

MODELING THE COGNITIVE PROCESSING OF DRUG USE QUESTIONS

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Introduction

Survey measurement error continues to be a problem in the field of substance abuse research. Although epidemiologic surveys retain their status as the primary methodology for monitoring substance use patterns in the United States, concerns regarding the quality of self-reports of illicit behaviors remain and challenge the credibility of this research (Miller, 1997). Considerable effort has to date been invested in assessing potential sources of measurement error and testing innovations designed to improve the quality of self-reports (Harrison and Hughes, 1997).

Much of this research has concentrated on evaluating characteristics of the respondent that may be associated with the accuracy of substance use reporting (Fendrich et al., 1999; Johnston and O'Malley, 1997). This work has in large measure been driven by the assumption that measurement error in substance use reporting is primarily a consequence of social desirability concerns. The illegal nature of most recreational drug use and the social stigma often associated with it is believed to provide many respondents with adequate motivation to deliberately under-report, or deny altogether, use of these substances. The desire to maintain a harmonious exchange with an interviewer is viewed as an additional motivation for under-reporting. Hence, deliberate under-reporting, motivated by confidentiality fears and/or the wish to avoid an uncomfortable social exchange, is widely believed to be the primary mechanism responsible for measurement error in substance abuse research. Schaeffer (2000) has organized a framework for understanding the perceived risks and losses that respondents may associate with answering truthfully when asked questions about threatening topics such as substance use.

Concerns with privacy, face-saving, and the threat of criminal sanctions are also believed to be the mechanisms underlying apparently robust race/ethnic differences in the quality of substance use reporting. A recently completed

review by Johnson and Bowman (2003) documented over 30 studies in which the reliability and/or validity of substance use reports varied significantly among survey respondents of differing race/ethnic backgrounds. In most cases, minority group membership was associated with poorer quality reporting of substance use behaviors. These differences were attributed to a cluster of factors related to social desirability concerns, including greater emphasis on confidentiality, privacy and harmonious social interactions, greater suspicion of research motives, and greater concern with criminal prosecutions in minority communities.

It should be noted that the social desirability framework described above also makes the implicit assumption that respondents are able to accurately comprehend the survey questions and retrieve the information necessary to construct correct answers. Indeed, these assumptions would appear to be accepted by many in the research community as an article of faith. In particular, the relative scarcity of studies that investigate question comprehension and memory retrieval as potential sources of measurement error in substance abuse research seems to support this conclusion. Ironically, the few available studies of these subjects suggest their relevance. Ethnographic work, for example, has documented that the names of drugs communicated in survey questions may not be consistent with the names associated with those in the community (Ouellet et al., 1997). This may be a problem that is somewhat unique to drug abuse research, given ever-changing street drug terminology as new drugs become available and as use patterns change. Drug use vocabulary is also likely to vary across regions. Consequently, questionnaire wording may not convey the same meaning to respondents that survey researchers assume it does, and personal definitions of various drugs may often override those provided in survey questions (Hubbard et al., 1992). Other methodological research also suggests broad variability in respondent interpretations of survey questions (Schober, Conrad and Fricker, In-press; Suessbrick et al., 2000). Ironically, recent technological innovations designed to improve substance use

reporting by reducing social desirability pressures (Turner et al., 1998) may themselves become a barrier to respondent comprehension when interviewers are become less available to clarify and help resolve the meanings of objective behavioral questions.

Respondent memory has received considerable attention in recent years as a source of survey measurement error (Sudman, Bradburn and Schwarz, 1996). Although research has been successful in using cognitive interventions to assist respondents in accessing relevant health-related memories and improving responses (Stone et al., 2000), there are few efforts to use knowledge of these processes to improve substance use reporting. Experiments reported by Hubbard (1992), in which variations of an anchoring manipulation that included the use of a calendar were used to assist respondents in framing their responses achieved mixed success in improving recall.

We are aware of no research that attempts to simultaneously evaluate the effects of these various cognitive processes on substance use reporting error. Doing so would be useful for determining the degree to which the conventional wisdom regarding the primacy of social desirability concerns in substance use reporting is correct and/or the degree to which other elements of information processing such as question comprehension and memory also contribute so reporting error. The goal of this paper is to examine the relative effects of comprehension, memory and social desirability on the accuracy of self-reported drug behaviors using a representative community sample. It will in addition explore potential race/ethnic differences in these processes.

Methods

The data for this study come from a multi-stage area probability survey of Chicago residents that was conducted between June 2001 and January 2002. At stage 1, census tracts in Chicago were randomly selected. At stage 2, one block was randomly selected from within each sampled tract. At stage 3, every household on the sampled block was screened for eligibility. At stage 4, one 18-40 year old adult was selected at random from within each eligible household (Bryant, 1975). Interviews were administered in the home by trained interviewers from the University of Illinois at Chicago Survey Research Laboratory using ACASI procedures. The drug survey portion of the study assessed lifetime and recent drug use using a format

similar to that employed by the National Household Survey on Drug Abuse (Office of Applied Studies, 2002). Although the overwhelming majority of subjects employed self-administered procedures for the substance use questions (90%), subjects could also opt to have their questions administered by the interviewer. All study protocols were reviewed and approved by the University of Illinois at Chicago Institutional Review Board. A total of 627 interviews were completed.

Using American Association of Public Opinion Research (2000) response rate formula #3, the overall response and cooperation rates for the survey were 40% and 59%, respectively. These rates reflect the challenges of conducting in-person survey interviews in urban environments where household response rates tend to be lower for many reasons (Groves and Couper, 1998). When restricted access, high-rise apartment buildings are excluded from consideration, the comparable response and cooperation rates were 51% and 80%, respectively. Restricted access apartment buildings are particularly problematic in urban surveys, as a single gatekeeper can successfully decline survey participation on behalf of dozens, and sometimes hundreds of potential respondents.

Questionnaire Contents: In addition to the drug questions noted above, the survey contained questions about substance use treatment experiences, psychological symptoms and demographics. Following the main survey, debriefing probes gauging respondent reaction to various aspects of the survey, which are the subject of the present study were administered (see Table 1). Respondents were asked to answer each of these probes using seven-point likert-type scales. The use of similar debriefing probes in substance use surveys have been previously reported (Bradburn, Sudman and Associates, 1979; Fendrich et al., 2003).

Drug Testing: Immediately following the drug assessment portion of the survey, subjects were asked to consent to participate in hair, saliva (hereafter referred to as "oral fluid"), and urine testing procedures. Note that subjects were invited to participate in the drug testing after substance use questions had been completed. The strengths and limitations of each of the testing procedures have been discussed in detail elsewhere (Wolf et al., 1999). Specimens were sent to the United States Drug Testing Laboratories in DesPlaines, Illinois for toxicological analyses. All specimens were

screened for amphetamines, cocaine, marijuana, and opiates. Drug test participation rates were as follows: Overall, 91% of the sample participated in at least one drug test. With respect to hair testing, 69% participated, with 12% refusing participation, and 21% judged ineligible. Oral fluid test participation was 90% and urine test participation was 76%.

Drug Test Classification: All respondents who participated in at least one drug test and who were confirmed positive for cocaine, marijuana or opiates by any of the three tests were classified as drug test positive cases. Amphetamine use was dropped from analysis because very few cases tested positive for this substance.

Drug Report-Drug Test Concordance: Respondents were classified as being concordant drug use reporters if their reported past-year use or nonuse of cocaine, marijuana and opiates were each consistent with the findings of respondent drug test assays for those substances. Respondents providing inconsistent information regarding use of one or more of these substances were classified as being discordant drug use reporters. Overall, 29.0% of the sample for which drug assay data were available (n=568) were classified as discordant drug use reporters. This served as the indicator of drug reporting measurement error for this paper.

Analysis: Covariance structure modeling was employed for these analyses. Using the debriefing probes presented in Table 1, a measurement model was constructed to represent three latent variables: respondent comprehension difficulties, memory difficulties, and social desirability concerns. It was hypothesized that two of these six debriefing items would be useful in representing each of these three cognitive processes. The independent effects of each process on the accuracy of substance use reports was simultaneously estimated. The conceptual model to be estimated is presented in Figure 1. Multi-group covariance structure modeling was subsequently conducted to examine similarities and differences in the associations between each process and errors in substance use reporting. The covariance matrices employed in these analyses were constructed using the Prelis 2 software program and the LISREL 8 program (Joreskog and Sorbom, 1993a; 1993b) was employed to conduct all covariance structure modeling.

Results

Respondent answers to each debriefing probe are presented in Table 1. As described earlier, each item was measured on a 7-point scale, and all variables were coded such that higher values represented greater levels of self reported difficulty in responding to the set of drug use questions included in the survey. Each item was skewed such that respondents tended to indicate few difficulties with each cognitive task. The full 7-point scale range was nonetheless employed by respondents in answering each of these probes.

The model depicted in Figure 1 was estimated using all sampled cases for which complete data were available (555 of 627 = 88.5% of all cases). Table 2 presents the coefficients derived from the measurement and structural components of the model, along with several model fit measures. Overall, the data closely fit the specified model ($\chi^2 = 3.72$, $df = 10$, ns; GFI = 1.00; AGFI = 0.99; RMSEA = 0.0; Critical N = 3460). The debriefing probes associated with each latent construct additionally demonstrated a close fit to the specified measurement model (Table 2, panel A). The structural model (panel B) revealed significant associations between two of the three latent variables (memory difficulties and social desirability concerns) and discordant drug use reporting.

There were sufficient numbers of African Americans (n = 233), Latinos (n = 100) and Caucasian (n = 168) respondents with complete data to permit cross-group comparisons of the conceptual model using a multi-group covariance structure model. Results of the multi-group model are shown in Table 3. First examining Panel A, the measurement model appears to have worked well within each of the three race/ethnic groups examined. The structural model, presented in Panel B, does reveal cross-group differences in the associations between cognitive indicators and errors in drug use measurement. Specifically, social desirability difficulties have a positive effect on measurement error among African American respondents only. In contrast, memory difficulties are associated with errors in drug use reporting only among Caucasian respondents. Among Latino respondents, none of the cognitive indicators were found to be associated with reporting error.

A series of nested multi-group models were next estimated to verify whether or not there were indeed race/ethnic differences in the associations between the indicators of cognitive

difficulties and drug use measurement error. In our unconstrained (base) model, all cognitive processes were estimated separately for each ethnic group. In our constrained (nested) models, identical parameters for each specific cognitive process were estimated across all ethnic groups. For each cognitive process, a significant difference in the X^2 Goodness of Fit statistic between the unconstrained and constrained model provides a test of the equivalence of that cognitive process across ethnic groups. (Hayduck, 1987). The overall X^2 model fit for the base model (which was described above and is shown in Table 3) and each nested model, and the X^2 difference statistic associated with each comparison, are shown in Table 4. The comparison, between the base model and a model constraining comprehension effects to be equal across race/ethnic groups was not significant ($X^2_{df=2} = 3.74, ns$). The comparison between the base model and a model constraining memory effects to be equal across groups was significant at the .10 level ($X^2_{df=2} = 5.89, p = .<.10$). This suggests a poorer model fit when the effects of memory problems on measurement error are constrained to be equal across race/ethnic groups. When social desirability concerns are constrained across groups, the model goodness of fit is significantly worse ($X^2_{df=2} = 15.87, p < .01$). Not surprisingly, a final comparison in which all three cognitive indicators were equated across race/ethnic groups also produced a significantly worse overall model fit ($X^2_{df=6} = 27.60, p < .001$).

Discussion

The findings of this paper confirm conventional wisdom regarding substance use reporting, which holds that social desirability concerns are the primary source of measurement error when collecting drug use information via survey research. Subgroup analyses, though, also provide some evidence that memory difficulties are also important, although in this case only among Caucasian respondents, who would appear to be less vulnerable to social desirability issues, relative to minority group members (see below). Another interpretation of these findings should also be considered. Social desirability concerns may have been more evident in this study because they would likely be applicable to very broad sets of drug use questions, making them easily ascertainable via general probes that inquire about “the drug-related questions included in this survey.” Both memory and comprehension difficulties, in contrast, are more

likely to be question-specific, making them less likely to be captured via the types of generic debriefing probes employed in this study. Thus, although it appears clear that social desirability concerns are an important source of measurement error in drug use reporting, additional research will be necessary to more definitively evaluate the degree to which these other dimensions of information processing also contribute to data quality. The use of sets of debriefing probes that are question-specific may be one way to avoid this potential problem.

Also consistent with previous speculation (Johnson and Bowman, 2003), social desirability concerns are found to be more likely to affect the quality of drug use questions among African Americans when compared to respondents from other race/ethnic groups, at least in the U.S. context. Given historical experiences of oppression, discrimination, exploitation (Massey and Denton, 1993), ongoing suspicions regarding the intentions of medical researchers (Friemuth et al., 2001), and the greater risk of criminal prosecution for drug-related offenses (Stone, 1998) experienced by African Americans, greater concerns with privacy, confidentiality and question threat are, of course, a rational reaction. Developing culturally sensitive survey methodologies that acknowledge these concerns presents an important research problem that should be addressed. Doing so is likely to be necessary if the current differences in reporting quality across race/ethnic groups (Johnson and Bowman, 2003) are to be eliminated.

There are several limitations that apply specifically to the interpretation of the causal models presented in this paper. In particular, the dependent measure, concordance, assumes perfect validity for the criterion measure, the drug test; this is clearly not the case. Indeed, drug tests vary with respect to both sensitivity, their ability to detect recent use, as well as specificity, their ability to accurately screen out non-users. Hair tests are insensitive to recent marijuana use. But these limitations are not just applicable to comparisons for marijuana reporting. A number of inconsistencies that might be classified as “over-reporting” (or a lack of self-report specificity) are a direct result of the fact that all drug tests can only detect very recent use of a drug. Any subject reporting use of *any* substance within the past year who did not actually use that substance within a three month period for hair, a three day period for urine, and a 24-48 hour period for oral fluid would have been erroneously classified as a discordant

respondent in this study. First, we note that these type of discordant respondents were relatively rare in comparison to under-reporters. In addition, when we take out over reporters from the discordant group in our analyses (analyses not shown), the results obtained paralleled those presented in this paper. Future analyses will spell out the effect of modifications in the construction of the dependent variable in greater detail.

Another important limitation in the criterion measure is that test participation varied considerably by type of test. The test with the most limited window of detection, oral fluid, had the highest participation rate, while hair and urine testing had the significantly lower participation rates (Fendrich et al., in press). This again speaks to the potential limitations in the validity of the criterion measure used for concordance, since most comparisons employed here are based on the least sensitive test.

There are also concerns that survey respondents may not be able to accurately report, or even be aware of, some of the higher order cognitive processes they routinely employ when answering questions (Nisbett and Wilson, 1977).

This paper nonetheless highlights one potentially valuable framework for organizing a set of debriefing measures to examine social cognition in survey research. In a previous report, we have presented an alternative approach to this same issue (Fendrich et al. 2003). Note that these two reports provide complementary evidence in support of the utility of these measures. This work suggests debriefing measures may provide valuable insight about the quality of substance abuse reporting in epidemiologic surveys.

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Table 1**Debriefing Probes**

	<u>(n)</u>	<u>Mean</u>	<u>SD</u>
<u>Comprehension Probes</u>			
“In general, how much difficulty did you have understanding the drug-related questions included in this survey?”*	(618)	1.71	1.39
“In general, how much difficulty did you have coming up with answers to the drug-related questions in this survey?”*	(619)	1.64	1.21
<u>Memory Probes</u>			
“Please rate how clear your memories were regarding the types of drug-related information asked about in this survey.”**	(620)	1.89	1.36
“How certain are you of the accuracy of your answers to these questions?”**	(620)	1.61	0.98
<u>Social Desirability Probes</u>			
“How threatening did you consider the drug-related questions in this survey to be?”***	(618)	1.61	1.26
“How embarrassing did you consider the drug-related questions in this survey to be?”****	(615)	1.57	1.17

* response options: 1=no difficulty, 7=a lot of difficulty.

** response options: 1=very clear, 7=not at all clear.

*** response options: 1=not at all threatening, 7= very threatening.

****” response options: 1=not at all embarrassing, 7=very embarrassing.

Table 2
Covariance Structure Model of the Relationships Between Information Processing Indicators and Errors in Drug Use Reporting (n = 555)

	<u>Coefficient</u>	<u>(SE)</u>
A. Measurement Model		
<u>Comprehension</u>		
1. Difficulty understanding drug questions	1.00 ^a	---
2. Difficulty answering drug questions	1.1.6	(0.14)***
<u>Memory</u>		
3. How clear were memories	1.00 ^a	---
4. How certain of accuracy of answers	0.74	(0.03)***
<u>Social Desirability</u>		
5. How threatening were drug questions	1.00 ^a	---
6. How embarrassing were drug questions	0.92	(0.03)***
B. Structural Model		
1. Effects of comprehension on reporting error	-0.01	(0.04)
2. Effects of memory on reporting error	0.07	(0.03)*
3. Effects of social desirability on reporting error	0.09	(0.03)**

Model fit statistics: $R^2 = 0.02$; $\chi^2 = 3.72$, $df = 10$, ns; GFI = 1.00; AGFI = 0.99; RMSEA = 0.0; Critical N = 3460.

^a fixed parameter.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 3
Multi-Group Covariance Structure Model of the Relationships
Between Information Processing Indicators and Errors in Drug Use Reporting

	<u>African Americans</u>		<u>Caucasians</u>		<u>Latinos</u>	
	<u>Coefficient</u>	<u>(SE)</u>	<u>Coefficient</u>	<u>(SE)</u>	<u>Coefficient</u>	<u>(SE)</u>
A. Measurement Model						
Comprehension						
1. Understand	1.00 ^a	--	1.00 ^a	--	1.00 ^a	--
2. Answer	0.80	(0.04)***	2.84	(0.54)***	0.87	(0.07)***
Memory						
1. Memory	1.00 ^a	--	1.00 ^a	--	1.00 ^a	--
2. Certain	1.44	(0.15)***	0.64	(0.05)***	0.76	(0.06)***
Social Desirability						
1. Threat	1.00 ^a	--	1.00 ^a	--	1.00 ^a	--
2. Embarrassment	0.93	(0.05)***	0.94	(0.06)***	0.86	(0.06)***
B. Structure Model						
1. Effects of Comprehension	-0.01	(0.03)	0.46	(0.26)	0.02	(0.06)
2. Effects of Memory	-0.05	(0.09)	0.20	(0.07)**	0.02	(0.06)
3. Effects of Social Desirability	0.24	(0.05)***	0.12	(0.07)	-0.07	(0.06)
C. Group Model Statistics						
R^2	0.08		0.11		0.01	
X^2 (df)	8.42		9.62		28.01	
GFI	0.99		0.98		0.93	
(<i>n</i>)	(233)		(168)		(100)	

^a fixed parameter. ** $p < .01$, *** $p < .001$. $X^2 = 46.05$; $df = 35$, ns; RMSEA = 0.04; Critical N = 621.

Table 4
Assessment of Nested Models Designed to Test
for Race/Ethnic Group Differences in Structural Parameters

	<u>Model X^2</u>	<u>(df)</u>	<u>Difference</u> <u>of X^2</u>	<u>(df)</u>
0. Base model – all structural parameters free across race/ethnic groups	46.05	(35)	---	---
1. Comprehension effects equated across race/ethnic groups	49.79	(37)	3.74	(2)
2. Memory effects equated across race/ethnic groups	51.92	(37)	5.87	(2)
3. Social desirability effects equated across race/ethnic groups	61.92	(37)	15.87**	(2)
4. All three effects equated across race/ethnic groups	73.65	(41)	27.60***	(6)

* $p < .05$

** $p < .01$

*** $p < .001$

Figure 1
Conceptual Model of the Relationships Between Information Processing
Indicators and Errors in Drug Use Reporting

