The Effect of Interviewer Experience on the Interview Process in the National Survey on Drug Use and Health

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Introduction

Analysis of survey data from the National Survey on Drug Use and Health (NSDUH) has shown a relationship between field interviewer (FI) experience, response rates, and the prevalence of self-reported substance use (Substance Abuse and Mental Health Services Administration [SAMHSA], 2000; Hughes, Chromy, Giacoletti, and Odom, 2001, 2002; Eyerman, Odom, Wu, and Bulter, 2002). These analyses have shown a significant and positive relationship between the amount of prior experience an FI has with collecting NSDUH data and the response rates that a FI produces with his or her workload. These analyses have also shown a significant and negative relationship between the amount of prior experience of an FI and the prevalence of substance use reported in cases completed by that FI. In general, these analyses have been consistent with the published literature that FIs can influence both the success of the data collection process and accuracy of the population estimates (Stevens and Bailar, 1976; Singer, Frankel and Glassman, 1983; Martin and Beerteen, 1999).

The previous NSDUH analyses have examined response rates and prevalence rates independently. This has made it difficult to determine if the lower prevalence rates for experienced FIs are a result of the change in the sample composition due to higher response rates or if the lower prevalence rates are a result of a direct effect of FI behavior on respondent self-reporting. This analysis combines these two explanations to produce a conceptual model that summarizes our expectations for the relationship between FI experience and prevalence rates. The combined explanation from the conceptual model is evaluated in a series of conditional models to examine the indirect effect of response rates and the direct effect of FI experience on prevalence rates.

Overview of NSDUH

NSDUH is the federal government's primary source of information on substance use in the U.S. household population aged 12 and older. The survey, conducted since 1971, has been sponsored by

SAMHSA since 1992. RTI International[1] has served as the data collection contractor since 1988. The NSDUH design is a multi-stage area probability sample of approximately 67,500 respondents per survey year that targets a respondent universe of non-institutionalized civilians aged 12 and older within the 50 states and the District of Columbia. Although the survey is conducted annually, the household sample is selected and fielded quarterly. Data from the survey are used by policymakers and researchers to measure the prevalence and correlates of drug use, to identify and monitor trends in substance use, and to analyze differences by population subgroups.

Household screening and interview respondent selection procedures are conducted with a hand-held computer. The NSDUH questionnaire is then administered via laptop computer using audio computer-assisted self-interviewing (ACASI) for the more sensitive questions and computer-assisted personal interviewing (CAPI) for the remainder of the questions. The instrument collects information about tobacco, alcohol, and drug use; knowledge and attitudes about drugs; mental health, and other health-related issues.

The NSDUH Conceptual Model

The FI can affect the data collection process at both the screening and the interview stages of the survey. For example, the FI may manipulate the eligibility rule during the screening stage to systematically remove dwelling units with a trait that he or she believes indicates they will be hard to complete. This will improve his or her response rates and costs per interview but will also affect prevalence rates if the trait is correlated with self-reported drug use. The same FI can affect the prevalence rate at the interview stage. For example, if he or she follows all the project protocols and is skilled at contacting and gaining cooperation, he or she will reduce nonresponse error and generate more representative estimates. However, he or she may also manipulate the protocol to gain cooperation or reduce the time required to conduct the survey, which may lead to greater measurement error.

Figure 1 shows the relationship between FI experience and prevalence rates for the full process

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[1] RTI International is a trade name of the Research Triangle Institute.

of screening and interviewing on the NSDUH. This model, based on Groves and Couper (1998) model allows us to distinguish between direct and indirect effects of FI experience on prevalence estimates. The first set of behaviors is indirect. That is, the increase or decrease of bias introduced in the prevalence rates comes through some intermediate step (for example, through increasing cooperation rates). The second set of behaviors shows the direct effects of experience on prevalence estimates. Estimates can be positively influenced by the FI's ability to serve as a "credible agent" for the survey request. His or her knowledge of the interview and ability to communicate effectively with the respondent can significantly decrease the effects of social desirability, which will reduce the bias on the prevalence estimate. At the same time, however, FIs might use their knowledge to manipulate the respondents' awareness of the protocols in order to gain cooperation. The lack of a full awareness of protocols could increase respondents' social desirability concerns and increase the bias on the estimate.
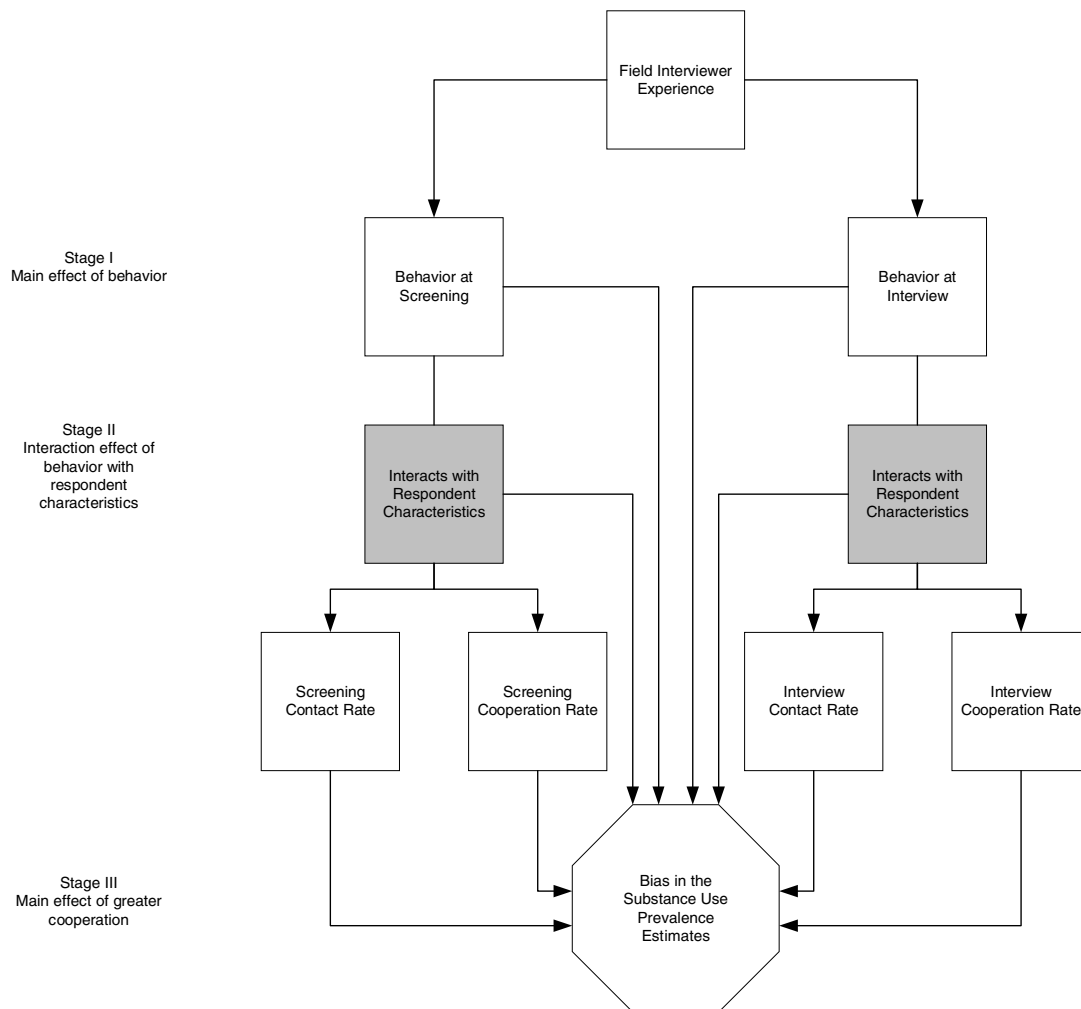

Figure 1. **Model of the paths of influence of field interviewer (FI) experience on prevalence estimates in the National Survey on Drug Use and Health (NSDUH).**

Statistical Analysis

Using the conceptual model as a guideline, statistical models were created to evaluate the relationship between FI-level measures and response/prevalence rates, while controlling for demographic and other available covariates. FI experience was investigated in a series of separate models that were conditionally based on the sequence of screening and interviewing events that is portrayed in Figure 1. This allowed for the exploration of the interrelationships of FI experience at different levels of the interviewing process. Each step was modeled using weighted logistic regression in SUDAAN with the appropriate design-based survey weights. In order to tie each step together, the weight in each model was adjusted using response propensities based on the previous models. Although each step of the interviewing process is of interest, our ultimate goal was to see how prevalence rates were affected by FI experience given each of the previous interviewing steps. Table 1 contains a detailed description of the statistical models.

Table 1. Conditional Models Investigating FI Experience

Model	Dependent Variable	Level of Design-Based Weight
1	Contacting household	Household
2	Gaining household cooperation (i.e., successful screening)	Contacted household
3	Contacting selected person in household	Selected person
4	Successfully interviewing selected person	Contacted person
5	Responding person reports substance use	Respondent

Description of Variables

In an attempt to explain the effect of FI experience on response and prevalence rates, the available data from 1999-2001 NSDUHs were collected and transformed into usable datasets that could be analyzed. The screening and interview data were grouped into the conceptual framework based on Groves and Couper's model (1998). The conceptual model explains the process of survey participation as the interaction between the respondent and the FI, which is influenced by four factors: social environment, householder (respondent) characteristics, FI characteristics, and

survey design. When investigating how respondents report drug use, a model of substance use was used based on past NSDUH experience. The data sources used for the analysis include: segment-level census data, FI demographics, design characteristics, selected person characteristics collected during the screening stage of the interview, and respondent interview data.

The variables included in the model were based in part on the Groves and Couper (1998) model for survey participation and previous NSDUH experience for predictors of substance use. The following variables were used in the models:

> **Environment**: Segment-level characteristics (based on updated Census data), including Census region, population density, Hispanic concentration, non-Hispanic Black concentration, and percentage of dwelling units that are owner-occupied.
> **Survey Design**: Survey year, number of persons selected in household, and whether segment was included in the 2001 Incentive Experiment (IE)[2].
> **Substance Use**: Respondent age, race/ethnicity, marital status, education, and family income.
> **Respondent Characteristics**: Selected person race, gender, and age category (where available).
> **FI Characteristics**: Race, gender, age category, and experience level of the FI.

FI experience was defined in two ways. The first way reports the number of *screenings* an FI has conducted since January 1, 1999[3] and is classified into the following three categories:

> *Inexperienced*=0 to 119 screenings since 1999 (for 1999 survey: no experience prior to 1999)
> *Experienced* =120 to 299 screenings since 1999 (for 1999 survey: any experience prior to 1999)
> *Highly Experienced*=300+ screenings since 1999

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[2] In quarters 1 and 2 of 2001, an Incentive Experiment (IE) was conducted within a subset of the NSDUH households. As expected, the incentive groups had significantly higher response rates. Therefore, it was important to distinguish effects of this experiment from FI effect in our models (SAMHSA, 2002).
[3] In 1999, the survey underwent dramatic changes including a change in the instrument (from paper-and-pencil to computer-assisted interviewing) and an increased in sample size (from approximately 25,000 to 67,500). As a result, FI experience is measured since this changed occurred.

The second way reports the number of interviews an FI has conducted since January 1, 1999 and was classified into the following three categories[4]:

Inexperienced=0 to 39 interviews since 1999 (for 1999 survey: no experience prior to 1999)
Experienced=40 to 99 interviews since 1999 (for 1999 survey: any experience prior to 1999)
Highly Experienced=100+ interviews since 1999

Results
Model 1
The first step in the screening process is to make contact with the household given that the household is eligible. Household contact was modeled based on this definition (see Table 2). Our interest was in seeing the effect of FI experience on household contact while controlling for other variables[5]. Highly experienced FIs had significantly higher odds of contacting a household than did inexperienced FIs (OR = 1.54). FIs with experience (120-299) had slightly higher odds of contacting a household than did inexperienced FIs, though this difference was nonsignificant.

Model 2
After contacting the household, the next step in the screening process is to complete a successful screening. Successful screening is conditional on eligibility and contacting the household. That is, Model 2 is conditional on Model 1. In the logistic model, design-based household survey weights were used, and these weights were adjusted by the predicted propensity taken from Model 1 in order to account for the first stage of the interviewing process. More specifically this analysis was limited to contacted households and the weight was divided by the predicted propensity taken from Model 1. Experienced and highly experienced FIs have increasingly higher odds of successful screening at a household (OR = 1.16 and OR = 1.43, respectively) than inexperienced FIs (see Table 2).

Model 3
After a successful screening, the next step in the interviewing process is to contact the selected

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[4]The screening and interviewing FI experience variables were defined under the general principle that approximately 3 attempted screening are required for each completed interview (3:1 ratio) in the NSDUH.

[5] While each model contained the covariates listed in the description of variables section (where available), this paper will only present the results of the field interviewer experience variable.

person(s) in the household. Contacting the selected person is conditional on household eligibility, household contact, and successful screening. That is, Model 3 is conditional on Models 1 and 2. The analysis was limited to selected persons and the weight in this model was divided by the predicted propensity taken from Models 1 and 2 in order to account for the first two stages of the interviewing process. Highly experienced FIs had significantly higher odds of contacting the selected person (OR = 1.14) than did inexperienced FIs (see Table 2). Similar to Model 1, experienced FIs did not show a significant relationship with contact rates. This may suggest that FIs need to be highly experienced before developing the skills that allow them to better contact households or persons.

Model 4
After contacting the selected person within a household, the next step in the interviewing process is to successfully interview the selected person (i.e., the selected person completes the questionnaire). A usable case rule was used to determine whether an interview was successful. A respondent was required to answer a certain number of core questions in order for the interview to be considered complete.[6] A successful interview is conditional on household eligibility, household contact, successful screening, and contacting the selected person. More specifically, Model 4 is conditional on Models 1-3. In Model 4 the analysis was limited to contacted persons and the weight used was a response propensity adjusted weighted from Model 3. Table 2 shows the result of this logistic model. Experienced and highly experienced FIs have increasingly higher odds of obtaining a successful interview (OR = 1.11 and OR = 1.33, respectively) than do inexperienced FIs.

Effect of FI Experience on Overall Response Rates
Assuming independence of the four rates (screening contact, screening completion, interview contact, and interview completion), an overall response rate can be computed as the product of the four rates. Models 1 through 4 used logistic regression to adjust for other covariates that were expected to influence response rates and estimated the impact of FI experience at the three defined levels (inexperienced, experienced, and highly experienced) after adjusting for these covariates. The logistic regression, however, provided estimates of the relationship among the FI experience effects in terms

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[6] The NSDUH usable case rule requires that the lifetime cigarette question and nine out of the remaining lifetime drug use questions be answered.

of the estimated beta coefficients of the logistic regression model or in terms of estimated odds ratios, but does not provide estimates of the level of the response rate by interview experience.

Table 2. FI Experience Results from Models 1-4.

	Beta	P-Value (Beta)	Odds Ratio
Model 1 (Contacting Household)			
FI Experience			
Inexperienced (RC)	0.00	.	1.00
Experienced	0.09	0.2131	1.10
Highly Experienced	0.43	<0.0001	1.54
Model 2 (Successful Screening)			
FI Experience			
Inexperienced (RC)	0.00	.	1.00
Experienced	0.15	<0.0001	1.16
Highly Experienced	0.36	<0.0001	1.43
Model 3 (Contacting Selected Person)			
FI Experience			
Inexperienced (RC)	0.00	.	1.00
Experienced	-0.04	0.4152	0.96
Highly Experienced	0.13	0.0005	1.14
Model 4 (Interviewing Selected Person)			
FI Experience			
Inexperienced (RC)	0.00	.	1.00
Experienced	0.10	0.0020	1.11
Highly Experienced	0.29	<0.0001	1.33

RC = Reference Cell

For each model, weighted estimates of the population size associated with each FI experience level were estimated by summing the adjusted weights for eligible sample dwelling units (Model 1), for contacted eligible sample dwelling units (Model 2), for eligible sample persons (Model 3), or for contacted eligible sample persons (Model 4). The level of the adjusted response rates by FI experience categories was set by requiring that their weighted average equal the unadjusted average for the whole population. Symbolically, this additional constraint can be written as:

$$\frac{\sum_{i=1}^{3} w_i r_i^{adj}}{\sum_{i=1}^{3} w_i} = \bar{r}$$

where w_i is the estimated population size for FI experience level i, r_i^{adj} is the adjusted response rate for FI experience level i, and $\bar{r}$ is the unadjusted response rate over all three levels of FI experience. With this additional constraint, the adjusted rate for FI experience level 1 was first set arbitrarily and the odds ratios for levels 2 and 3 were used to obtain the adjusted rates for levels 2 and 3. The weighted sum was then compared to the overall unadjusted rate. Iterative interpolation was then used to adjust the level 1 rate and recompute the level 2 and 3 rates until the constraint above was satisfied. Table 3 shows the results of these computations and the products of the four rates as an overall response rate. Inexperienced FIs achieved an (adjusted) response rate of 61.1%. Experienced FIs achieved an adjusted response rate of 63.5%, an increase of 2.4% over the inexperienced FIs. Highly experienced FIs achieved an (adjusted) response rate of 68.4%, an increase of 4.9% over experienced FIs and 7.3% over inexperienced FIs.

Table 3. Adjusted Response Rate at Each Interview Stage, by FI Experience.

	Interview Stage	Inexperienced	Experienced	Highly Experienced
		FI Experience		
1	Contacting HH	0.9629	0.9661	0.9756
2	Gaining HH Cooperation/ Successful Screening	0.9285	0.9378	0.9489
3	Contacting Selected Person	0.9372	0.9348	0.9445
4	Interviewing Selected Person	0.7296	0.7497	0.7821
	Overall Response Rate	0.6113	0.6349	0.6838

HH = Household

Model 5

After a selected person responds to the interview, the next step in the interviewing process is to measure substance use. In this case, reports of drug use are the variables of interest; they are categorized by lifetime use, past year use, and past month use. Model 5 is conditional on each of the four previous models and is limited to complete respondents. The person weight used was taken from Model 4 and then adjusted by dividing the weight by the response propensity of the fourth model. Models were run on

a number of substance use measures[7]; however, only lifetime use of any illicit drugs is reported here. Our model contains known sociodemographic correlates of substance use based on previous NSDUH experience with the addition of FI characteristics and FI experience.

Table 4 shows the result of the model for any lifetime illicit drug use. Experienced and highly experienced FIs have increasingly lower odds of a respondent's reporting any illicit lifetime usage (OR = 0.91 and OR = 0.83, respectively) than inexperienced FIs.

Similar to the estimation of the FI experience effect on actual response rates, comparable methodology was developed to estimate the experience effect on substance use rates. Adjusted prevalence rate estimates were developed for the selected substance use measures analyzed using Model 5. In this case, adjusted respondent weights were summed for each FI experience level. Then the weighted average of the adjusted prevalence rate estimates by experience level was required to equal the unadjusted prevalence rate for the entire population. These adjusted prevalence rate estimates by level of FI experience are shown for any illicit drug use by lifetime, past year, and past month use in Table 5. Again, a number of substances were analyzed; however, only any illicit lifetime use is reported. Without exception, the adjusted prevalence rates for the six substances studied decreased as FI experience increased.

Table 4. Model 5—Probability of Respondent Reporting Drug Use (Any Illicit Lifetime) Given Models 1-4.

Variable	Beta	P-Value (Beta)	Odds Ratio
FI Experience			
Inexperienced (Reference Cell)	0.00	.	1.00
Experienced	-0.09	0.0003	0.91
Highly Experienced	-0.19	<0.0001	0.83

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[7] The substances analyzed include lifetime, past year, and past month use of any illicit, any psychotherapeutic, marijuana, pain relievers, alcohol, and cigarettes.

Table 5. Adjusted and Marginal Prevalence Rates (Any Illicit Use) by FI Experience.

	FI Experience		
	Inexper-ienced	Exper-ienced	Highly Experienced
Lifetime			
Adjusted	0.42466	0.40177	0.37977
Marginal	0.42466	-0.19157	0.09408
Past Year			
Adjusted	0.12688	0.11656	0.10665
Marginal	0.12688	-0.15095	-0.02196
Past Month			
Adjusted	0.07003	0.06383	0.06061
Marginal	0.07003	-0.09686	0.01883

Summary

The impact of increased FI experience was to simultaneously increase response rates and decrease estimated prevalence rates. What could explain these observed phenomena? Three possible hypotheses are summarized below:

Hypothesis 1: The decrease in reported substance use can be explained by lower reporting by the additional selected persons who respond to FIs who have more experience.
Hypothesis 2: Persons interviewed by more experienced FIs generally report lower substance use regardless of their propensity to respond.
Hypothesis 3: The decrease in prevalence rates associated with more experienced FIs is explained by some mix of lower substance use reporting by new respondents and lower substance use reporting by all respondents.

If we accept hypothesis 1, then selected persons who respond to inexperienced FIs would report the same substance use when interviewed by more experienced FIs. This assumption was applied to computing a marginal prevalence rate for the additional persons who respond to experienced and highly experienced FIs. Recall from earlier that inexperienced FIs achieved overall response rates of 61.1%, experienced FIs increased the response rate by 2.4%, and highly experienced FIs increased the response rate by an additional 4.9%. The marginal rates shown in Table 5 for experienced and highly experienced FIs are the rates that would have to be reported by the additional respondents in order to achieve the adjusted rates projected by Model 5. As an example, the prevalence rate of lifetime any illicit use reported to inexperienced FIs is 42.5%. A marginal rate for the additional respondents would have to be -19.2% in order to achieve an average

prevalence rate of 40.2% for persons interviewed by experienced FIs. This can be verified by noting that the weighted average for initial respondents to inexperienced FIs and additional respondents obtained by experienced FIs can be computed as the following weighted average:

$$\frac{61.1}{63.5}*42.5+\frac{2.4}{63.5}*-19.2=40.2$$

and corresponds to the adjusted rate for experienced FIs. Similarly, the weighted average of the marginal rates over all three groups corresponds to the adjusted rate for highly experienced FIs.

$$\frac{61.1}{68.4}*42.5+\frac{2.4}{68.4}*-19.2+\frac{4.9}{68.4}*9.41=38.0$$

The solutions for the marginal rates are obtained algebraically by solving simultaneous linear equations.

The marginal rates in Tables 5 follow from the assumption that hypothesis 1, as defined above, explains the impact of additional FI experience[8]. For the substance reported, lifetime use of any illicit drug, the algebraic solution leads to a negative marginal rate, which is clearly impossible. Yet for other substances examined but not reported, the marginal rates seem more plausible. Nevertheless, the marginal rates may be too extreme to support the reasonableness of hypothesis 1. It appears more likely that FI experience influences reporting of substance use through other mechanisms than just the increased response rates.

Conclusions

In conclusion, our analysis shows that increased FI experience simultaneously increases response rates and decreases prevalence rates. In addition, the effect of increased FI experience on prevalence rates cannot be fully explained by the adjustments based on earlier models (i.e., screening and interview level) to the final prevalence rate model. In other words, the FI effect on prevalence rates cannot be fully attributed to the increase in response rates by experienced FIs. Furthermore, FI experience was significant in the final model, showing that our covariates also did not account for all the decrease in prevalence rates. In the previous section, three hypotheses were given as

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[8] Please note that the estimates of the marginal rates are based on small sample sizes and no estimates of their standard errors have been derived.

possible explanations for the decrease in prevalence rates. As was shown in the statistical analysis section, the marginal rates are too extreme to support the first hypothesis. This means that although some level of selection bias may be occurring, it is not the only cause of the decrease in prevalence rates for experienced FIs. More likely, the relationship between FI experience and prevalence rates is captured in hypothesis 3—that is, the decrease in prevalence rates for experienced FIs is a function of lower substance use reporting by the additional respondents they obtain and also the remaining respondents that FIs with all levels of experience interview.

These results have important implications for survey methodology in general and more specifically for the NSDUH. It is important to reduce any type of selection bias present in a survey, and maintaining high response rates is the key to this goal. If our assumption in hypothesis 3 is true that experienced FIs are obtaining interviews from respondents who are more likely to report lower substance use, this is an important methodological concern. Currently, weighting techniques are used to estimate these nonrespondents. However, if the nonrespondents are fundamentally different than the respondents and the weights are not able to capture this, bias will be introduced into our estimates. Furthermore, a high standard of interviewing is also key to reducing bias and it is important that the FIs strictly follow survey protocol. It is believed that the inexperienced FIs follow interview protocol more closely than experienced FIs due to the tailoring that the experienced FIs begin to use after gaining experience on the survey. For example, one tailoring method that breaches survey protocol is FIs' telling the respondent that saying "no" to drug gate questions makes the interview go faster. This behavior can negatively affect prevalence rates and, as a result, is a threat to the validity of the survey. Ensuring that FIs strictly follow survey protocol can be achieved through rigorous training and observations throughout the year.

This paper provides a comprehensive analysis of NSDUH FI experience and expands the previous analysis that investigated separately prevalence and response rates in relation to FI experience. Yet there are limitations to this work. FI behaviors, which are an important component of the conceptual model, were not accounted for due to inadequate data. Any future analysis will hopefully use an additional data source that will address FI behaviors namely field observations which started in a limited scale in the 2001 survey and were expanded in the 2002 survey and beyond. Another important improvement to any future analysis would be the creation of a more

sensitive measure of experience that incorporates more than the number of screenings or interviews conducted. For instance, it has been suggested that FIs who conduct a small number of interviews and then terminate employment conduct interviews differently than FIs who are employed for a substantial amount of time. If this is true, then the early interviews conducted by each group should be analyzed separately and not be combined together in the "inexperienced" group. Another suggestion is to analyze the relationship between prevalence rates and FI attrition to determine if the areas with higher substance use are more likely to experience FI turnover. Further analysis is planned to verify whether the decrease in reporting substance use occurs within FIs as they gain expertise or whether other factors interact with FI retention rates to create an artificial association of FI experience with substance use.

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