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MEMORANDUM FOR   Jason Fields
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From: Ruth Ann Killion
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Subject: Evaluation of the Impact of Computer Audio-Recorded
                             Interviewing (CARI) on 2013 Survey of Income and Program
                             Participation Event History Calendar (SIPP-EHC) Response Rates
                             and Quality Measures

The Evaluation of the Impact of Computer Audio Recorded Interviewing (CARI) on the 2013 Survey of Income and Program Participation Event History Calendar (SIPP-EHC) Response Rates and Quality Measures is attached. Questions and comments may be directed by phone or email to Rachel Bray at (301) 763-2631.

Attachment:

Evaluation of the Impact of CARI on 2013 SIPP-EHC Response Rates and Quality Measures

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Evaluation of the Impact of Computer Audio-Recorded Interviewing (CARI) on the 2013 Survey of Income and Program Participation Event History Calendar (SIPP-EHC) Response Rates and Quality Measures

I. Executive Summary

The use of Computer Audio Recorded Interviewing (CARI) as a tool for monitoring interviewers has been shown to be feasible through several Census tests. However, the effects of CARI on data quality remain unclear. The 2013 SIPP-EHC test consists of both Wave 3 interviews of respondents selected in the 2011 panel of the SIPP-EHC test and Wave 2 interviews of respondents selected for the 2012 CARI SIPP-EHC test. All respondents in the 2013 test were asked the consent question, and those that agreed were recorded.

The SIPP-EHC tests took place in low-income areas only, for a subset of states. As such, all measures and comparisons are unweighted and should not be used to make inferences about introducing CARI into surveys of the general U.S. household population. The 2013 SIPP-EHC evaluation of the impact of CARI yielded the following major findings:

1. Wave 2 of the 2013 test, which consists of respondents who had undergone two waves of data collection with CARI, has significantly higher refusal, noninterview eligible, and person Type Z rates than the 2012 SIPP-EHC test, which consists of respondents who had undergone two waves of data collection without CARI.

2. The introduction of CARI to respondents who have already participated in the survey without the CARI component may have a detrimental impact on data quality. The panel of respondents selected in the 2011 test was first introduced to CARI in their third wave of data collection in 2013. This panel had a large decrease in response rate from 73.14 percent in 2012 to 64.98 percent in 2013.

3. There is very little evidence that the continuation of CARI into a second wave of data collection results in decreased data quality. Response rates did not significantly change between the 2012 CARI test and Wave 2 of the 2013 test. There was a significant increase seen in the person proxy rate from 31.61 percent to 34.82 percent, though it is unclear how this increase would be related to CARI.

4. The CARI cooperation rates all experienced a significant decrease from 41-43 percent in 2012 to 31-33 percent in 2013. Experienced interviewers continued to have lower CARI cooperation rates than inexperienced interviewers, and a larger proportion of interviewers were experienced in 2013 than in 2012.

5. There were substantial interviewer effects associated with CARI cooperation. Household, person, and person asked CARI cooperation rates were associated with

interviewer effects ranging from 0.434 to 0.487. This means that the interviewer alone may explain over forty percent of the variation in CARI cooperation. This may be due to differences in interviewer workloads (i.e. some interviewers may have assignments that are disproportionately difficult to gain consent from) or differences in how interviewers are following procedures.

6. There are significant differences in the odds of CARI consent propensity by respondent, household, geographic, and interviewer characteristics. Persons not born in the U.S. and those of Hispanic ethnicity are less likely to provide consent to be recorded by CARI. Households and persons living outside of cities are more likely to provide consent to be recorded then persons living in cities. Households in neighborhoods where the interviewer observed poorly tended yards or evidence of illegal activity were less likely to provide consent to be recorded; however households with self reported poor housing conditions such as pest problems or cracks in the walls were more likely to consent to be recorded.

II. Background

A. CARI Application

CARI is a laptop software application, developed by the Research Triangle Institute (RTI) that is integrated into computer assisted survey instruments. With the respondent's consent, CARI seamlessly records the verbal exchange between the interviewer and the respondent without disrupting the normal interview process. Quality assurance monitors can evaluate the likelihood that the exchange between the interviewer and the respondent is authentic by reviewing portions of the recorded interview (Arceneaux, 2007). CARI can also be used to determine whether interviewers are recording and coding responses correctly (Thissen et. al., 2008). The integration of CARI in to a quality assurance program could assist in detecting and deterring interviewer fabrication, and by serving as a tool for evaluating interviewer performance. CARI has the capability to reduce the need for field observations and verifications and thus has the potential of lowering costs.

The capability of CARI technology has been shown in previous tests conducted by the U.S. Census Bureau including the 2006 Health and Wellness Study Field test, the 2010 American Community Survey Content test, and the 2012 CARI SIPP-EHC test.

B. Re-engineering SIPP

Several tests have been conducted to assess the data quality difference between the event history calendar (EHC) and traditional SIPP data collection methods. The 2011 SIPP-EHC test and 2012 CARI SIPP-EHC test were both Wave 1 data collections in which respondents were contacted to complete a SIPP-EHC interview for the first time. The

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2011 test consisted of a sample of approximately 4,000 addresses across twenty states, while the 2012 CARI test consisted of a sample of approximately 1,300 addresses across ten states.

The 2012 CARI test allowed for portions of the respondent's interview to be recorded upon their consent. The CARI consent question was asked each time the interviewer entered the instrument, and each time the interviewer spoke with a new respondent. If the respondent agreed to be recorded, the CARI application was executed and a specific set of questions was automatically recorded. The interview proceeded as normal without recording if the respondent did not provide consent. For proxy interviews, the respondent was not asked the consent question if the respondent had already answered the consent question earlier in the interview. The interviewer turned off the recording if the respondent changed their mind and decided to not be recorded during the interview, or if a respondent left the interview and a proxy respondent continued the interview.

The 2012 SIPP-EHC test was administered using a Wave 2 instrument and consisted of respondents from the 2011 test. Interviewers conducting the 2012 test also conducted interviews for the 2012 CARI test. The 2012 test and 2012 CARI test were conducted at the same time, and interviewers were aware of which cases contained the CARI component. The 2012 and 2012 CARI tests were conducted in low income areas (and in a subset of states), and as such, the tests are not representative of the U.S. population.

Results from the 2012 CARI test suggested that CARI may have an impact on data quality. The 2012 CARI test had a national household response rate of 68.85 percent, which is significantly lower than the response rates from the 2011 test (85.37 percent) and the 2012 test (79.70 percent). Confounding factors such as wave, year of data collection, and workload prioritization between the 2012 tests may account for some of the differences in quality measures between the 2012 CARI test and the 2011-2012 tests.

The household and person CARI cooperation rates from the 2012 CARI test were between 41 and 44 percent. The 2012 CARI test also found that that in most households all respondents either agreed or did not agree to be recorded for the entire interview. See Sirkis (2013) for additional information about the 2012 CARI SIPP-EHC test.

III. Methodology

A. CARI SIPP-EHC Survey Design

The 2012 CARI SIPP-EHC and 2012 SIPP-EHC interviews were combined to form the 2013 SIPP-EHC test. The 2013 test consists of both Wave 2 and Wave 3 interviews. Originally, the design was to only ask a sample of Wave 2 and Wave 3 cases the consent question, and utilize the CARI application to record those that consented. Ultimately, the consent question came on path for all cases, and the CARI application was utilized in the

same manner as in the 2012 CARI test. Table 1 provides an overview of the design of the 2011-2013 SIPP-EHC panels.

Table 1. Overview of the SIPP-EHC Tests, 2011-2013

		Year		
		2011	2012	2013
Panel	Households selected for the 2011 test	**Wave 1** No CARI	**Wave 2** No CARI	**Wave 3** All CARI
	Households selected for the 2012 CARI test	----	**Wave 1** All CARI	**Wave 2** All CARI

B. Response Rates and Other Data Quality Indicators

Response rates and other data quality indicators are calculated for the 2013 test at the national level and by wave. All data quality indicators are unweighted. Returning and new household members are included in the quality indicators, while household members who moved out of the household in a prior interview are excluded. The SIPP-EHC requires that a proxy respondent complete the interview for a household member less than 15 years old. Therefore, proxy rates are calculated for eligible respondents 15 years or older. The data quality indicators consist of both household (HH) and person rates and are defined below.

Notation: I= interviews, P=partial interviews, A = noninterview eligible hh, M= movers,
T=telephone interviews, PV=personal visit interviews, Self=self interviews,
and Proxy= proxy interviews.

$$HH\ Response\ Rate = \frac{I + P}{I + P + A + M} \times 100$$

$$Noninterview\ Eligible\ HH\ Rate = \frac{A}{I + P + A + M} \times 100$$

$$HH\ Refusal\ Rate = \frac{Refusals}{I + P + A + M} \times 100$$

$$Telephone\ HH\ Rate = \frac{T}{T + PV\ (Including\ I, P, A)} \times 100$$

$$Personal\ Visit\ HH\ Rate = \frac{PV}{T + PV\ (Including\ I, P, A)} \times 100$$

$$Person\ Type\ Z\ Noninterview\ Rate = \frac{Person\ Noninterviews}{Eligible\ Persons\ Age\ 15 +} \times 100$$

$$Person\ Proxy\ Rate = \frac{Proxy}{Self + Proxy\ (Including\ Eligible\ Persons\ Age\ 15+)} \times 100$$

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Unless otherwise stated, all comparisons are conducted using difference of proportions tests, assuming unequal variances, at the 90 percent confidence level. Since all respondents in the 2013 test were asked the consent question, there is no direct comparison for which all confounding factors such as panel, wave, and year of data collection are controlled. However, tests of the differences between the 2013 quality indicators and indicators from the 2012 and 2012 CARI test may still be informative. Significance testing is not being conducted to infer to a population beyond the low-income areas included in each of the SIPP-EHC tests, and significant differences may be the result of the confounding factors mentioned above.

A comparison of data quality measures between Wave 3 of the 2013 test and the 2012 test shows the impact of adding CARI to interviews of households that had previously conducted two waves of data collection without CARI. Tests of the difference in quality measures between Wave 2 of the 2013 test and the 2012 CARI test show the impact of continuing CARI through a second wave of data collection. Both of these comparisons control for panel but not wave or year of data collection. A third comparison of quality measures from Wave 2 of the 2013 test and those from the 2012 test shows the impact of CARI while controlling for wave, though there may be confounding from panel and year. Each of these comparisons is limited to the SIPP-EHC sample of high poverty areas, and the results may not speak to the impact of CARI in surveys of all U.S. households.

For this evaluation, an interviewer is considered experienced if they had previously conducted a SIPP-EHC interview during any SIPP-EHC test from 2010 through 2012. Comparisons of the quality measures between experienced and inexperienced interviewers will determine the 2013 measures differ by interviewer experience level.

C. Cooperation Measures

Results from the 2012 CARI SIPP EHC test suggest that low CARI cooperation rates may be a concern (Sirkis, 2013). If respondents are not consenting to be recorded then recordings will not be available to verify the authenticity of interviews. CARI cooperation measures are calculated at the national, wave, and interviewer experience levels to determine if respondents were receptive to the use of CARI in the SIPP-EHC instrument. The cooperation measures are not weighted. A respondent is considered as having provided consent for the cooperation measures upon agreement to be recorded for the entire interview and never altering their response. For the cooperation measures, respondents who provided a no response to the consent question at any point in the interview are considered as not consenting. The household (HH) and person level cooperation rates are defined below.

$$\text{Person Asked Cooperation Rate} = \frac{\begin{array}{c}\text{Number of persons who were asked}\\\text{the consent question and agreed to}\\\text{be recorded for the entire interview}\end{array}}{\begin{array}{c}\text{Number of persons}\\\text{asked consent question}\end{array}} \times 100$$

$$\text{Person Cooperation Rate} = \frac{\begin{array}{c}\text{Number of persons who agreed}\\\text{to be recorded for the}\\\text{entire interview}\end{array}}{\begin{array}{c}\text{Number of complete and proxy}\\\text{interviews}\end{array}} \times 100$$

$$\text{Full CARI HH Cooperation Rate} = \frac{\begin{array}{c}\text{Number of HH where all}\\\text{respondents agreed to be recorded}\\\text{for the entire interview}\end{array}}{\begin{array}{c}\text{Number of HH asked}\\\text{consent question}\end{array}} \times 100$$

$$\text{Partial CARI HH Cooperation Rate} = \frac{\begin{array}{c}\text{Number of HH where some}\\\text{respondents agreed to be}\\\text{recorded for}\\\text{the entire interview}\end{array}}{\begin{array}{c}\text{Number of HH}\\\text{asked consent question}\end{array}} \times 100$$

$$\text{Full CARI Refusal HH Rate} = \frac{\begin{array}{c}\text{Number of HH where all}\\\text{respondents did not agree to be}\\\text{recorded for the entire interview}\end{array}}{\begin{array}{c}\text{Number of HH}\\\text{asked consent question}\end{array}} \times 100$$

$$\text{HH Respondent Cooperation Rate} = \frac{\begin{array}{c}\text{Number of HH respondents who}\\\text{agreed to be recorded for the}\\\text{entire interview}\end{array}}{\begin{array}{c}\text{Number of HH respondents}\\\text{asked consent question}\end{array}} \times 100$$

Cooperation measures were also calculated at the interviewer level in order to determine whether interviewers had an impact on whether the respondents agreed or did not agree to be recorded during the interview. Interviewers with low CARI cooperation rates may not be administering the CARI question properly. Thissen et. al. (2008) suggests that a high CARI refusal rate may be an indicator of falsification, although some of the variation in CARI cooperation rates between interviewers may be attributable to differences in workload (see the consent propensity modeling).

A two-way analysis of variance (ANOVA) with interviewers nested within states is used to explore geographic and interviewer effects on CARI cooperation. The proportion of the variance attributable to the states and to interviewers within states are indicative of the geographic and interviewer effects respectively. An ANOVA with interviewer effects alone is fit first, and then an ANOVA with interviewer and state effects is fit. The model is subset to include only interviewers with four or more cases and states with four or more interviewers meeting the inclusion criteria.

D. CARI Consent Propensity Models

Consent propensity is the likelihood that a person or household will consent to be recorded by the CARI application. Identifying and understanding characteristics of respondents who are more and less likely to provide consent is key in considering how to implement CARI in future survey programs. For example, a high CARI refusal rate may be less alarming for an interviewer whose workload is disproportionately concentrated in

regions and demographic groups that are less likely to consent to being recorded due to privacy concerns. Huang et. al (2007) found that privacy concerns led to differential record linkage consent rates by age, socioeconomic status, gender, health status, and ethnicity. Persons with privacy concerns about record linkage may also have concerns about their interview being recorded by CARI, and thus these demographic factors will be considered for inclusion in the models.

Logistic regression modeling at the person and household levels is used to explore whether person, household, and interviewer characteristics can explain variation in CARI consent propensity. The models are not weighted. Sirkis (2013) found that education (less than a high school diploma or GED), having a regular non-interest earning checking account, interviewer experience level, and having an interview in a language other than English had the largest effects in the propensity models for the 2012 CARI test. The statistical models take the general form given in Equation 1.

<u>Equation 1: Logistic Regression Model</u>
$$logit(p_i) = \log\left(\frac{p_i}{1 - p_i}\right) = \alpha + \beta_1 x_1 + \cdots \beta_k x_k + \varepsilon$$

Where p_i is the consent propensity of the ith person and $(x_1 \ldots x_k)$ is the vector of covariates.

The dependent variable is the log odds of the response propensity for either the person or the household. The independent variables consist of respondent, household, and interviewer characteristics. Respondent characteristics include sex, race, age, and education level. Household characteristics considered for the models include tenure, household size, and housing unit conditions. Interviewer experience level is also considered for inclusion in the models, as are geographic factors such as regional office and urbanicity.

The models only include respondents that were asked the consent question; proxy interviews are excluded from the models. Due to small sample sizes, interaction effects were not considered in the potential statistical models. Issues relating to sample size, missing values, and colinearity among independent factors were taken into account when choosing an appropriate model. Forward, backward, and stepwise selection procedures were all used in fitting the models.

Odds ratios are reported for the final person and household consent propensity models. Odds ratios allow one to comment on the strength of association between each of the characteristics and consent propensity, while controlling for other covariates in the model. The odds ratios are reported with their 90 percent confidence intervals.

IV. Findings

A. Response Rates and Other Data Quality Indicators

Table 1 contains basic counts and measures for each of the SIPP-EHC tests and for the 2013 test overall and by wave. One advantage of the 2013 CARI SIPP EHC test is the larger sample size resulting from including households from both the 2012 CARI SIPP EHC test and the 2012 SIPP EHC test.

Table 1. 2012-2013 SIPP-EHC Interviews and Noninterviews by Year, Test, and Wave

Description	2013			2012	
	Overall	Wave 2	Wave 3	CARI SIPP-EHC	SIPP-EHC[1]
Total Number Households	4,203	859	3,344	1,321	3,416
Interviewed Households	2,246	524	1,722	725	1,950
Type A Noninterviews	765	161	604	328	468
Refusals	517	97	420	164	234
Type B Noninterviews	30	2	28	189	30
Type C Noninterviews	780	114	666	79	720
Type D Noninterviews	382	58	324	0	248
Total number person interviews	6,115	1,431	4,684	2,044	5,380
Type Z Noninterviews	603	128	475	193	389
Proxy Interviews	1,632	383	1,249	483	1,525
Respondents Age 15 and older	4,748	1,100	3,648	1,528	4,150

Table 2 contains household and person level data quality indicators for the 2013 test, both overall and by wave. All of the rates in Table 2 are given in percentages. Measures from the 2012 and 2012 CARI tests are given for reference.

Table 2: Data Quality Indicators (%)

Description	2012		2013		
	CARI SIPP-EHC	SIPP-EHC[2]	Overall	Wave 2	Wave 3
Response Rate	68.85	73.14	66.20	70.53	64.98
Noninterview Eligible Household Rate	31.15	17.55	22.55	21.67	22.79
Refusal Rate	15.57	8.78	15.24	13.06	15.85
Telephone Rate	13.90	23.61	29.21	25.78	30.26
Personal Visit Rate	86.10	76.39	70.79	74.22	69.74
Person Type Z Noninterview Rate	12.63	9.37	12.7	11.64	13.02
Person Proxy Rate	31.61	36.75	34.37	34.82	34.24

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[1] The 2012 SIPP-EHC results are not limited to the states in which the 2012 CARI test was conducted, and thus differ from results in Sirkis (2013).

[2] The 2012 SIPP-EHC results are not limited to the states in which the 2012 CARI test was conducted, and thus differ from results in Sirkis (2013).

Comparisons of data quality indicators from the 2012 test and Wave 2 of the 2013 test control for differences in wave but not panel or year. Wave 2 of the 2013 test consists of respondents who have only seen the SIPP-EHC with the CARI component, while respondents in the 2012 test had been through two waves of data collection without CARI. There are no significant differences in the response, personal visit, and person proxy rates between Wave 2 of the 2013 test and the 2012 test. The refusal rate, noninterview eligible rate, and person type Z rate are significantly higher in Wave 2 of the 2013 test when compared with the 2012 test.

Comparisons of Wave 2 and Wave 3 control for year and whether the data was collected in Wave 2 or later, though comparisons may be confounded by differences across panels. The noninterview eligible household rate, person proxy rate, and person Type Z rate were not significantly different across waves. The response rate and personal visit rate were significantly higher for Wave 2. The refusal rate and telephone rate were significantly higher for Wave 3.

Comparisons of Wave 2 of the 2013 test and the 2012 CARI test show the impact on data quality from continuing CARI in to a second wave of data collection of the SIPP-EHC. There are no significant differences in the response, refusal, and person Type Z noninterview rates between Wave 2 of the 2013 test and the 2012 CARI test. In Wave 2 of the 2013 test, the noninterview eligible and personal visit rates are significantly lower and the person proxy and telephone rates are significantly higher than the corresponding measures from the 2012 CARI test. The higher telephone rate in Wave 2 of the 2013 test is consistent with earlier findings for SIPP-EHC that later waves typically have higher telephone rates. The only evidence of a decrease in quality from the 2012 CARI test to Wave 2 of the 2013 test is the significant increase in the person proxy rate from 31.61 percent to 34.82 percent, although this is accompanied by a decrease in the household noninterview eligible rate from 31.15 percent to 21.67 percent.

Tests of differences in quality measures between Wave 3 of the 2013 test and the 2012 test are indicative of the impact on data quality resulting from introducing CARI in a later wave of SIPP-EHC data collection to a panel of respondents that had not previously been exposed to CARI. The personal visit rate, person proxy rate, and response rate are lower in Wave 3 of the 2013 test when compared with the 2012 test. The refusal rate, noninterview eligible household rate, and person Type Z rate are higher in Wave 3 of the 2013 test when compared with the 2012 test. The higher personal visit rate in the 2012 test is consistent with the SIPP-EHC finding that personal visit rates are higher in earlier waves. The decrease in the response rate from 73.14 percent in 2012 to 64.98 percent in Wave 3 of the 2013 test is evidence of a decrease in data quality. The higher refusal, noninterview eligible, and person Type Z rates in Wave 3 of the 2013 test also suggest

that the introduction of CARI to respondents who have already participated in the survey without the CARI component may have a detrimental impact on data quality.

In the 2013 CARI SIPP EHC test, approximately 70 percent of the interviewers were experienced, and experienced interviewers conducted over 75 percent of cases. This is an increase from the 2012 CARI test, where less than 40 percent of interviewers were experienced. In 2013, experienced interviewers had a household response rate of 67.88 percent, which is significantly higher than the response rate from inexperienced interviewers of 60.59 percent. The person proxy rate for experienced interviewers of 35.22 percent is significantly higher than the person proxy rate for inexperienced interviewers of 31.92 percent. The person Type Z noninterview rate, household noninterview eligible rate, and household refusal rate do not significantly differ by interviewer experience level.

B. Cooperation Measures

Table 3 contains household respondent, person asked and person cooperation rates from the 2012 and 2013 CARI SIPP-EHC tests at the national and interviewer experience levels. All cooperation rates are unweighted. The person cooperation rates include proxy interviews.

Table 3. CARI Cooperation Rates for the 2012 and 2013 CARI SIPP EHC Tests

	Household Respondent		Person Asked		Person	
	2012	2013	2012	2013	2012	2013
National	41.44	31.45*	41.68	31.86*	43.58	32.13*
Experienced Interviewers	24.29	28.43	25.10	28.68	24.53	28.91*
Inexperienced Interviewers	48.44	42.71*	47.51	43.33	50.62	44.06*

* The 2013 measure is significantly different from the 2012 measure, with p-value < 0.10.

Comparisons of the 2012 and 2013 CARI Cooperation Measures show that cooperation rates at the national level for the household respondent, persons asked the consent question, and all persons (including proxy interviews) were lower in 2013 when compared to rates from 2012. However, this trend did not always hold within experience level categories. Inexperienced interviewers had significantly lower household respondent and person CARI cooperation rates in 2013 when compared with measures from inexperienced interviewers in 2012. However, the difference in experienced interviewers' cooperation rates from 2012 to 2013 were either not significant (household respondent, person asked) or higher in 2013 (person). Overall, in 2013, experienced interviewers continued to have significantly lower cooperation rates than inexperienced interviewers.

Table 4 presents CARI cooperation rates for the 2013 test by wave at the national and interviewer experience level. The household respondent, person asked, and person CARI

cooperation rates are all higher for Wave 3, when compared to the Wave 2 measures. This trend holds regardless of interviewer experience level.

Table 4. CARI Cooperation rates for the 2013 CARI SIPP EHC Test by Wave

	Household Respondent		Person Asked		Person	
	Wave2	Wave 3	Wave2	Wave 3	Wave2	Wave 3
National	23.14	33.97*	23.74	34.45*	24.66	34.54*
Experienced Interviewers	19.55	31.06*	20.50	31.17*	21.97	31.10*
Inexperienced Interviewers	35.29	45.20*	33.90	46.79*	33.80	47.69*

* The Wave 3 measure is significantly different from the Wave 2 measure, with p-value < 0.10.

Table 5 contains household cooperation measures for the 2012 and 2013 tests, by the number of persons asked the consent question within the household. As in 2012, in most households either all members agreed or refused to be recorded in 2013. There was a small percentage of households that had partial CARI cooperation.

Table 5. Household Cooperation Measures by Number of Persons Asked the Consent Question

	Full CARI HH Cooperation Rate		Partial CARI HH Cooperation Rate		CARI HH Refusal Rate	
	2012	2013	2012	2013	2012	2013
All Households	40.61	31.17	--	--	56.35	66.70
One person asked consent	42.36	32.26	--	--	57.64	67.73
More than one person asked consent	36.23	28.87	10.63	6.62	53.14	64.51

An unweighted analysis of variance was used to determine the proportion of the variation in household, person asked, and person cooperation rates attributable to individual interviewers, a correlation that is commonly referred to as an interviewer effect. The criteria that each interviewer is associated with at least four households and each state is associated with four interviewers meeting the first criteria resulted in excluding a little less than ten percent of households and persons from the analysis of interviewer effects.

A substantial amount of the variation in cooperation rates is attributable to the interviewer. The estimated interviewer effect for household respondent cooperation rate is 0.434, meaning that 43.4 percent of the variation in household respondent CARI cooperation rates is attributable to the interviewer. For person asked and person cooperation rates respectively, the estimated interviewer effects are 0.469 and 0.487. Fitting ANOVA models with interviewer effects nested within states resulted in increases of less than 0.003 to the effects, suggesting that interviewers explain more of the variation in cooperation rates than does state-level geography.

C. CARI Consent Propensity Models

Although there are substantial interviewer effects in CARI cooperation, there may be differences in interviewer workloads that are contributing to the effects. For example,

some interviewers may have workload disproportionately concentrated within respondents with privacy concerns, and thus have lower CARI cooperation rates because of their assignments. Logistic regression modeling of CARI consent is used at both the person and household level to determine whether certain kinds of respondents are more or less likely to consent to being recorded.

The covariates used in the person model are given in Table 6. Predictors include respondent characteristics previously found to influence record linkage consent in other surveys, including age, race, sex, and education. There are also geographic predictors considered including a recoded Metropolitan Statistical Area (MSA) status. Interviewer characteristics such as experience level are also considered for inclusion in the model.

Table 6. Covariates Considered for Inclusion in Person Consent Propensity Models

Name	Levels	Description
Recoded Age	3	Less than 18, between 18 and 64, Older than 64
In good Health	2	Generally in good health, not in good health
Disability Status	3	Yes – One or more Disabilities, No Disabilities, Unable to answer one or more disability questions
Born in the U.S.	2	Yes, No
Recoded Education	4	Less than High School, High School Diploma, More than High School, Don't Know/Refuse
Recoded Race	3	Black Alone, White Alone, Other
Hispanic Origin	2	Hispanic, Non-Hispanic
Recoded MSA status	2	City in MSA, MSA Outside City/Non-MSA
Sex	2	Male, Female
Regional Office	6	New York, Philadelphia, Atlanta, Chicago, Denver, Los Angeles
Interviewer Experience	2	Inexperienced, Experienced

A backward elimination procedure retained effects from the person CARI consent model for Hispanic origin, born in the U.S., disability status, recoded MSA status, interviewer experience level, and regional office. The same effects were retained when forward and stepwise selection procedures were used. Odds ratios and their 90 percent confidence intervals for effects remaining in the final person model are given in Table 7.

Table 7. Odds Ratios for Significant Effects in Person Consent Propensity Models

Predictor	Effect	Odds Ratio (90% CI)
Born in the U.S.	Born in the U.S. vs Not Born in the U.S	1.495 (1.217, 1.836)
Hispanic Origin	Non-Hispanic vs Hispanic	1.306 (1.058, 1.612)
Recoded MSA Status	MSA outside city or Non MSA vs. City in MSA	1.656 (1.369, 2.003)
Disability Status	Disability vs No Disability	1.638 (1.348, 1.991)
	DK/Ref to Disability Question vs No Disability	0.616 (0.088, 4.299)

Table 7. Odds Ratios for Significant Effects in Person Consent Propensity Models

Predictor	Effect	Odds Ratio (90% CI)
Interviewer Experience	Inexperienced vs Experienced	2.032 (1.652, 2.5)
Regional Office	New York vs Atlanta	1.444 (1.022, 2.04)
	Philadelphia vs Atlanta	2.278 (1.593, 3.258)
	Chicago vs Atlanta	4.307 (2.908, 6.378)
	Denver vs Atlanta	4.087 (2.899, 5.762)
	Los Angeles vs Atlanta	2.453 (1.76, 3.418)

Several of the effects are in the expected direction, with persons who were born in the U.S. having odds of consenting about 1.5 times that of the odds for persons not born in the U.S. and Non-Hispanic persons having higher odds than Hispanic persons of consenting to be recorded. This is consistent with privacy concerns of persons not born in the U.S. and of persons of Hispanic Origin that were found in the record linkage literature (Huang et. al., 2007). Persons living in rural or suburban areas (those in an MSA but outside of a city) were more likely to consent than persons living in cities. The effect of disability was the in the opposite direction from what was expected from the literature on record linkage, with persons having a disability more likely to consent to be recorded.

There were also significant effects associated with regional office and interviewer experience level. The Atlanta RO was associated with the lowest odds of persons consenting, with persons in other regional office areas having odds of consenting from 1.4 (New York) to 4.3 (Chicago) times the odds of persons consenting in Atlanta. The odds of an inexperienced interviewer gaining respondent consent for CARI are nearly twice the odds of an experienced interviewer.

A second logistic regression model is used to describe characteristics associated with household respondents' propensity to consent. Covariates considered for the household respondent model are given in Table 8. Poor housing unit conditions refer to respondent self-reports of one or more of the following: cracks in the ceiling or walls, holes in the floor, a problem with pests, or plumbing problems. Interviewer observations were used to gather whether there was a neighborhood presence of gangs, prostitutes, or illegal activity (Gangs); well tended yards or gardens (Yards); and bus stop or access to public transportation (Bus Stop).

Table 8. Covariates Considered for Inclusion in Household Respondent Consent Propensity Models

Name	Levels	Description
Tenure	2	Owned, Rented
Housing Unit Conditions	3	One or more poor conditions, No poor conditions, answered don't know or refuse to one or more housing unit conditions
Household Size	4	One person, Two Persons, Three Persons, Four or More Persons
Gangs	2	Gangs in the Neighborhood, No Gangs
Yards	2	Well-tended Yards in the Neighborhood, Not Well-tended Yards
Bus Stop	2	Bus stop, No Bus Stop
Interview Outcome	2	Complete, Sufficient Partial
Recoded MSA status	2	City in MSA, MSA Outside City/Non-MSA
Regional Office	6	New York, Philadelphia, Atlanta, Chicago, Denver, Los Angeles
Interviewer Experience	2	Inexperienced, Experienced

A backward elimination procedure retained nearly all of the effects, with tenure being the only effect eliminated, and forward and stepwise regression yielded the same results. Odds ratios for effects remaining in the final household model are given in table 9.

Table 9. Odds Ratios for Significant Effects in Household Respondent Consent Propensity Models

Predictor	Effect	Odds Ratio (90% CI)
Housing Unit Conditions	No Poor Conditions vs Poor Conditions	0.547 (0.428, 0.698)
	DK/Ref to Condition Questions vs Poor Conditions	0.583 (0.407, 0.836)
Household Size	Two-Person vs Single Person	0.794 (0.611, 1.03)
	Three-Person vs Single Person	0.761 (0.561, 1.034)
	Four or more Persons vs Single Person	0.636 (0.484, 0.837)
Gangs	No Gangs vs Gangs	2.391 (1.624, 3.521)
Yards	Well-Tended Yards versus Not Well-Tended Yards	1.326 (1.083, 1.625)
Bus Stop	Bus Stop vs No Bus Stop	0.685 (0.554, 0.847)
Recoded MSA Status	MSA outside city or Non MSA vs. City in MSA	1.858 (1.488, 2.322)
Interview Outcome	Complete Interview vs Sufficient Partial	1.408 (1.034, 1.916)
Interviewer Experience	Inexperienced vs Experienced	2.239 (1.764, 2.841)
Regional Office	New York vs Atlanta	1.356 (0.925, 1.988)
	Philadelphia vs Atlanta	3.836 (2.549, 5.772)
	Chicago vs Atlanta	8.674 (5.429, 13.861)
	Denver vs Atlanta	4.115 (2.822, 6.001)
	Los Angeles vs Atlanta	2.12 (1.477, 3.042)

Households with one or more poor housing conditions were more likely to consent to the use of CARI. This suggests that respondents who spoke candidly about household conditions such as pests, plumbing, holes in the floor and cracks in the walls were not bothered by the introduction of CARI. Households that had complete interviews were also more likely to consent to CARI. Households with four or more persons had lower odds of consenting than single-person households. Positive neighborhood characteristics such as the presence of well-tended yards and no neighborhood presence of gangs, prostitutes, or illegal activity are associated with higher odds of consenting, although the measurement of these neighborhood attributes is subject to interviewer observation.

Several of the effects from the person consent models carry over to the household respondent consent propensity models. As with the person consent models, household respondents living outside of a city were more likely to consent than those living in a city and inexperienced interviewers were more likely to gain consent than experienced interviewers. The Atlanta RO continued to have some of the lowest odds of respondent consent, though the difference between the New York and Atlanta ROs is not significantly different in the household respondent model. The odds ratio for Chicago versus Atlanta is very large, with household respondents under the Chicago regional office having odds of consent over eight times the odds of consent for household respondents under the Atlanta Regional Office.

There is evidence of a lack of fit in both the person and household respondent models. The maximum adjusted pseudo R-square values were 0.135 for the final person consent model and 0.189 for the final household consent model. This suggests that less than twenty percent of the variation in consent propensity is explained by the final models.

V. Conclusions

This evaluation shows that there are some impacts of the implementation of CARI technology on response rates and data quality indicators from the SIPP-EHC tests conducted in low-income areas. Wave 2 of the 2013 test, which consists of respondents who had undergone two waves of data collection with CARI, has significantly higher refusal, noninterview eligible, and person Type Z rates than the 2012 SIPP-EHC test, which consists of respondents who had undergone two waves of data collection without CARI. Introducing CARI to respondents who had already participated in the survey without the CARI component may have a detrimental impact on data quality, as evidenced by the large decrease in response rate from 73.14 percent in 2012, to 64.98 percent in 2013, for a panel of respondents first introduced to CARI in their third wave of data collection in 2013. However, there is very little evidence that the continuation of CARI into a second wave of data collection results in decreased data quality, as response

rates between the 2012 CARI test and the next wave of data collection for this panel in 2013 were not significantly different.

The CARI cooperation rates for households, persons, and persons asked the CARI question in 2013 showed a significant decrease from the same measures in 2012. Some of this decrease is attributable to more of the interviewing staff having worked one or more SIPP-EHC tests, and thus being experienced. Experienced interviewers continued to have lower CARI cooperation rates than inexperienced interviewers. There are large interviewer effects of over forty percent associated with CARI cooperation, which may be attributable to differences in how interviewers are administering procedures or attributable to differences in interviewer workloads (i.e. low-level geography). The significance of neighborhood characteristics such as presence of crime and well-tended yards in the CARI propensity modeling supports the notion that part of interviewer effect may be attributable to characteristics of the neighborhoods in which interviewers' workload is concentrated.

The CARI propensity modeling reinforced the differences in CARI consent by interviewer experience level, with the odds of gaining CARI consent for cases conducted by inexperienced interviewers being over twice the odds for cases conducted by experienced interviewers. Propensity modeling also showed large differences between the regional offices, with New York and Atlanta having low CARI consent and Chicago having the high CARI consent propensity. Several of the demographic variables in the person model were significantly associated with CARI consent propensity including whether the person was born in the U.S., Hispanic Origin, and disability status. Several household characteristics including the presence of one or more poor housing conditions, household size, and interview outcome were associated with the household respondents' consent propensity. Both the person and household respondent consent propensity models had significant effects associated with urbanicity, with persons outside of cities more likely to consent to CARI.

VI. Limitations

The original design of the 2013 CARI SIPP – EHC evaluation depended on random assignment of cases to a CARI treatment, or a control group that was not to be asked the CARI question. Ultimately, the CARI consent question was asked of all respondents. As a result, there is no direct comparison that controls for all confounding factors.

The SIPP-EHC tests took place in low-income areas only, and a subset of states. As such, the unweighted measures and comparisons should not be used to make inferences about introducing CARI into surveys of the general U.S. household population.

Due to small sample sizes, it is difficult to disentangle interviewer effects from lower level-area effects. The estimated interviewer effects may be indicative of differences in

interviewer workloads (including the geography of the workloads) as well as differences in how interviewers are administering interviews.

VII. Further Research

This evaluation fit general linear models of interviewer effects and of logistic regression models of consent propensity separately. Further research should address whether mixed models are able to estimate interviewer effects while also controlling for the covariates in the logistic regression models.

Further research is needed to directly measure the effect of CARI while controlling for confounding factors. A randomized experiment in which some respondents are randomly placed in to a CARI treatment group and asked the CARI consent question would be the gold standard for evaluating the effect of CARI on response rates and quality measures.

VIII. References

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