



Predictors of Agreement between Hair Analysis and Self Report of Drug Use

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Abstract

Aims: To examine predictors of agreement between hair analyses and self-report of drug use.

Methods: This is a secondary analysis from the National Drug Abuse Treatment Clinical Trials Network (NIDA CTN) randomized trial "Screening, Motivational Assessment, Referral, and Treatment in Emergency Departments (CTN-0047; SMART-ED)". Self-reported drug use during follow-up over a 90-day recall period on the Timeline Follow Back Instrument was compared to drug use from hair analysis for Cannabis, Cocaine, Prescribed Opioids [PO] and Street Opioids [SO]. Measures of agreement/disagreement, including under-reporting (self report negative when hair indicates drug use) and over-reporting (self-report positive when hair does not indicate drug use) were calculated. The following variables were examined as predictors of disagreement: source of hair (head vs. body), drug of choice, site, AUDIT-C score, DAST-10 score, visit, treatment arm, sex, race, ethnicity and age. Of the 1,285 randomized participants, 1120 (87%), 875 (68%), 893 (69%) and 832 (65%) provided hair samples at baseline, 3-, 6-, and 12-month visits, respectively.

Results: The agreement between the hair sample results and TLFB was high for cannabis (cohen's $\kappa = 0.49-0.54$) and SO ($\kappa = 0.73-0.81$), but lower for cocaine ($\kappa = 0.31-0.35$) and PO ($\kappa = 0.18-0.30$). Drug of choice, irrespective of being cannabis, cocaine, SO or PO, had statistically significantly lower under-reporting of drug use compared with other self-reported drug use (all p-values < .01). Of note, females (p=.0085; F vs M; OR = 1.33) and older age (p=.0076; 45-<55 vs 18-<25; OR = 2.02) were associated with under-reporting of cannabis use.

Conclusions: Hair collection can be an important biological measure to assess drug use, and can be used to assist in corroborating self-report. From these analyses, there are a number of factors that impact agreement between drug use as measured by hair and drug use through self-report.

Introduction

In clinical trials, a common way to collect illicit drug use information is self-report. Often self-report is complemented by a biological measure such as urine drug screens (UDS). Hair testing is another measure that enables detection of substance use over a significantly longer window of time than UDS. This study compares hair sample results to self-report collected via timeline follow-back (TLFB). Exploratory analyses were performed to investigate concordance between hair outcomes and self report for cannabis, cocaine, street opioids and prescribed opioids. Factors were also investigated for predictors of agreements between self report and the hair testing results.

Methods

- Hair samples results mapped to TLFB daily use data to assess: cannabis, cocaine, prescription opioid (PO) and street opioid (SO).
- Over-reporting:** any use in past 90 days on TLFB, given hair sample comparator was negative
- Under-reporting:** no use in past 90 days on TLFB, given hair sample comparator was positive
- The following statistics were used to assess agreement at follow-up visits: percent agreement, Kappa, sensitivity, specificity, positive predictive value, negative predictive value, and area under the curve (AUC).
- Predictor analyses conducted using generalized estimating equations
- Predictors examined: hair source, drug of choice, site, AUDIT-C score (<4 vs ≥ 4), DAST-10 score (<8 vs ≥ 8), visit, treatment group, gender, race, ethnicity and age

Results

Table 1: Disposition of Hair Sample

	Baseline	3-Month Visit	6-Month Visit	12-Month Visit
Total Randomized	1285	1285	1285	1285
Collected	1120 (87%)	875 (68%)	893 (69%)	832 (65%)
Hair From Head	759 (68%)	587 (67%)	595 (67%)	557 (67%)
Hair From Body	361 (32%)	288 (33%)	298 (33%)	275 (33%)
Not Collected	165 (13%)	147 (11%)	213 (17%)	211 (16%)
Insufficient Hair	104 (63%)	59 (40%)	63 (30%)	51 (24%)
Refused	56 (34%)	18 (12%)	24 (11%)	27 (13%)
Phone Interview	0 (0%)	60 (41%)	98 (46%)	103 (49%)
Other	5 (3%)	10 (7%)	28 (13%)	30 (14%)
Missed Visit	0 (0%)	263 (20%)	179 (14%)	242 (19%)

Table 1 Summary: Approximately 2/3rds of samples collected from the head. Insufficient hair primary reason for sample not collected.

Fig 1: Availability of Hair Sample to Test Drug Class

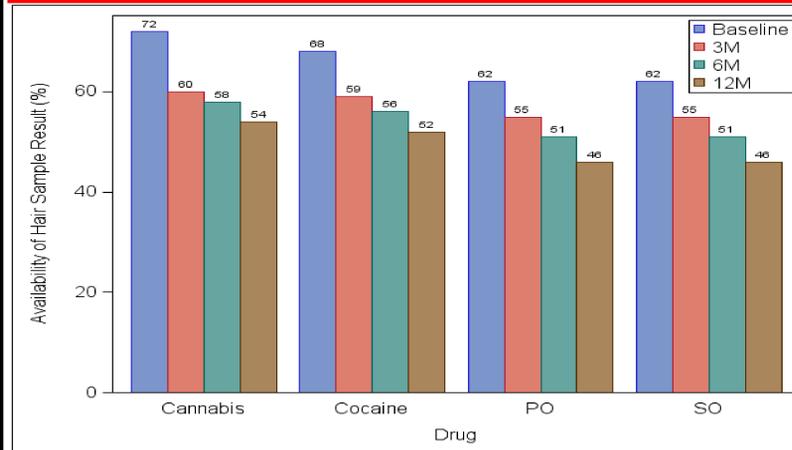


Figure 1 Summary: Hair sample not always sufficient to perform tests on all drug classes, so primary drug of choice was tested first. Testing was highest for cannabis (54-72%)

Fig 2: Proportion of Hair Sample Positive for Drug Use

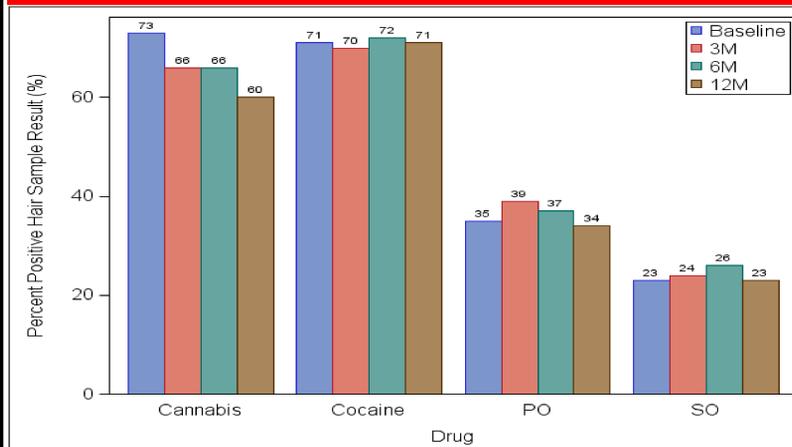


Figure 2 Summary: Cannabis (60-72%) and cocaine (70-72%) both tested highest at baseline and over follow-up compared with prescribed opiates and street opiates.

Fig 3: Measures of Agreement: TLFB to Hair at Month 3 (The agreement statistics at Months 6 and 12 are similar to Month 3)

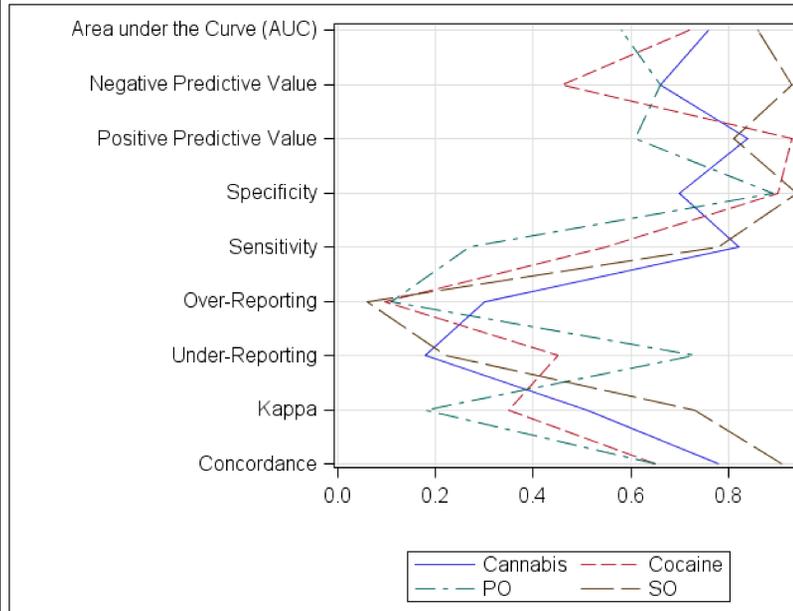


Figure 3 Summary based on Month 3 visit:

- Concordance based on % agreement and Kappa: highest for street opioids and cannabis
- Over-reporting (self report positive and not detected in hair): similar among all drugs
- Under-reporting (self report negative and detected in hair): lowest for cannabis

Table 2: Predictors of Under-reporting (Odds ratios of significant factors presented)

	Cannabis	Cocaine	Prescribed opioids	Street opioids
Drug of choice	P<0.001	P<0.001	P=0.006	P=0.004
Cannabis	Ref	4.1	1.8	9.2
Cocaine	3.4	Ref	3.0	4.1
Prescribed opioids	3.1	6.9	Ref	1.9
Street opioids	5.3	2.6	3.3	Ref
Other drug	4.6	5.0	1.4	3.4
Site	P<0.001	P<0.001	P<0.001	NS
Audit-C Score (Ref ≥ 4)	NS	P=0.02	NS	NS
< 4		1.2		
DAST-10 Score (Ref ≥ 8)	NS	P=0.05	P=0.03	P=0.02
< 8		1.2	1.3	1.5
Visit	NS	P<0.001	NS	P=0.03
Gender (Ref=male)	P=0.009	NS	NS	NS
1.3				
Race (Ref=White)	NS	NS	P=0.003	
Black			4.4	
Age (Ref=<25)	P=0.008	NS	NS	NS
25-<35	0.8			
35 - < 45	1.2			
45 - < 55	2.0			
55+	1.5			

Table 3: Predictors of Over-reporting (Odds ratios of significant factors presented)

	Cannabis	Cocaine	Prescribed opioids	Street opioids
Drug of choice	P=0.003	NS	P=0.04	P=0.03
Cannabis	Ref		0.5	0.1
Cocaine	0.6		0.5	0.3
Prescribed opioids	0.3		Ref	0.5
Street opioids	0.3		1.1	Ref
Other drug	0.4		0.2	0.3
Source (Ref= head)	NS	0.007	NS	NS
Body		0.4		
Site	P=0.04	NS	P=<0.001	NS
Audit-C (Ref ≥ 4)	P=0.05	P=<0.001	<0.001	NS
< 4	0.8	0.4	0.5	
DAST-10 (Ref ≥ 8)	NS	P=0.04	NS	NS
< 8		0.6		
Visit	NS	NS	NS	P=0.03
Race (Ref=White)	NS	NS	P=0.001	P=<0.001
Black			0.3	0.2

Table 2 (Under-reporting) Summary:

- Drugs, other than drug of choice, detected from hair were more likely not self-reported
- Female gender and older age important factors for under-reporting of cannabis
- Lower DAST-10 scores predicted under-reporting for all drugs except cannabis

Table 3 (Over-reporting) Summary:

- Over-reporting may be due to the inaccuracy of the hair sample assay procedure
- Over-reporting of cocaine was lower in body hair
- Drug of choice was associated with over-reporting
- Higher AUDIT-C associated with over-reporting of cannabis cocaine and prescribed opioids
- Black race was associated with lower over-reporting of prescribed opioid use and street opioids

Conclusions

- This study provides useful information regarding the hair sample analysis and its agreement with self report in substance drug use disorder trials examining cannabis, cocaine, street opioids and prescribed opioids.
- Hair collection and analysis as an alternative to urine drug screens should be considered as secondary outcome measures in clinical trials where there are infrequent visits.
- Strengths of the study include a large sample from multiple emergency departments across the US.
- There are limitations, such as all participants not able to provide hair samples, and findings need to be considered exploratory (no adjustments for multiple testing made).

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