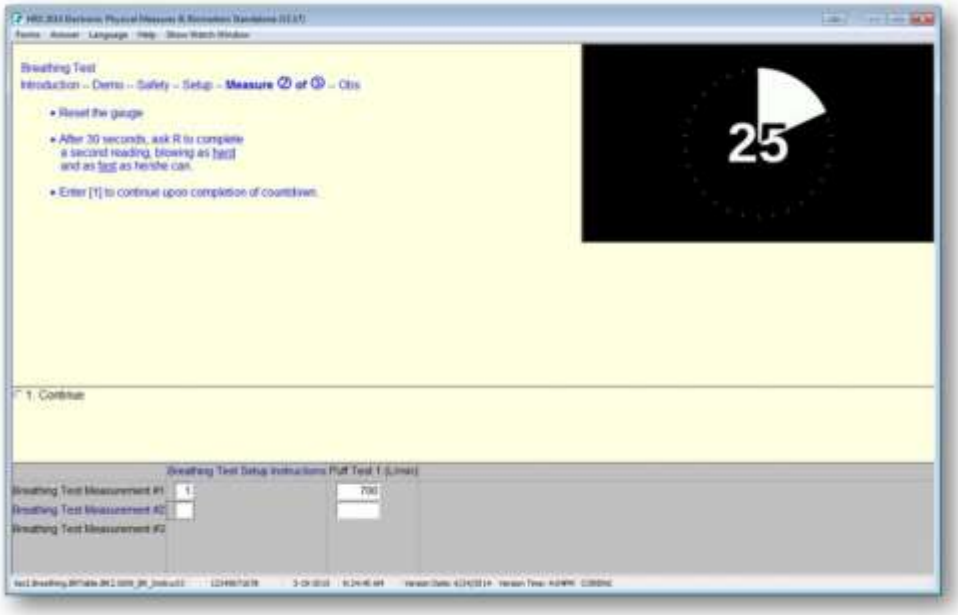


Figure 6: Video Timers to Ensure Proper Wait Time between Measurements



4.4 Reduction in fields requiring data entry

We were also able to take advantage of the capability in CAI to auto fill fields. These included various completion flags and timings.

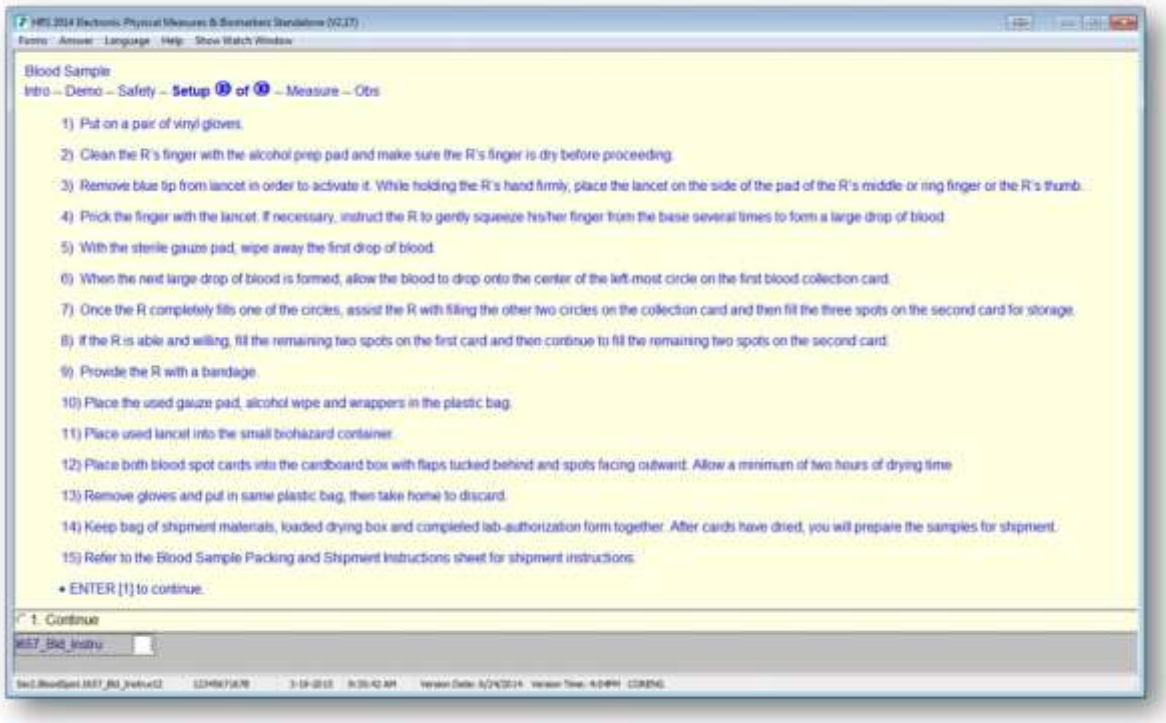
4.5 In production revisions

Although avoided, CAI does allow the flexibility to make in production revisions. Making similar changes using paper booklets would be costly, lead to version control issues and would only be made if absolutely necessary.

4.6 Text formatting and screen layout

The step by step instructions provided to interviewers for some measures are extensive, ranging from around eight to 20 steps (an example is provided in figure 7 below). For those measures with more steps it was necessary to split the instructions across multiple screens, they could not be split arbitrarily so some time had to be spent deciding how to group the steps.

Figure 7: Blood Sample Instructions



4.7 Allow out of sequence completion

From experience administering the PM and Bio section, we knew that it was sometimes necessary to administer some measures, particularly the Bio samples out of sequence so it was necessary to allow for this in the CAI version. For example, some Respondents are unable to provide the saliva sample in the time allowed. In this situation, the interviewers could delay entering details of the saliva sample until later in the section. This was accomplished by programming the saliva questions within a procedure where the questions were presented as auxiliary fields and then saved back to their original location when Blaise comes out of the procedure. Similar flexibility had to be provided to handle a situation where the interviewer was unable to use the bar code scanner to input a serial number. In this situation we had to allow manual entry (although this was discouraged, unless absolutely necessary). Figure 8 and 9 below, provides screenshots of the relevant screens).

Figure 8: Option to Manually Enter Barcodes

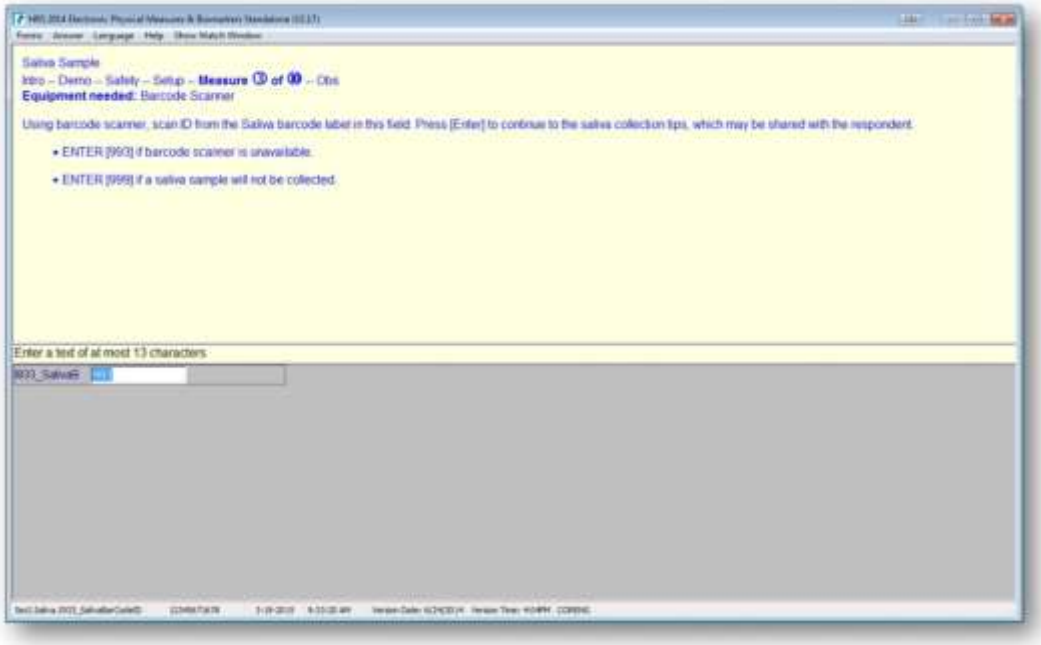
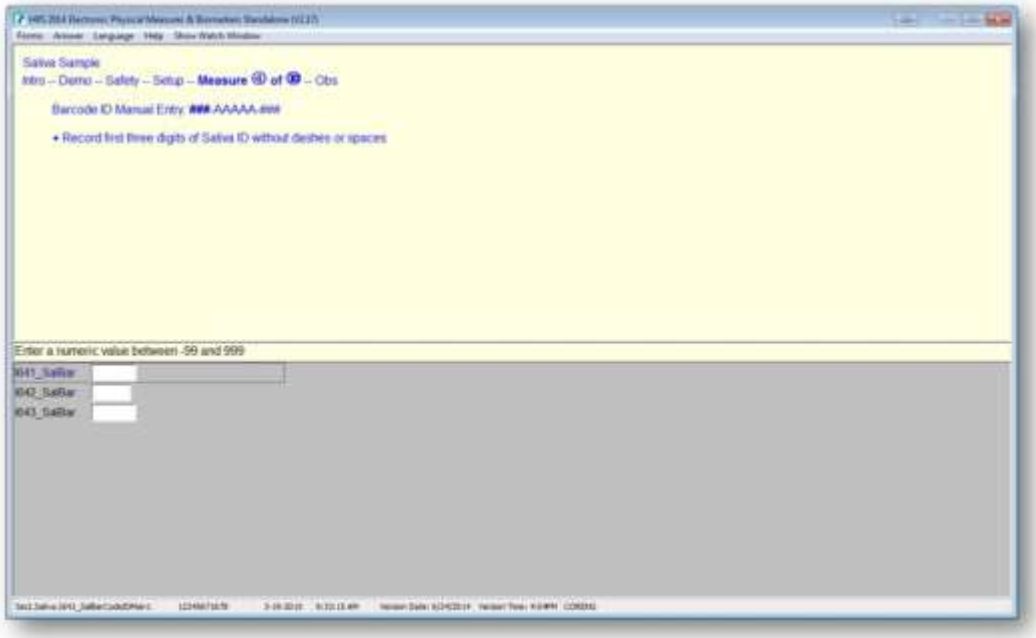


Figure 9: Three Follow Screens to Capture Manual Barcode Entry



4.8 Interviewer acceptance

One of the major considerations throughout the conversion process was to design a tool which interviewers liked to use. This meant that the design had to be good – the version we launched had to be well thought out and with minimal 'loose ends'. We involved interviewers by collecting feedback throughout the conversion process and referred back to feedback provided on previous occasions when the idea of converting to CAI was considered. The conversion process was an iterative testing process which started prior to the 2012 data collection when we carried out a small pilot of a first CAI version of the section. This test involved a small number of interviewers and the section included

some of the functionality, such as video timers and photos which were included in the final version, but with some refinements based on interviewer feedback.

5. Outcome

Overall, the launch of the new CAI version of the PM and Bio section has been successful. Many of the goals have been met and we have gained efficiencies through administering the section using CAI – these are discussed in further detail in this section of the paper.

5.1 Interviewer feedback

Prior to the interviewer training at the beginning of the 2014 wave, we had anticipated that the experienced interviewers may be skeptical about moving from the paper booklet to CAI. Around 40 per cent of approximately 200 HRS interviewers HRS interviewers involved in the 2014 data collection had experience using the paper booklet. We were pleased, however, that experienced interviewers accepted the move to CAI and during training, some interviewers expressed a preference to administration using CAI rather than the paper booklets.

We found that training the experienced interviewers was more about training them how to adapt to the CAI administration and feel comfortable with the tool. For example, we needed to remind interviewers not to jump ahead of the steps displayed on each screen but to move on to the next screen once they had completed the last step on the screen.

Even after training and part way through the data collection, a few interviewers still felt that administering the section using a laptop created a barrier between them and the Respondent in what was a section they could have a break from the laptop and be more engaged with the Respondent.

Overall interviewers became more comfortable during the data collection wave – data collected from interviewers showed that they were more positive about the section after the first few months of data collection. The following are a selection of feedback from interviewers:

Pros…
Also, feel that Respondents are more engaged in electronic administration. Writing results in booklet felt somewhat like a judgment or diagnosis.

[in the Blood Pressure section] *Rs liked seeing the timer; Rs asked to see computer screen and wanted to see the demonstration images. Rs interested in seeing the screen. More screen-sharing.*

Four of my Respondents commented on transition. "Must be saving the trees"

Felt like it went more quickly;

I love the opportunity to lessen the chance for error. No chance for transcription error. Also, psychologically less draining as there are fewer post-interview tasks to complete.

The flow just seems to work smoothly on the computer. Easier to just enter the data into the computer once instead of recording it on paper then having to transfer it to the computer later.

Cons…
The Interviewer is locked into the screen and not engaged with the Respondent and doesn't let the Interviewer be untethered from the laptop.

5.2 Consent improvements

During the 2014 wave the consent rates for the physical measures, blood and saliva samples have been consistently higher than previous waves. We also made some changes to the training for 2014, which may also have influenced this increase, but we are confident that at least some of this improvement is due to the conversion of the consent forms from paper to electronic administration. Interviewers have provided feedback that the electronic form is less intimidating to Respondents than a paper form.

5.3 Interview length

The primary goal of the conversion was not to increase interview length. The timings data suggests that administering the section using CAI has not lengthened the time spent on this section with the respondent and has reduced the overall time required to administer and enter the data for this section.

5.4 Streamline reconciliation

The time spent on reconciliation has been greatly reduced both for the paper booklets and the consent forms.

6. Further development

We will use feedback from interviewers to further improve the design of the PM and Bio section as we prepare for the next wave of data collection which will begin in 2016. Along with specific issues mentioned by interviewers, we aim to eliminate the need for an administration booklet for the four measures which remain on paper.

We may also consider reviewing and adding some touchscreen aspects similar to those used by Dinkelmann and colleagues (2015) to aid the administration of some of particular areas of the PM and Bio section. Additionally, employing this touchscreen approach could potentially allow the interviewers to the do the entire section on the computer. We may also explore using native camera as the barcode scanner or adding checks to ensure they are using their barcode scanner.

7. References

Dinkelmann, K., Guyer, H., & Gatward, R. (2015). *Prototyping Touchscreen Blaise Applications.* The Sixteenth International Blaise Users Conference (IBUC), Beijing, China.