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The effects of using answer sheets on reported drug use and data quality in a classroom survey: A cluster-randomized study

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ABSTRACT

Background: We compare self-reported prevalence of drug use and indicators of data quality from two different response modes (with and without an independent answer sheet for recording responses) in a survey conducted in 2015 among secondary school students.

Methods: Stratified cluster-randomized study conducted among students in grades 8–12 from public, private and subsidized schools in Chile (N = 2317 students in 122 classes). Measurements included were: percentage reporting substance use (tobacco, alcohol, marijuana, cocaine, ecstasy); number of inconsistent responses; number of item nonresponses; percentage of extreme reports of drug use; percentage reporting using the nonexistent drug, *relevón*; and completion times.

Results: Compared with those who responded directly in the questionnaire booklet, students who used a separate answer sheet took 17.6 more minutes (95% confidence interval [CI]: 14.4–20.8) to complete the survey and had on average 1.5 more inconsistent responses (95%CI: 0.91–2.14). The prevalence and variance of drug use was higher among those who used an answer sheet for all substances except tobacco; the prevalence ratio (PR) of reported substance use for low-prevalence substances during the past year were: cocaine PR = 2.5 (95%CI: 1.6–4.1); ecstasy PR = 5.0 (95%CI: 2.4–10.5); *relevón* PR = 4.8 (95%CI: 2.5–9.3).

Conclusions: Using an answer sheet for a self-administered paper-and-pencil survey of drug use among students result in lower quality data and higher reports of drug use. International comparison of adolescent drug use from school-based surveys should be done with caution. The relative ranking of a country could be misleading if different mode of recording answers are used.

1. Introduction

Early initiation of substance use is associated with long-term health risks, including an increased likelihood of substance-use disorders in the future and related psychiatric disorders (Cho et al., 2007; McGue and Iacono, 2005). Monitoring the patterns of substance use among school-aged adolescents is important for understanding the magnitude and trend of the problem of early substance use and for identifying targets for evidence-based drug-prevention programs. National surveys of substance use among secondary school students are used to produce estimates that serve these purposes. Producing estimates that are accurate, precise and comparable over time is crucial to monitoring current use and time trends.

According to the 2015 Report of Drug Use in the Americas, Chile has the highest prevalence of use of cocaine, cocaine paste, marijuana and tobacco among school-age children (Observatorio Interamericano de Drogas, 2015). With the exception of marijuana, which has increased rapidly in the past years, Chile has had a consistently higher prevalence of drug use among secondary students (survey with self-administered paper-and-pencil questionnaire), but not necessarily in the general population (survey with face-to-face interview). These results raise concerns about the validity, precision and comparability of the Chilean measurements, in particular regarding the school population.

1.1. School surveys on substance use

In school settings, self-administered surveys targeting students have traditionally been implemented in the classroom, using paper-and-

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pencil, and some times using machine-readable answer sheets (Centers for Centers for Disease Control and Prevention, 2016; United Nations Office on Drugs and Crime, 2003; United Nations Office on Drugs and Crime, 2015). Compared to the more typical questionnaire booklets (that can include standardized or non-standardized marks, depending on the survey), the answer-sheet strategy is considered cheaper (e.g., less paper to print) and faster (e.g., machine captured instead of human keying). Additionally, students are familiar with this format that is commonly used for standardize testing.

Surveys using booklets include the national surveys of substance use among secondary school students conducted in Uruguay, Argentina, Spain, Ontario province in Canada, Europe, and the United States (Boak et al., 2013; Hibell et al., 2012; Miech et al., 2015; Observatorio Argentino de Drogas, 2014; Observatorio Uruguayo de Drogas, 2014; Plan Nacional de Drogas, 2012). Surveys using a separate answer sheet to record responses include those conducted in Chile, some state or city versions of the U.S. Youth Risk Behavior Survey, the Global School-based Student Health Survey, and the Global Youth Tobacco Survey (Centers for Disease et al., 2013; Centers for Disease Control and Prevention, 2016; Global Youth Tabacco Survey Collaborative, 2002; Observatorio Chileno de Drogas, 2014; World Health Organization, 2016).

Research on the quality and comparability of substance-use survey data across these two modes remains scarce. Studies of mode effects have compared reported drug use from surveys completed on paper versus computer (Beck et al., 2014; Hallforsa et al., 2000), by mail versus on the web (Callas et al., 2010; McCabe, 2004; McCabe et al., 2002), and by phone versus other modes (Link and Mokdad, 2005; Marcano Belisario et al., 2015). Other outcomes, such as nonresponse (Kongsved et al., 2007; Rolstad et al., 2011) and completion times (Rolstad et al., 2011), have also been compared across modes. To the best of our knowledge no previous studies have explicitly evaluated the potential impact of using a separate answer sheet as a mode of data collection on a survey's results or data quality.

1.2. Survey response process model

The survey methods literature provides a useful framework to think about mechanisms that could help explain how the use of an answer sheet to record survey responses could affect the quality of self-reports of drug use (and likely other sensitive topics) in the school setting. The survey response process model (Cannell et al., 1981; Strack and Martin, 1987; Tourangeau, 1984; Tourangeau et al., 2000) stipulates that, after hearing a survey question, respondents have to "understand" the question, "retrieve" the relevant information asked for, make a "judgment" as to what answer to provide, and finally "map" the response to the required format. Respondents go through this process with more or less involvement and not necessarily in this order. Survey questions and modes of data collection could also pose stronger demands on different parts of the process.

Fig. 1 illustrates a model of the cognitive mechanisms that help explain the effects of using a separate answer sheet to record responses to sensitive behaviors in a school-based setting. We hypothesized that the use of an answer sheet influences two of the four processes in the survey response model – judgment and mapping.

Regarding the judgment process, the use of an answer sheet to record responses – instead of a questionnaire booklet – should reduce the risks of disclosure by making it more difficult for a third party to see the questions and their corresponding answers. The reduced risk of disclosure may increase the sense of privacy, that should help increase the reports of sensitive behaviors such as drug use, and reduce item nonresponse to these questions.

Regarding the mapping process, using an answer sheet imposes a more difficult task on the respondent – which is first having to locate the place where to mark the responses, and then mark them carefully to comply with the specifications for optical scanning. Just on the operational side having to perform these tasks requires additional time, and thus we expect that respondents using an answer sheet would show longer completion times than respondents using a questionnaire booklet. Taking more time to respond could increase item nonresponse if respondents do not have the time to respond all the survey questions. Item nonresponse increases the variance of the survey estimates (by effectively reducing the sample size) and it could bias the survey reports if the missing data mechanism is not missing at random. As the survey takes longer, respondents probably get tired which could reduce their concentration and commitment to the survey task. A reduction in concentration could produce an increase in inconsistent responses, whereas a decrease in commitment could give rise to random responses (variance) or careless responses (such as reporting a fake drug, or extreme reports of use of drugs).

This study aimed to estimate the effects that using a direct versus answer sheet approach to record responses (currently under use in Chile) had on completion times, data quality (i.e., item nonresponse, inconsistent responses, extreme reports of drug use, reporting use of a fake drug), and the prevalence of reports of substance use. The study also aimed to examine whether differences in completion time mediated the effect of response modality on data quality and whether differences in completion time and data quality mediated the effect of response modality on reported prevalences of substance use. The study used data from a fully randomized experimental design conducted in a school-based setting following the same data collection protocols as those of the Chilean National Drug Surveys among Secondary Students (NDSSS).

2. Methods

2.1. Design and procedures

This was a stratified, cluster-randomized study conducted in 2015 in which classrooms of students in the same grade comprised the clusters. To avoid potential contamination among subjects, we randomized classrooms instead of students, either to the treatment condition, corresponding to the alternative method under evaluation (i.e., marking nonstandardized responses in the questionnaire booklet), or to the control condition, corresponding to the current method used to record responses in the Nation Drug Survey among School Students (NDSSS) conducted every two years since 2001 (i.e., marking responses on a separate answer sheet). Fig. S1 in the supplemental material shows an example of both methods used in this study.

All other aspects of data collection were exactly the same for both the treatment and control groups, following the procedures of the 10th version of the NDSSS (Observatorio Chileno de Drogas, 2014). The survey has a self-administered paper-and-pencil questionnaire without skips, which is implemented in the classroom by trained pollsters; teachers and other school authorities are not allowed in the classroom during the survey. When students finish responding, they deposit the answer sheet (control group) or questionnaire (treatment group) in a sealed cardboard box.

All ethical safeguards relevant to human participants were met. We requested written authorization from school principals and, when requested by school authorities, we sent a passive informed consent letter to the parents of children in the selected classes. Pollsters informed students about the study's objectives and explained that the survey was completely anonymous and voluntary and that the data would be handled under strict confidentiality protocols in accordance with national legislation (Ministerio Secretaría General de la Presidencia, 1999).

2.2. Sample

Fifteen sampling strata were created by combining the three types of schools (public, private and subsidized schools) and the 5 grades