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Data Collection on Sensitive Topics with Adolescents Using Interactive Voice Response Technology

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Abstract

We describe the development and implementation of a survey administered using interactive voice response (IVR) technology to collect information on sensitive topics in a US national sample of adolescents age 12-17. Respondents were participants in the Panel Study of Income Dynamics 2014 Child Development Supplement (N=1,098). We review questionnaire design, fieldwork protocols, data quality and completeness, and respondent burden. We find that in the context of research on sensitive topics with adolescents, IVR is a cost-efficient and flexible method of data collection that yields high survey response rates and low item nonresponse rates with distributions on key variables that are comparable to other national studies.

Keywords: interactive voice response; adolescents; sensitive topics; social desirability bias



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Modes of data collection that allow greater anonymity, such as the internet, text messages, or interactive voice response, generally lead to more reporting of sensitive behaviors compared to standard telephone interviewing (Kreuter et al. 2008; Midanik & Greenfield 2010; Schober et al. 2015). Telephone interviewing is more likely to elicit accurate reports of sensitive behaviors when respondents are able to find a private setting in which to complete the interview or questions are worded or a response booklet is used so as to not require respondents to provide sensitive responses aloud. These conditions may be harder to achieve in telephone interviews with adolescents for three reasons: first, adolescents may have less control over the presence or interference of others during a telephone interview compared to adults, thus increasing the risk that sensitive information will be disclosed to a parent or sibling; second, the consequences of such disclosure may be uniquely consequential and detrimental for adolescents; and third, adolescents' greater tendency to provide socially desirable responses in survey settings compared to adults potentially compromises the quality of information on sensitive topics collected during an interviewer-administered telephone interview (Paulhus 1991; Reynolds & Richmond 1978).

Interactive voice response (IVR) technology provides an attractive method to overcome these concerns (Corkrey & Parkinson 2002; Stritzke et al. 2005; Tourangeau et al. 2002). In the survey context, IVR technology uses a pre-recorded or computer-generated voice to deliver questionnaire content to respondents and allows respondents to use their telephone keypads to input responses. This method allows participants to respond to sensitive questionnaire content without disclosing their answers directly to an interviewer and without the risk of inadvertent or intentional verbal disclosure to others. Responses are recorded in an electronic database without personally identifying information and the database is delivered securely from the IVR vendor to the survey operations team.

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We describe the development and implementation of an IVR-administered questionnaire as one part of the Panel Study of Income Dynamics (PSID) 2014 Child Development Supplement (CDS-2014), a large-scale national study of children aged 0-17 years in U.S. households. While telephone audio computer-assisted self-interview (A-CASI) and IVR data collection methods have been used with small regional samples of adults (Beach et al. 2010; Cooley et al. 2000) and youth (Stritzke et al. 2005), we are aware of no other national study that has used IVR technology to collect information on sensitive topics from adolescents. Below we describe the design, protocols, and implementation of IVR data collection in this context, discuss participant cooperation rates and data quality, and offer lessons learned and recommendations for future data collection using this mode.

Context

The U.S. Panel Study of Income Dynamics (PSID) began in 1968 with a nationally-representative sample of 4,800 U.S. families. As the world's longest-running household panel study, it is a cornerstone for empirical social science research on socioeconomic mobility, health, and status attainment. It includes data collected over 40 waves (annually until 1997 and biennially since then) from up to five generations of family members descended from original PSID householders. Immigrant sample refreshers in 1997 and 2017 combined with low rates of attrition from wave to wave have kept the sample broadly representative of the U.S. population. PSID has been directed by a research investigator team at the Institute for Social Research at the University of Michigan since its inception.

CDS-2014 is a multidisciplinary study of child development and well-being embedded in PSID. The sample includes all children aged 0-17 years who resided in a household that completed the 2013 PSID Core interview and their primary caregivers, usually a child's mother (N=4,333 children in 2,517 households, 88% response rate). Study content includes information on children's family, neighborhood, and school contexts and on their cognitive, emotional, behavioral, and social development. Data were collected primarily through telephone interviews with primary caregivers and adolescents aged 12-17 years. In addition, a random 50 percent of households were selected to receive an in-home visit to collect information that could not be obtained reliably by telephone. The in-home component included cognitive achievement assessments for children and primary caregivers, children's time diaries for a randomly-assigned weekday and weekend day, interviewer observations, and interviews with children aged 8-11 years. Data collection occurred between November 2014 and April 2015 and between November 2015 and February 2016. CDS-2014 builds upon the original PSID Child Development Supplement, which began in 1997 to collect information on up to two children aged

0-12 years per household. Where CDS-2014 included home visits with a random half of participating families, the original CDS included home visits with all families. During these visits children completed computer-assisted personal interviews (CAPI) and A-CASI interviews on sensitive topics.

The Choice to Use IVR Technology

The CDS survey interview with adolescents includes sensitive questions on bullying, physical development, sexual activity, drug and alcohol use, and delinquent behavior. Data collected on these topics via A-CASI in the original CDS have been used widely in research spanning a variety of disciplines including economics, criminology, psychology, and epidemiology (Agnew et al. 2008; deBlois & Kubzansky 2016; Neymotin & Downing-Matibag 2013; Wen & Shenassa 2012).

Given broad public interest in these topics and the demonstrated value of related CDS data to the research and policy communities, the study's investigator team was committed to retaining the related questionnaire content in CDS-2014. However, the shift to telephone interviewing with adolescents required converting the A-CASI instrument used in the original CDS to a different mode of data collection. Criteria for selecting another mode included protection of respondent privacy; minimizing disclosure risk, social desirability bias, and respondent burden; and consistency with the A-CASI mode of administration in order to minimize mode effects. Options including a mail-out/mail-back questionnaire and a web-based instrument were discarded because no mechanisms were available to ensure respondent privacy or confidentiality or to authenticate a respondent's identity prior to administration. For example, another person in an adolescent's household could intercept a paper questionnaire or observe questionnaire content on a computer screen during a web-based interview.

In contrast, IVR technology minimizes the potential for interference or intervention. Survey questions are read by a pre-recorded or computer-generated voice and respondents enter responses on their telephone keypad, thus limiting the potential for others to hear or read interview content. Because no interviewer involvement is required to record responses or to transmit data to the IVR service provider, the risk of social desirability bias is also substantially reduced compared to an interviewer-administered questionnaire. Further, the IVR instrument may be programmed to require login credentials provided only to respondents, thereby reducing opportunity for another household member to intervene and complete the interview in place of the targeted respondent. Beyond these gains, IVR was a relatively inexpensive mode of data collection compared to the costs of paper questionnaire production, postal service, web programming, or field interviewer time.

IVR Questionnaire Development

The IVR instrument was adapted from the A-CASI instrument used in previous rounds of CDS. In the A-CASI administration, respondents listened to question wording and response categories through headphones and were able to read the questionnaire content on a laptop computer screen at the same time. Because interviews were done during a household visit, an interviewer was always present to ensure that the respondent completed the A-CASI task in private without interference. In contrast, the IVR administration was prepared with the expectation that respondents would only hear questionnaire content and would have no visual cues to prompt their progress through the instrument. (In advance of the interview, respondents received a printed booklet that contained response categories to each item in the questionnaire, but the booklet did not include question wording and respondents were not required to have the response booklet on hand to complete the IVR interview.) The shift to a new mode of administration required modifications to the presentation of content, strategies to allow respondents to skip items they did not wish to answer, and methods to train respondents in how to use the instrument. We review these modifications here.

IVR technology allows response entry using the keypad on a conventional landline telephone or on a cellular telephone or smartphone. In advance of the interview, CDS-2014 respondents received an inexpensive set of earbuds so that those using a cellular telephone could hear the interview questions and see the keypad at the same time. To ensure that respondents understood question intention, the programmed voice stressed the most salient words in each item, and at the outset of the interview, respondents were instructed to use their keypad to have any question repeated. For standalone questions and the first in any series of questions that used the same response set, the entire question and all response categories were presented before the respondent could enter a response on their telephone keypad. Higher-order items in a series required the respondent to hear the complete question wording but permitted response entry before the complete response set was presented. For all items, the response set repeated after three seconds if no response or an out of range response was entered. Respondents were permitted to skip over any item after the question and response set were repeated once, and the instrument automatically skipped to the next item if no response was entered after the response set was presented three times. As in the earlier A-CASI administration, “do not know” was not permitted as a valid response.

To train respondents to interact with the IVR instrument, three practice questions were included at the beginning of the interview. These items asked respondents to report their gender and age and whether their response booklet was available. Three questions at the end of the interview assessed the respondent’s

perception of task difficulty. Questionnaire content is available at <https://psidonline.isr.umich.edu/cds/questionnaires/cds-14/child.pdf>.

All questionnaire content and protocols were developed by the research investigator team. A commercial service provider programmed the instrument, hosted the toll-free telephone line and secure server for data collection, and transferred content data files to Survey Research Operations at University of Michigan twice each week during the fieldwork period. The cost per eligible case for these services was approximately \$9. The service provider had no identifying information about or means to contact respondents.

Protocol

Adolescents' eligibility to participate in the CDS-2014 interview required informed consent and assent from, respectively, an adolescent respondent's primary caregiver and the adolescent. Eligibility for the IVR interview further required that the adolescent first complete the interviewer-administered portion of the telephone interview (N=1,098). Three protocols to connect eligible respondents to the IVR interview were used in the course of fieldwork. At the outset, technical limitations prevented interviewers from being able to transfer respondents directly to the IVR interview.¹ Instead, interviewers provided each eligible adolescent with the toll-free telephone number to access the IVR instrument and a randomly-generated unique identifier to use as a login credential. If the respondent had not called in to connect to the IVR instrument within three days, the interviewer made a follow-up call to the adolescent's household. The interviewer provided the telephone number and unique identifier again only if speaking directly to the adolescent. Approximately 46 percent of eligible respondents (N=509) initiated the telephone call to access the interview within the first 16 weeks of fieldwork under this protocol (November 2014 to mid-February 2015).

Ten weeks before the end of the initial fieldwork period, an endgame strategy was introduced. Letters were mailed to eligible adolescent respondents who had not yet initiated the IVR interview with instructions on three ways to connect: Those who still had the telephone number and login credential could call in directly; those who no longer had the contact information could either call a centralized survey lab at the University of Michigan to be transferred directly to the IVR interview; or the respondent could await a call from the survey lab to connect them. Respondents were offered a \$10 conditional incentive for their participation. This incentive was

1 Decentralized interview staff conducted telephone interviews from their own homes on personal telephone lines that were not equipped to accommodate call transfers. The cost to transition to dedicated business lines for the purpose of enabling call transfers was prohibitive.

offered in addition to the \$25 incentive already provided upon completion of the interviewer-administered portion of the telephone interview. Approximately 29% of adolescents who had not responded prior to the endgame initiated the IVR interview before the initial fieldwork period ended under this protocol (N=172, 15.7% of all eligible adolescents, mid-February-April 2015).

A four-month fieldwork extension began in November 2015 to contact IVR nonrespondents in order to increase response rates, sample size, and population representativeness. The protocol for the IVR interview included a letter mailed to the adolescent respondent that contained the toll-free telephone number and login credential, a \$5 cash pre-payment for participation, and the offer of a \$20 conditional incentive. Field staff followed up with reminder calls to households where adolescents did not initiate a telephone call within one week of the mailing. Approximately 40% of eligible adolescents who had not previously initiated the IVR interview did so during this fieldwork extension period (N=191, 17.4% overall). We investigated whether interviews completed during the fieldwork extension period (among respondents with a higher nonresponse propensity) displayed worse data quality (Fricker & Tourangeau 2010). No statistically significant differences were found in item nonresponse rates or in perceived burden between late responders and participants who completed the IVR interview during the main data collection period, although average administration time was about two minutes shorter during the fieldwork extension ($p < .05$).

In total, 872 respondents (79.4%) connected to the IVR system to begin the interview. (See Table 1) A slightly smaller fraction provided complete or partial data, as we describe below. The endgame strategy and fieldwork extension period increased sample size and improved the race/ethnic representativeness of the sample. Latino adolescents were more likely than their non-Latino white and black peers to participate in the endgame. This may be due in part to a later fieldwork start date for families with Spanish-speaking caregivers, which meant Latino adolescents were more likely to complete the interviewer-administered portion of the interview during the endgame period. Non-Latino black and Latino adolescents were also somewhat more likely to initiate the IVR interview during the fieldwork extension period rather than during the initial period compared to non-Latino white youth. The gender and age distribution of respondents was similar across the three periods.

Cooperation Rates

Of the 872 adolescents who initiated the IVR interview, 802 completed it, 30 provided partial data, and 40 broke off during the interview introduction or practice questions. The overall cooperation rate combining partial and complete data was

Table 1 Interactive voice response (IVR) interview, PSID 2014 Child Development Supplement, adolescents aged 12-17 years

Final status	N	Percentage
Began interview	872	79.4%
<i>Completed interview</i>	802	73.0%
<i>Partial interview</i>	30	2.7%
<i>Breakoff</i>	40	3.6%
No contact	226	20.6%
Total	1098	

75.8% $([802+30]/1098)$. Table 2 characterizes the eligible sample overall and by IVR interview outcome, comparing the subset of adolescents who did not call in or who broke off early in the interview to those who provided complete or partial data. Characteristics are weighted to be representative of U.S. adolescents aged 12 and older who were born in 1997 or later and whose families had resided in the U.S. at least since that year. IVR participants were similar to the full sample on child and caregiver age, child gender, family size, and educational attainment of the household head. Non-Latino black and Latino adolescents and youth in households with lower family income were over-represented among nonparticipants in the IVR interview.

Table 3 summarizes results from a random effects logistic regression model estimating the log-odds of adolescent non-cooperation in the IVR interview as a function of the characteristics presented in Table 2. The random effects model is clustered on the household identifier in order to estimate the share of variance in the probability of non-cooperation that is attributable to differences between compared to within households. Adjusting for other sociodemographic characteristics, the log-odds of non-cooperation was similar by adolescent age and gender, sample origin, geographical region, and household composition. Adolescents in households where the head had some college or a Bachelor's degree or higher were more likely to participate compared to those in households where the head had a high school education. Latino adolescents and those living in households with family income in the bottom quartile were more likely not to participate compared, respectively, to non-Latino white adolescents and peers with family income in the top quartile. Although these individual coefficients were statistically significant, the full sets of coefficients associated with categorical variables were not jointly statistically significant for any of the multi-category covariates. Coresident siblings' log-odds of

Table 2 Descriptive statistics, adolescents aged 12-17 years eligible to complete the PSID 2014 Child Development Supplement IVR interview overall and by interview outcome

	IVR interview outcome					
	Eligible sample		Partial or complete data		No contact or breakoff	
	Mean	SD	Mean	SD	Mean	SD
<u>Child characteristics</u>						
Age in years	14.423	1.648	14.476	1.669	14.231	1.558
Male	0.506	0.500	0.493	0.500	0.556	0.498
<i>Race/ethnicity</i>						
Non-Latino white	0.580	0.494	0.634	0.482	0.386	0.488 *
Non-Latino black	0.157	0.364	0.145	0.352	0.202	0.402 *
Latino any race	0.223	0.416	0.186	0.389	0.356	0.480 *
Other race	0.036	0.187	0.034	0.182	0.044	0.205 *
Race/ethnicity unknown	0.003	0.057	0.001	0.028	0.012	0.110
<u>Family characteristics</u>						
<i>Sample source</i>						
1968 general population	0.747	0.435	0.785	0.411	0.611	0.489 *
1968 low-income oversample	0.077	0.267	0.068	0.251	0.112	0.316 *
1997 immigrant refresher	0.175	0.381	0.147	0.355	0.277	0.448 *
<u>Region of the United States</u>						
Northeast	0.135	0.342	0.142	0.349	0.110	0.314
North Central	0.260	0.439	0.281	0.450	0.182	0.386 *
South	0.375	0.484	0.366	0.482	0.407	0.492
West	0.231	0.421	0.211	0.408	0.301	0.459 *
Metropolitan area	0.743	0.437	0.736	0.441	0.769	0.422
<i>Family income in 2012</i>						
Bottom quartile	0.153	0.361	0.125	0.331	0.254	0.436 *
2nd quartile	0.241	0.428	0.215	0.411	0.336	0.473 *
Third quartile	0.253	0.435	0.271	0.445	0.188	0.392 *
Top quartile	0.352	0.478	0.388	0.488	0.221	0.416 *
No. of children in household (topcoded at 5)	2.404	1.141	2.384	1.137	2.476	1.153
Two parents in household (biological, adoptive, or step)	0.608	0.488	0.636	0.481	0.505	0.501 *
Household head employed	0.822	0.383	0.851	0.356	0.717	0.451 *

Table 2 continued

	IVR interview outcome					
	Eligible sample		Partial or complete data		No contact or breakoff	
	Mean	SD	Mean	SD	Mean	SD
<i>Household head age</i>						
29 years or younger	0.031	0.174	0.027	0.163	0.046	0.209
30-45 years	0.599	0.490	0.585	0.493	0.648	0.478
46 years or older	0.370	0.483	0.388	0.487	0.306	0.462
<i>Household head education</i>						
<12 years	0.144	0.351	0.130	0.337	0.191	0.394
High school graduate	0.292	0.455	0.274	0.446	0.357	0.480
Some college	0.255	0.436	0.254	0.436	0.258	0.438
Bachelor's degree or higher	0.302	0.459	0.339	0.474	0.171	0.377 *
Unknown	0.007	0.082	0.002	0.046	0.024	0.152
N	1098		832		266	

*p<.05

Table 3 Random effects logistic regression estimates of the log-odds of IVR interview nonparticipation, PSID 2014 Child Development Supplement

	B	SE
<u>Child characteristics</u>		
Age in years	-0.192	0.121
Male (vs. female)	0.365	0.395
<i>Race/ethnicity (vs. non-Latino white)</i>		
Non-Latino black	1.262	0.841
Latino any race	2.264	0.971 *
Other race	1.292	1.355
Race/ethnicity unknown	5.346	3.534
<u>Family characteristics</u>		
<i>Sample source (vs. 1968 general population)</i>		
1968 low-income oversample	0.592	0.808
1997 immigrant refresher	0.437	1.143
<i>Region of the United States (vs. West)</i>		
Northeast	-0.180	0.999
North Central	-1.203	0.799
South	-0.574	0.747
Metropolitan area	0.195	0.595

Table 3 continued

	B	SE	
<i>Family income in 2012 (vs. top quartile)</i>			
Bottom quartile	1.984	0.907	*
2nd quartile	1.454	0.799	
Third quartile	0.471	0.742	
No. of children in household (topcoded at 5)	0.142	0.235	
Two parents in household (biological, adoptive, or step)	-0.211	0.554	
Household head employed	-0.137	0.626	
<i>Household head age (vs. 30-45 years)</i>			
29 years or younger	0.485	1.179	
46 years or older	-0.177	0.585	
<i>Household head education (vs. high school graduate)</i>			
<12 years	-1.031	0.827	
Some college	-1.285	0.595	*
Bachelor's degree or higher	-1.959	0.729	*
Unknown	1.574	2.853	
Constant	-2.906	2.300	
Rho	0.903	0.016	
N=1,098			
k=880 (observations clustered on household identifier)			
Wald chi-square (df=24)	46.14		*

*p<.05

participation were correlated at .90 ($\rho=.903$), meaning that most variation in the likelihood of participation was due to differences across rather than within households. A weighted logistic regression clustered on the household identifier produced substantively similar associations.

We cannot establish definitively why Latino and lower-income adolescents were less likely to participate in the IVR interview compared to their peers, but a few explanations are plausible. Among Latinos, a higher probability of nonresponse may have resulted from the later fieldwork start for primary caregiver interviews conducted in Spanish. Adolescents in lower-income families who did not immediately complete the IVR interview might have been more difficult to reach in follow-up compared to those in higher-income families if they changed residence (Desmond et al. 2015) or contact telephone numbers more often during the study period. Variation in concerns about intrusiveness, disclosure, or social desirability associated with sensitive topics also may have contributed to sociodemographic patterning of nonresponse (Tourangeau & Yan 2007). However, we note that eligi-

bility for the IVR interview was conditional on completion of several other study components, suggesting that the eligible sample overall might have been more open to an interview on sensitive topics compared to samples selected unconditionally.

Partial Data

Cases with partial data are those that advanced beyond the first three practice questions but did not reach the end of the interview. Among those who provided partial data, breakoff points varied; that is, it did not appear that interview length or any single questionnaire item disproportionately increased the risk of breakoff. The share of cases providing only partial data (4 percent of those with any data) is low despite two circumstances. First, because of a programming limitation, respondents who terminated the IVR interview early were required to start from the beginning when they called in to resume the interview, thus increasing respondent burden. Second, the case management system flagged respondents who had not yet initiated their IVR interviews for interviewer follow-up but did not flag IVR interviews that contained only partial data, so interviewers did not recontact adolescents who terminated the IVR interview early. Nevertheless, approximately 14% of respondents who eventually provided a complete interview terminated the interview early at least once and re-entered the system to complete the interview from the beginning. Adolescents might have done so in order to overwrite their initial responses to sensitive questions, for example, to change their reported history of sexual activity or substance use. However, a review of the partial and completed interview records demonstrated that responses were consistent across administrations.

A number of issues potentially contributed to breakoffs among the 40 respondents (3.6% of total) who terminated the interview before advancing beyond the practice questions. First, the interview script for the second practice item prompted respondents to enter the *pound* (#) sign after entering their age in years. Adolescents who recognized this symbol as a *hash* sign and who were unfamiliar with the term “pound sign” might have been uncertain about how to proceed. Second, the third practice item asked whether respondents had their response booklet on hand for the interview but did not state that the booklet was not required to proceed. Respondents who had disposed of or misplaced the response booklet might have interpreted this question to mean that they would be unable to complete the interview. Third, respondents who found the IVR interview experience cumbersome or dull might have decided to terminate the interview near the outset, particularly if they were aware that they had already qualified to receive the incentive for participation.

Respondent Burden

The IVR instrument included a total of 94 items with some path-dependent content. Adolescents who completed the interview responded to 51.3 questionnaire items on average, and the average administration time was 18.7 minutes. The oldest adolescents required three minutes more to complete the interview compared to the youngest (20.9 minutes for 17-year-old respondents vs. 17.8 minutes for 12-year-old respondents) and were presented with 7.4 more items (55.5 items vs. 48.1 items respectively) on average.

Rules for response entry on the telephone keypad introduced a source of respondent burden beyond interview length. Where items required a single-digit response, participants advanced to the next questionnaire item upon keying in a response value. Where items allowed or required a response with two digits or more (e.g., age or year), respondents were asked to use the pound (hash) sign as a delimiter to indicate when the entry was complete. The opportunity to enter multiple digits introduced more room for error in any response compared to single-digit coding schemes, and the requirement to enter the pound sign added the potential for confusion about how to advance to the next item. Nevertheless, items with multiple-digit response options did not have higher rates of nonresponse or subsequent breakoff compared to questionnaire items with single-digit responses. When asked about perceived burden at the end of the interview, 94 percent of respondents with complete data reported that they had answered questions carefully and accurately, and 93 percent reported that the IVR questionnaire was either easy or “neither difficult nor easy” to complete.

Data Quality and Social Desirability Bias

Non-random variation in three study participant behaviors potentially threatens data quality: survey nonresponse, item nonresponse, and inaccurate reporting. To the extent that social desirability bias increases the risk that respondents evade or provide misleading responses on questions pertaining to sensitive topics, the CDS-2014 IVR interview may be particularly susceptible to compromised data quality.

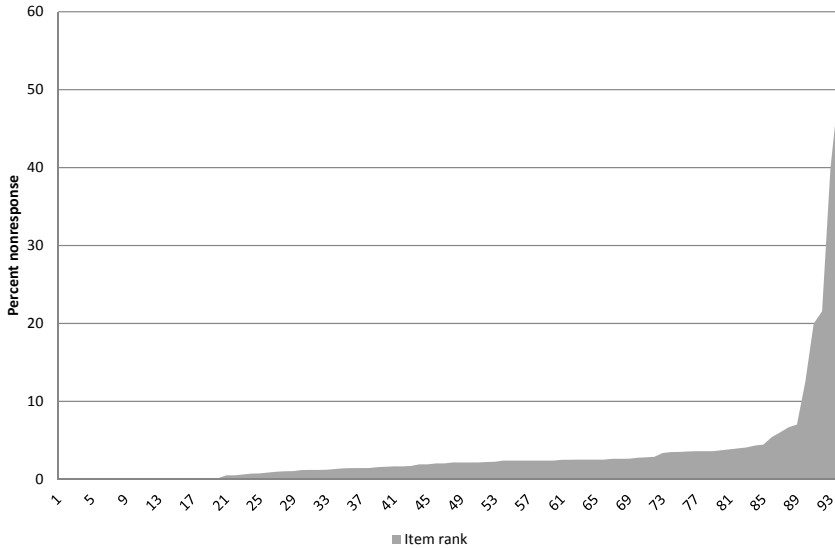
With regard to survey nonresponse, approximately one-quarter of eligible adolescents either did not initiate the IVR interview or did not advance beyond the practice questions. We do not know the reason some adolescents declined to participate. Certainly, the study’s protocol requiring the adolescent to call in to initiate the interview likely reduced willingness to participate regardless of interview content. Beyond that, a subset of adolescents or their parents may have been discouraged from participating after learning about the sensitive content during the informed consent process. As Table 2 demonstrates, nonresponse was not random:

racial and ethnic minority youth, younger adolescents, and those from socioeconomically disadvantaged families were less likely to respond than their peers. To the extent that nonrespondents differ from participants on the attributes measured by the IVR questionnaire, survey results are not fully representative of the target population, but sample selectivity could be reduced by constructing and applying non-response weights to the IVR component of the study based on characteristics obtained in other parts of the study.

Figure 1 presents the distribution of item nonresponse across the 94 items included in the IVR questionnaire ranked from the lowest to the highest nonresponse rate. Item nonresponse is measured as the share of respondents to whom a questionnaire item was administered who did not provide a valid response. It excludes individuals who were skipped out of the item or who terminated the interview before reaching it. Three-quarters of items had nonresponse rates below three percent, and all but five items had nonresponse rates below 10 percent. Items with the highest nonresponse rates (40 to 50 percent) pertained to the circumstances surrounding a live birth (birth complications, placement for adoption) that were reported by the small set of adolescents (10 or fewer) who had this experience. Nonresponse rates were also high in response to questions about the calendar month and year of menarche and first sexual intercourse, but most respondents subsequently reported their age at these events instead. For example, 23 percent of girls who had reached menarche did not report the calendar date of the event ($N=83$), but 94 percent of those respondents ($N=78$) reported age at onset in the follow-up question.

Lastly, we compare weighted distributions on key variables to two other data sources. There is no gold standard for prevalence of sensitive behaviors, and distributions vary across studies as a function of sample design, mode of data collection, and change over historical time. Nevertheless, to the extent that results are roughly consistent across studies, we may conclude that CDS-2014 captured reports on similar constructs. We compare reported age at sexual initiation for CDS-2014 respondents aged 15 to 17 to reports from the 2013-15 U.S. National Survey of Family Growth (NSFG) (National Center for Health Statistics 2016) and reports on lifetime smoking behavior for all adolescents compared to the 2015 wave of Monitoring the Future (MTF) (Miech et al. 2017). These studies are frequently cited as high-quality surveys of U.S. adolescent sexual behavior and substance use respectively. Information on sexual activity is collected in NSFG via an in-person interview.

Figure 1 Distribution of item nonresponse, PSID 2014 Child Development Supplement interactive voice response interview, complete and partial cases, N=832



Information on substance use is collected in MTF via an in-school administration of a paper-and-pencil interview.²

Table 4 summarizes these comparisons. In all cases, the confidence intervals from the CDS-2014 sample include the population estimates reported from external data sources. The prevalence of sexual initiation and average age at first sexual intercourse reported in CDS-2014 among adolescents aged 15-17 years is comparable to estimates provided by NSFG respondents in the same age group. The prevalence of reported sexual initiation among boys is 4.3 percentage points lower in CDS-2014 compared to NSFG, while among girls it is 1.6 percent points higher. Average reported age at sexual initiation is 0.14 years higher for boys and 0.28 years lower for girls in CDS-2014 compared to NSFG. Lifetime prevalence of reported

2 Beyond differences in mode of administration, the multiconditional nature of unit nonresponse probability in CDS-2014 (i.e., the requirement that participants and their families complete various interview components in order to reach the IVR interview) may yield a sample selected on characteristics that are more difficult to adjust for in probability weights compared to the unconditional cross-sectional MTF and NSFG samples, potentially contributing to divergent weighted population estimates. Further, those studies differ from CDS-2014 in their broad questionnaire content and in their sampling frames, which include foreign-born adolescents and adolescents with foreign-born parents who entered the United States since 1997.

Table 4 Prevalence of sexual activity and substance use, CDS-2014 and national comparison surveys (weighted estimates with 95% confidence intervals in italics)

	CDS-2014	National Survey of Family Growth (2013-15), ages 15-17	Monitoring the Future (2015)
<i>R ever had sexual intercourse</i>			
Male (15-17 years) (N=201)	24.2% <i>(16.8%-31.6%)</i>	28.5%	
Female (15-17 years) (N=176)	27.9% <i>(19.7%-36.1%)</i>	26.3%	
<i>Age in years at first intercourse</i>			
Male (15-17 years) (N=68)	14.67 <i>(14.02-15.33)</i>	14.53	
Female (15-17 years) (N=60)	14.62 <i>(14.26-14.99)</i>	14.90	
<i>R ever tried smoking a cigarette</i>			
9th grade or lower (N=495)	10.4% <i>(6.9%-13.8%)</i>		13.3% (8th grade)
10th-11th grade (N=258)	20.8% <i>(14.7%-26.9%)</i>		19.9% (10th grade)
12th grade or higher (N=58)	29.4% <i>(15.1%-43.8%)</i>		31.1% (12th grade)

cigarette smoking in CDS-2014 roughly aligns with estimates from Monitoring the Future for students in grades 8, 10, and 12, although estimates are somewhat lower for the youngest and oldest adolescents in CDS-2014. We conclude that population estimates based on data collected in the IVR interview are comparable to estimates generated from similar samples interviewed using other modes of data collection.

Research Ethics

Protection of respondent privacy and confidentiality and strategies to minimize the risk of deductive disclosure are paramount in any study of children, who are considered a vulnerable population in human subjects research. In a supplemen-

tal study derived from a genealogical sample design like CDS-2014 in the context of the Panel Study of Income Dynamics, these concerns are further heightened because family members are likely aware of children's participation and may seek to find their responses to sensitive items once the data are publicly released. We adopted a variety of strategies to address these concerns.

Protection of privacy and confidentiality, especially from parents and siblings, drove the choice to adopt IVR technology to administer sensitive questionnaire content in the context of a telephone interview with adolescents. Further, login credentials provided directly to the adolescent were developed to preserve respondent fidelity and prevent any tampering or intervention. While parents were allowed to inquire about the content of the questionnaire (an option few actually exercised), no one was permitted to access the child's survey responses.

Three strategies protect respondent confidentiality after data collection. First, all data transfer and storage policies comply with standards developed by Panel Study of Income Dynamics staff and approved by the University of Michigan Institutional Review Board. Second, a Certificate of Confidentiality issued by the U.S. Department of Health and Human Services prior to the start of fieldwork protects the study investigators from being compelled through a legal proceeding to provide individually-identifying information about a respondent. Third, data on sensitive topics collected through the IVR interview are made available to researchers to use only in a secure data enclave under terms of a restricted-use data agreement. (Details available at <https://simba.isr.umich.edu/restricted/ChildReportSensitive.aspx>.)

Lessons Learned and Recommendations

CDS-2014 is the first large-scale national study to collect information on sensitive topics from adolescents using interactive voice response technology. The preceding review demonstrates that IVR is a cost-efficient and flexible method of data collection that yields high survey response rates and low item nonresponse rates with distributions on key variables that are comparable to other national studies. We conclude with an assessment of lessons learned and recommendations based on the CDS-2014 fieldwork experience.

IVR provides an interview context that is expected to reduce measurement error arising from social desirability bias and to increase item response rates compared to data collection methods that are perceived to be less anonymous (Sakshaug et al. 2010). To the extent that such gains were achieved in CDS-2014, the tradeoff was a decline in survey response rates compared to the CATI interview that immediately preceded the IVR interview which occurred at least in part because of technical limitations in the capacity to transfer respondents to the IVR telephone

line directly. Substantial field staff time and resources were invested in a variety of strategies to follow up with and engage respondents to complete the interview. Ultimately, this additional effort paid off, as the weighted samples from the main child interview and the IVR interview are substantively similar on key sociodemographic characteristics. Nevertheless, a primary recommendation for future CATI-based data collection efforts supplemented by IVR technology is to have in place a mechanism to transfer respondents directly from one interview mode to another. For respondent protection, this mechanism should require the interviewer or the participant to provide unique login credentials in order to launch the interview. Even under optimal transfer conditions, some respondents will choose to break off or will be lost during the transfer. Depending on the design of IVR implementation, such costs can be weighed against the gains from achieved data quality in subsequent analysis and evaluation.

Other recommendations pertain to the IVR instrument itself. First, instructions should be developed with the assumption that the respondent will have no written material on hand as an additional learning support (even if such materials are provided in advance of the interview), and instructions should be evaluated for clarity prior to fieldwork. Second, vocabulary used in instructions should be familiar to respondents. For example, in the case of CDS-2014, adolescents recognized the symbol # as a “hash” sign rather than as a “pound” sign. Third, to balance consistency in the administration of questionnaire items against respondent burden, the programmed instrument should require the respondent to hear the complete question and set of response options on the first administration of an item or at the beginning of a set of related items, and then allow flexibility in the presentation of response options so that respondents may key over the repeated full set when they know how they wish to respond. Finally, minimize the number of keypad strokes required by the respondent. In the case of CDS-2014, single-digit response categories worked best.

To summarize, IVR interviewing carries some tradeoffs compared to other modes of data collection and requires substantial forethought and planning to maximize survey response rates and minimize respondent burden and error. To the extent that these costs are counterbalanced by complete data and diminished social desirability bias among respondents, IVR interviewing can provide an effective method to collect high-quality data on sensitive topics with adolescents.

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