Schizophrenia Research xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Schizophrenia Research

journal homepage: www.elsevier.com/locate/schres

Latent class analysis of discordance between results of drug use assessments in the CATIE data

Kiersten L. Johnson [a,*], Sarah L. Desmarais [a], Marvin S. Swartz [b], Richard A. Van Dorn [c]

[a] Department of Psychology, North Carolina State University, Campus Box 7650, Raleigh, NC 27695, United States
[b] Department of Psychiatry & Behavioral Sciences, Duke University Medical Center, 238 Civitan Building, Box 3173, Durham, NC 27710, United States
[c] Behavioral Health Epidemiology Program, RTI International, 3040 E. Cornwallis Road, P.O. Box 12194, Research Triangle Park, NC 27709, United States

ARTICLE INFO

Article history:
Received 6 June 2014
Received in revised form 11 November 2014
Accepted 17 November 2014
Available online xxxx

Keywords:
Assessment
Drug use
Latent class analysis
Schizophrenia

ABSTRACT

Objective: The primary aim is to examine concordant/discordant results of drug use assessments in adults with schizophrenia.
Methods: Latent class analysis and multinomial logistic regression were used to examine concordance/discordance between drug use measures and identify characteristics differentiating participants across classes.
Results: Four classes – *non-users*, *users*, *probable users*, and *RIA discordant* – fit best. Age, sex, race/ethnicity, and psychiatric symptoms differed significantly across classes.
Conclusions: Findings showed that discordance between results occurs at non-trivial rates and is, in part, attributable to individual characteristics. Results suggest the need for strategies to limit discordance and improve detection of drug use in adults with schizophrenia.

1. Introduction

The co-occurrence of schizophrenia and illicit drug use is associated with adverse outcomes such as violence, homelessness, and treatment noncompliance (Swofford et al., 2000; Swanson et al., 2006; Reimherr et al., 2010). Accordingly, accurate identification of illicit drug use is critical for research and clinical practice (Drake et al., 1989; Carey and Correia, 1998; Bennett, 2009). Frequently used measures include self-report, collateral report, clinician interviews, and biological tests.

Such measures are increasingly used in combination to improve identification of drug use. Though this approach may increase detection rates (Drake et al., 1990; Swartz et al., 2003), it introduces the potential for discordance, when measures disagree in their classification of drug use or non-use. Convention has been to classify an individual as drug using if at least one measure produces a positive result (Bahorik et al., 2013; Drake et al., 1990; Swartz et al., 2003). However, doing so may result in the misallocation of limited treatment resources to *non-users* in cases of false positives. Alternatively, it may preclude treatment or reduce housing options (Drake et al., 2001; Brunette et al., 2004). Moreover, false positives may overestimate the prevalence of drug use in epidemiological research and misinform related policies.

2. Methods

2.1. Study design and sample

We used baseline data from the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) study, a randomized clinical trial examining antipsychotic medication effectiveness in adults with schizophrenia ($N = 1460$). Study design and protocol are provided elsewhere (Stroup et al., 2003).

2.2. Measures

2.2.1. Drug use measures

The use of marijuana, cocaine, opiates, PCP, amphetamines, and other illicit drugs was assessed at baseline using: (1) self-report (participants' self-reported drug use in the prior three months); (2) collateral report[1] (family members/caregivers' ratings of participants' drug use in the prior month); (3) clinician ratings (Drug Use Scale ratings of drug use in the prior three months); (4) hair RIA (drug use in the prior three months); and (5) drug urinalysis (drug use in the past one to four days, but up to three weeks). For all measures, responses were

[1] Collateral report was available for 645 (44.2%) participants.

* Corresponding author at: Department of Psychology, North Carolina State University, Campus Box 7650, Raleigh, NC 27695-7650, United States. Tel.: +1 919 515 2251; fax: +1 919 515 1716.
E-mail addresses: kljeske@ncsu.edu (K.L. Johnson), sdesmarais@ncsu.edu (S.L. Desmarais), marvin.swartz@duke.edu (M.S. Swartz), rvandorn@rti.org (R.A. Van Dorn).

http://dx.doi.org/10.1016/j.schres.2014.11.016
0920-9964/

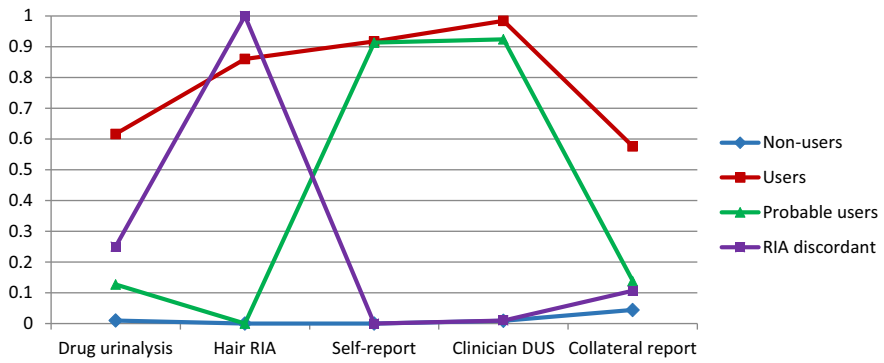

Fig. 1. Conditional probabilities of drug use assessment measures.

dichotomized to indicate use or non-use (Van Dorn et al., 2012; Desmarais et al., 2013).

2.2.2. Participant characteristics

Participant *sex* was measured dichotomously (1 = *female*, 0 = *male*). *Age* was measured continuously (in years), reflecting age at baseline. *Race/ethnicity* was measured categorically (3 = *White*, 2 = *Black*, 1 = *Hispanic*, 0 = *other race/ethnicity*). Psychiatric symptoms were assessed at baseline with the Positive and Negative Syndrome Scale (Kay et al., 1987); we used a 4-factor model to calculate continuous scores for *affect*, *negative*, *positive*, and *disorganized cognitive processing (DCP)* symptoms (Van Dorn et al., under review).

2.3. Statistical analyses

Latent class analysis (LCA) was conducted in Mplus to identify concordant and discordant classes of drug use measures. The bootstrap likelihood ratio test (BLRT) and adjusted Bayesian Information Criterion (BIC) were used to determine number of latent classes (Nylund et al., 2007). Data in the CATIE is missing at random (Shortreed and Moodie, 2012; Van Dorn et al., 2013); thus, maximum likelihood estimation was used in our analyses to account for missing data. We then conducted two multinomial logistic regressions in SPSS. *Non-users* served as reference group in the first model, and *users*, the second. Male and White participants served as reference groups. Odds ratios show the probability of membership in each class as compared to the reference class.

3. Results

3.1. Latent class analyses

Both adjusted BICs and BLRT identified a 4-class model as best fitting the data (adjusted BICs: 3-class = 4371.41, 4-class = 4353.48, 5-class = 4372.36).[2] Conditional probabilities, which illustrate the probability of each measure indicating drug use, are plotted for latent classes in Fig. 1.

Classes 1 and 2 were both concordant in nature, and Classes 3 and 4 were discordant. Class 1, termed *non-users*, included participants with near-zero probabilities of being classified as a drug user by each of the measures. Class 2, named *users*, included participants for whom all measures indicated drug use over half of the time. In Class 3, termed *probable users*, participants had near-zero probabilities of being classified as drug users by urinalysis, hair RIA, and collateral report, but were almost always identified as drug users by self-report and clinician DUS. In Class 4, named *RIA discordant*, participants were unlikely to be classified as drug users by all measures except hair RIA, which always classified them as *users*.

Non-users comprised a majority of the sample (66.2%), followed by *users* (18.6%), *RIA discordant* (10.1%), and *probable users* (5.2%). All four classes exhibited high posterior probabilities, indicating that there were few cases of ambiguity regarding classification.[3]

3.2. Descriptive statistics

Table 1 presents participant characteristics overall and within classes.

3.3. Multinomial logistic regression

Compared to *non-users*, younger, male, and Black participants were more likely to be classified as *users*, as were participants with higher and lower levels of affect and negative symptom scores, respectively (see Table 2). Younger participants, and those with higher positive and lower negative symptom scores, were more likely to be *probable users*. Black participants were more likely to be *RIA discordant*.

Compared to members of the *users* class, participants classified as *probable users* were significantly more likely to be younger and female, and more likely to be White than Black (see Table 3). Additionally, *probable users* had lower affect and higher positive symptom scores. Participant age and sex also distinguished members of *RIA discordant* from *users*, with older and female participants more likely to be classified in the former. Participants exhibiting more negative symptoms also were more likely to be in *RIA discordant* than *users*.

4. Discussion

LCA identified four classes of concordant and discordant test results when multiple measures were used to detect drug use in a sample of 1460 adults with schizophrenia: *non-users*, *users*, *probable users*, and *RIA discordant*. Together, findings raise general concerns regarding multi-method drug use assessments as well as specific considerations for schizophrenia researchers and clinicians.

Results showed that, compared to *non-users*, *probable users* were significantly more likely to be younger in age, with higher positive and

[2] In addition to the adjusted BICs and BLRT, the 4-class solution was easier to interpret compared to both 3- and 5-class solutions. Specifically, the 3-class solution retained all members of *non-users* and *RIA discordant* but grouped *probable users* with *users*, precluding the ability to examine predictors of the discordant group. In the 5-class solution, the four classes presented here were retained – albeit with smaller sizes and lower posterior probabilities – and accompanied by an additional class (n = 62) with very poor posterior probabilities (<.391).

[3] Within *probable users*, specifically, that almost all participants were identified as users by self-report (91.3%) and clinician report (92.4%), and substantially fewer were identified by urinalysis (12.7%) and collateral report (13.8%) illustrates that some participants were placed in this class meeting some, but not all, of the criteria. Subsequently, this class appears to include cases of alternative forms of discordance that did not warrant an additional class.

Please cite this article as: Johnson, K.L., et al., Latent class analysis of discordance between results of drug use assessments in the CATIE data, Schizophr. Res. (2014), http://dx.doi.org/10.1016/j.schres.2014.11.016