

Best Evidence Summaries of Topics in Mental Healthcare

BEST in MH *clinical question-answering service*

Question

“For adults addicted to drugs and alcohol (sub groups include heroin, cocaine, crack, amphetamine and alcohol) how accurate is hair strand drug and alcohol testing, when compared to mouth swabs, urine testing and breathalysers in achieving accurate testing of drug and/or alcohol use?”

Clarification of question using *PICTRO* structure

<i>Patients:</i>	Adults at risk of drug and/or alcohol addiction
<i>Index test:</i>	Hair strand drug and alcohol testing
<i>Comparator tests:</i>	Mouth swabs, urine testing and breathalysers
<i>Target condition:</i>	Drug and/or alcohol use
<i>Reference standard:</i>	Patient report or urine testing of drug or alcohol use
<i>Outcome:</i>	Sensitivity, Specificity

Clinical and research implications

Four small studies assessed hair strand testing drug and alcohol testing. Only one study evaluated hair testing against a reference standard that classified participants according to their drug use status independent of the hair test results. Data from the other studies can therefore not provide strong direct evidence on the accuracy of the hair test. Generally there was support for hair testing for cocaine with the evidence suggesting that this is a highly sensitive and specific method and more accurate than urine or self report. Results were less clear for opiate use. One very small cohort study suggested that urine testing may be more appropriate for monitoring opiate use but this study was judged at high risk of bias. In contrast, the prevalence of a positive result was greater for the hair test than for the urine test in another study but lower than for self-report. It is likely that the timing of the test in relation to when the drug was used affects the accuracy of the test and so the choice of test is likely to be influenced by the setting in which the test will be used. Methadone, cannabis, alcohol and amphetamine were each assessed in single studies and so it was difficult to draw conclusions. The limited data suggested that hair strand testing may have limited utility for cannabis testing. The small number of studies in this area, and the lack of studies comparing hair testing against a valid reference standard mean that there is a need for further high quality studies assessing the accuracy of hair strand testing for drug and alcohol use.

What does the evidence say?

Number of included studies/reviews (number of participants)

Four studies (n=147) were included. Three were diagnostic accuracy studies (2 diagnostic cohort, 1 diagnostic case-control) providing information on the accuracy of testing for alcohol or drug use, the third provided information on the prevalence of drug use based on different testing methods. The reference standard varied in the two diagnostic cohort studies. One used hair toxicology as the reference standard with self report and breath and urine tests as index tests(1) the other used urine specimens as the reference standard and hair strand testing as the index test(3). The case-control study selected known drug users who had reported using cocaine in the previous days or months and selected controls who claimed never to have used cocaine (4).

Main Findings

Cocaine use (n=3)

The case control study reported a sensitivity of 97% and specificity of 100% for the hair strand test; the urine test was negative in all patients (4). The cohort study which used the hair stand test as the reference standard reported a sensitivity of 50% and specificity of 100% for self-reported use of cocaine, and a sensitivity of 44% and specificity of 98% for the urine test(1). The study that reported on the prevalence of a positive test result reported 38% prevalence of cocaine use based on self-report, 28% based on urine test, and 55% based on the hair test. It was unclear how many, if any, of these were false positive results; this applies to all data from this study(2).

Opiate use (n=3)

The cohort study which used the hair test as the reference standard reported a sensitivity of 58% and specificity of 93% for self-reported use of opiates, and a sensitivity of 52% and specificity of 95% for the urine test(1). The second cohort study took multiple measures at various time points from the same 10 patients. Overall sensitivity and specificity were 87% and 96% respectively for the hair strand test. Based on hair data, 6/10 patients appeared to have discontinued opiate use, however

urine data suggested only 4/10 patients had discontinued use (3). The study that reported on the prevalence of a positive test result reported 89% prevalence of opiate use based on self-report, 70% based on urine test, and 81% based on the hair test.

Methadone (n=1)

The study that reported on the prevalence of a positive test result reported 32% prevalence of methadone use based on self-report, 30% based on urine test, and 49% based on the hair test.

Cannabinoids (n=1)

The study that reported on the prevalence of a positive test result reported 55% prevalence of methadone use based on self-report, 45% based on urine test, and 32% based on the hair test.

Amphetamines (n=1)

The study that reported on the prevalence of a positive test result reported 2% prevalence of methadone use based on self-report, 0% based on urine test, and 2% based on the hair test.

Alcohol use (n=1)

Self-report had a sensitivity of 36% and specificity of 85%, breath test had a sensitivity of 12% and specificity of 100% compared to the hair strand test for detecting alcohol use.

Authors Conclusions

The prevalence study concluded that cocaine hair tests appeared to be highly sensitive and specific in identifying past cocaine use even in settings of negative urine tests, but hair lacks sensitivity as a detection agent for cannabinoids.(2) This was supported by the case-control study which concluded that the hair test appears to be highly sensitive and specific in identifying past cocaine use in the setting of a negative urine test (4). The small cohort study that assessed recent opiate use and used urine testing as the reference standard concluded that urine appeared to be a more sensitive indicator of changes in the patterns of drug use during the course of clinical drug treatment(3). The cohort study which used hair testing as the reference standard and which assessed alcohol, cocaine and opiate use concluded that conventional drug tests (self-report, breath and urine testing) are relatively good measures of recent substance use but their ability to detect sporadic users or verify continuous abstinence is limited. Hair testing produces different information than conventional drug tests, and so the authors recommend combining these approaches to generate a more complete picture of each patient's drug use.

Reliability of conclusions/Strength of evidence

Only a small number of relevant studies were identified and all included studies were relatively small in size ranging from 10 to 47 participants. One study was judged at low risk of bias(4), two were judged at high risk of bias (2, 3), and one was judged as unclear risk of bias(1). The study judged at low risk of bias was the case-control study. Diagnostic accuracy studies using such a design are generally judged to be at high risk of bias based on patient selection. However, for this topic area it seems reasonable to select a group of patients with known drug use status and this would be unlikely to bias the results of the study. The cohort study in which hair testing was the reference standard was judged as unclear risk of bias as it was unclear whether this was an appropriate reference standard. The prevalence study was rated as high risk of bias for reference standard as this study did not include a reference standard. The cohort study that assessed opiate use was judged at high risk of bias for patient selection and index test. It enrolled a very small sample of

possibly selected patients (n=10) and it was unclear whether the index test was interpreted blind to the reference standard. The results from these two studies should therefore be interpreted with some caution.

What do guidelines say?

NICE guidelines on Drug Misuse Opioid Detoxification (CG 52) include a discussion of testing for drug use although specific recommendations are not made they do state the following “*Urinalysis is the most reliable tool for identifying drug use and has higher sensitivity and specificity than oral fluid testing for a number of substances (DH, in press). In addition, urinalysis is substantially less costly than oral fluid testing. Therefore, the routine use of urinalysis is more cost effective, since it represents a more efficient use of limited NHS resources. Healthcare professionals should normally consider using urinalysis for drug testing as the first choice, and consider oral fluid testing only in circumstances where urinalysis is impractical or unacceptable to the service user.*”

Date question received: 24/01/2013

Date searches conducted: 24/01/2013

Date answer completed: 31/01/2013

References

Guidelines

National Institute for Health and Clinical Excellence (2008) Drug Misuse. Opioid Detoxification CG52. London: National Institute for Health and Clinical Excellence.
<http://www.nice.org.uk/nicemedia/live/11813/35999/35999.pdf>

Primary Studies

1. Haller, D.L., Acosta, M.C., Lewis, D., Miles, D.R., Schiano, T., Shapiro, P.A., Gomez, J., Sabag-Cohen, S. and Newville, H. (2010) Hair Analysis Versus Conventional Methods of Drug Testing in Substance Abusers Seeking Organ Transportation. *American Journal of Transplantation* 10, pp. 1305-1311.
2. Musshoff, F., Driever, F., Lachenmeier, K., Lachenmeier, D.W., Banger, M. and Madea, B. (2006) Results of hair analyses for drugs of abuse and comparison with self-reports and urine tests. *Forensic Science International* 156, pp. 118-123.
3. Charles, B.K., Day, J.E., Rollins, D.E., Andrenyak, D., Ling, W. and Wilkins, D.G. (2003) Opiate Recidivism in a Drug-Treatment Program: Comparison of Hair and Urine Data. *Journal of Analytical Toxicology* 27. pp. 412-428.
4. Ursitti, F., Klein, J., Sellers, E. and Koren, G. (2001) Use of Hair Analysis for Confirmation of Self-Reported Cocaine Use in Users with Negative Urine Tests. *Clinical Toxicology*, 39 (4) pp. 361-366.

Results

Diagnostic test accuracy studies

Author (year)	Inclusion criteria	Number of participants	Summary of results	Risk of bias
Haller et al. (2010)(1)	<p><i>Participants:</i> adults with end-stage hepatic or renal disease who had been denied a transplant due to recent (past 6 months) use of alcohol and/or other drugs.</p> <p><i>Index test 1:</i> Self report using Addition Severity Index-Lite structured clinical interview</p> <p><i>Index test 2:</i> Breath test (for alcohol), urine test (for cocaine or opiate use)</p> <p><i>Reference standard:</i> hair toxicology.</p> <p>Target condition: alcohol, cocaine or opiate use</p> <p><i>Outcome:</i> sensitivity and specificity</p>	42	<p>Alcohol use: Self-report had a sensitivity of 36% and specificity of 85%, breath test had a sensitivity of 12% and specificity of 100%</p> <p>Cocaine use: Self-report had a sensitivity of 50% and specificity of 100%, urine test had a sensitivity of 44% and specificity of 98%</p> <p>Opiate use: Self-report had a sensitivity of 58% and specificity of 93%, urine test had a sensitivity of 52% and specificity of 95%</p> <p>Commented that breath and urine tests limited because of their brief detection window</p>	Unclear
Musshoff et al. (2006)(2)	<p><i>Participants;</i> adults who were know drug users from a psychiatric clinic.</p> <p><i>Index test 1:</i> Urine immunoassay</p> <p><i>Index test 2:</i> Hair tests by means of</p>	51; appropriate hair sample available in 47 patients	<p>Opiates: Self report: 89% (42/47) Urine test: 70% (33/47) Hair test: 81% (38/47)</p>	High

Author (year)	Inclusion criteria	Number of participants	Summary of results	Risk of bias
	<p>gas chromatography–mass spectrometry.</p> <p><i>Index test 3/Reference standard:</i> Self-reported data in an interview protocol that incorporated DSM-IV and ICD-10 diagnostic criteria.</p> <p><i>Target condition:</i> opiate, cocaine, methadone, cannabinoid, amphetamine use</p> <p><i>Reference standard:</i> NA</p> <p><i>Outcome:</i> Prevalence rates based on different tests</p>		<p>Cocaine</p> <p>Self report: 38% (18/47)</p> <p>Urine test: 28% (13/47)</p> <p>Hair test: 55% (26/47)</p> <p>Methadone</p> <p>Self report: 32% (15/47)</p> <p>Urine test: 30% (14/47)</p> <p>Hair test: 49% (23/47)</p> <p>Cannabinoids</p> <p>Self report: 55% (26/47)</p> <p>Urine test: 45% (21/47)</p> <p>Hair test: 32% (15/47)</p> <p>Amphetamines</p> <p>Self report: 2% (1/47)</p> <p>Urine test: 0% (0/47)</p> <p>Hair test: 2% (1/47)</p>	
Charles et al. (2003)(3)	<p><i>Participants;</i> adults aged 18 to 65 who were seeking treatment for opiate dependence at a treatment centre.</p> <p><i>Index test:</i> Drug detection results from hair specimens by means of liquid chromatography-mass spectrometry.</p> <p><i>Target condition:</i> Opiate use in drug treatment programme</p> <p><i>Reference standard:</i> Drug detection results from urine specimens.</p>	10	<p>Opiates:</p> <p>Multiple measures presented at various time points. Overall sensitivity and specificity based on multiple readings per patient were Sensitivity of 87% and specificity of 96%. Based on hair data, 6/10 patients appeared to have discontinued opiate use, however urine data suggested only</p>	High

Author (year)	Inclusion criteria	Number of participants	Summary of results	Risk of bias
	<i>Outcome:</i> Sensitivity and specificity		4/10 patients had discontinued used.	
Ursitti et al. (2001)(4)	<p><i>Participants:</i> admitted cocaine users aged 18 to 70. Reported to have refrained from using cocaine in the few days to months prior to the test (40% described as current users). Compared to 10 controls who claimed to have never used cocaine.</p> <p><i>Index test 1:</i> Cocaine and benzoylecgonine extracted from unwashed hair and tested with established immunoassays</p> <p><i>Index test 2:</i> Urine tests for cocaine and benzoylecgonine by thin-layer chromatography.</p> <p>Target condition: Cocaine use Reference standard: Self report</p> <p><i>Outcome:</i> Sensitivity and specificity</p>	38 cases + 10 controls	<p>Cocaine:</p> <p>Hair test: Sensitivity 97%, specificity 100%. There was significantly more cocaine in black hair per mg of cocaine dose reported to have been consumed than in brown or blonde hair.</p> <p>Urine test negative in all patients.</p>	Low

Risk of Bias

Diagnostic test accuracy studies

Study	RISK OF BIAS			
	PATIENT SELECTION	INDEX TEST	REFERENCE STANDARD	FLOW AND TIMING
Haller et al. (2010)				
Musshoff et al. (2006)				
Charles et al. (2003)				
Ursitti et al. (2001)				

 Low Risk

 High Risk

 Unclear Risk

Search Details

Source	Search Strategy	Number of hits	Relevant evidence identified
<i>SRs and Guidelines</i>			
NICE	Drug detection Alcohol testing Drug testing Hair strand Mouth swab Urine testing Breathalysers	959	1
DARE	1 MeSH DESCRIPTOR Substance-Related Disorders EXPLODE ALL TREES 721 Delete 2 MeSH DESCRIPTOR Substance Abuse Detection EXPLODE ALL TREES 21 Delete 3 #1 AND #2 18 Delete 4 ("hair strand drug test") OR ("mouth swabs") OR ("urine test") OR (breathalyser) 22 Delete 5 ("substance abuse") OR ("illicit drug use") OR (alcohol) OR (heroin) OR (crack) 1092 Delete 6 (cocaine) OR (amphetamine) 115 Delete 7 #5 OR #6 1137 Delete 8 #1 OR #7 1439 Delete 9 #2 OR #4 43 Delete 10 #8 AND #9 24 Delete	24	
CDSR	MeSH descriptor: [Substance-Related Disorders] 1 tree(s) exploded 10355 #2 Enter terms for search "Alcohol abuse""Alcohol abuse" 1007 #3 Enter terms for search heroin or cocaine or crack or amphetamineheroin or cocaine or crack or amphetamine		

	<p>4025</p> <p>#4 Enter terms for search</p> <p>#1 or #2 or #3#1 or #2 or #3 13295</p> <p>#5 MeSH descriptor: [Substance Abuse Detection] this term only 298</p> <p>#6 Enter terms for search</p> <p>"substance abuse test*" 1</p> <p>#7Enter terms for searc"hair strand test"1</p> <p>#8Enter terms for searc"mouth swab*"6</p> <p>#9Enter terms for searc"urine test*"336</p> <p>#10Enter terms for searcbreathalyser*14</p> <p>#11Enter terms for searc#5 or #6 or #7 or #8 or #9 or #10627</p> <p>#12Enter terms for searc#4 and #11 382</p> <p>Cochrane 53</p>		
Primary studies			
CENTRAL	<p>MeSH descriptor: [Substance-Related Disorders] 1 tree(s) exploded 10355</p> <p>#2 Enter terms for search</p> <p>"Alcohol abuse""Alcohol abuse" 1007</p> <p>#3 Enter terms for search</p> <p>heroin or cocaine or crack or amphetamineheroin or cocaine or crack or amphetamine</p> <p>4025</p> <p>#4 Enter terms for search</p> <p>#1 or #2 or #3#1 or #2 or #3 13295</p> <p>#5 MeSH descriptor: [Substance Abuse Detection] this term only 298</p> <p>#6 Enter terms for search</p> <p>"substance abuse test*" 1</p> <p>#7Enter terms for searc"hair strand test"1</p> <p>#8Enter terms for searc"mouth swab*"6</p> <p>#9Enter terms for searc"urine test*"336</p> <p>#10Enter terms for searcbreathalyser*14</p> <p>#11Enter terms for searc#5 or #6 or #7 or #8 or #9 or #10627</p> <p>#12Enter terms for searc#4 and #11 382</p> <p>CENTRAL 302</p>	302	

PsycINFO	8. PsycINFO; specificity.tw; 22680 results. 9. PsycINFO; (pre-test OR pretest ADJ probability).tw; 2538 results. 10. PsycINFO; "post-test probability".tw; 16 results. 11. PsycINFO; "likelihood ratio*".tw; 1167 results. 12. PsycINFO; "predictive value*".tw; 5101 results. 13. PsycINFO; sensitivity.tw; 58961 results. 14. PsycINFO; 1 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13; 81314 results. 15. PsycINFO; exp DRUG ADDICTION/; 10673 results. 16. PsycINFO; exp DRUG ABUSE/; 80731 results. 17. PsycINFO; ALCOHOL ABUSE/; 12957 results. 18. PsycINFO; "Alcohol abuse".ti,ab; 7360 results. 19. PsycINFO; (heroin OR cocaine OR crack OR amphetamine).ti,ab; 27510 results. 20. PsycINFO; 15 OR 16 OR 17 OR 18 OR 19; 100501 results. 21. PsycINFO; SCREENING TESTS/; 4187 results. 22. PsycINFO; DRUG USAGE SCREENING/; 864 results. 23. PsycINFO; "illicit drug testing".ti,ab; 1 results. 24. PsycINFO; "street drug test*".ti,ab; 0 results. 25. PsycINFO; "hair strand drug test".ti,ab; 0 results. 26. PsycINFO; "mouth swab*".ti,ab; 3 results. 27. PsycINFO; "urine testing".ti,ab; 156 results. 28. PsycINFO; breathalyser*.ti,ab; 18 results. 29. PsycINFO; breathalyzer*.ti,ab; 103 results. 30. PsycINFO; "hair analysis".ti,ab; 79 results. 31. PsycINFO; 21 OR 22 OR 23 OR 26 OR 27 OR 28 OR 29 OR 30; 5296 results. 32. PsycINFO; 20 AND 31; 1127 results. 33. PsycINFO; 14 AND 32; 203 results.	203	
EMBASE	Search History: 1. EMBASE; exp DRUG ADDICTION/; 62818 results. 2. EMBASE; exp DRUG ABUSE/; 55341 results. 3. EMBASE; ALCOHOL ABUSE/; 17549 results. 4. EMBASE; "Alcohol abuse".ti,ab; 13813 results. 5. EMBASE; (heroin OR cocaine OR crack OR amphetamine).ti,ab; 60283 results. 6. EMBASE; 1 OR 2 OR 3 OR 4 OR 5; 161741 results.	529	

	<p>7. EMBASE; SCREENING TESTS/; 0 results. 8. EMBASE; DRUG USAGE SCREENING/; 0 results. 9. EMBASE; "illicit drug testing".ti,ab; 6 results. 10. EMBASE; "street drug test*".ti,ab; 0 results. 11. EMBASE; "hair strand drug test".ti,ab; 0 results. 12. EMBASE; "mouth swab*".ti,ab; 73 results. 13. EMBASE; "urine testing".ti,ab; 767 results. 14. EMBASE; breathalyser*.ti,ab; 61 results. 15. EMBASE; breathalyzer*.ti,ab; 183 results. 16. EMBASE; "hair analysis".ti,ab; 862 results. 17. EMBASE; "hair drug test*".ti,ab; 5 results. 18. EMBASE; "hair screen".ti,ab; 2 results. 19. EMBASE; ("hair follicle" adj3 "drug test").ti,ab; 0 results. 20. EMBASE; (hair adj3 "drug test").ti,ab; 0 results. 21. EMBASE; SUBSTANCE ABUSE DETECTION/; 35446 results. 22. EMBASE; sensitivity.tw; 565460 results. 23. EMBASE; (pre-test OR pretest ADJ probability).tw; 5203 results. 24. EMBASE; "post-test probability".tw; 393 results. 25. EMBASE; "predictive value*".tw; 79251 results. 26. EMBASE; "likelihood ratio*".tw; 9384 results. 27. EMBASE; specificity.tw; 342754 results. 28. EMBASE; exp "SENSITIVITY AND SPECIFICITY"/; 182337 results. 29. EMBASE; 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28; 888837 results. 30. EMBASE; 9 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 21; 37262 results. 31. EMBASE; 6 AND 29 AND 30; 529 results.</p>		
Medline	<p>Search History: 37. MEDLINE; exp DRUG ADDICTION/; 343859 results. 38. MEDLINE; exp DRUG ABUSE/; 343859 results. 39. MEDLINE; ALCOHOL ABUSE/; 63892 results. 40. MEDLINE; "Alcohol abuse".ti,ab; 10445 results. 41. MEDLINE; (heroin OR cocaine OR crack OR amphetamine).ti,ab; 53112 results. 42. MEDLINE; 37 OR 38 OR 39 OR 40 OR 41; 380266 results.</p>	689	

	<p>43. MEDLINE; SCREENING TESTS/; 4740 results.</p> <p>44. MEDLINE; DRUG USAGE SCREENING/; 0 results.</p> <p>45. MEDLINE; "illicit drug testing".ti,ab; 7 results.</p> <p>46. MEDLINE; "street drug test*".ti,ab; 0 results.</p> <p>47. MEDLINE; "hair strand drug test".ti,ab; 0 results.</p> <p>48. MEDLINE; "mouth swab*".ti,ab; 66 results.</p> <p>49. MEDLINE; "urine testing".ti,ab; 627 results.</p> <p>50. MEDLINE; breathalyser*.ti,ab; 46 results.</p> <p>51. MEDLINE; breathalyzer*.ti,ab; 133 results.</p> <p>52. MEDLINE; "hair analysis".ti,ab; 690 results.</p> <p>53. MEDLINE; "hair drug test*".ti,ab; 4 results.</p> <p>54. MEDLINE; "hair screen".ti,ab; 1 results.</p> <p>55. MEDLINE; ("hair follicle" adj3 "drug test").ti,ab; 0 results.</p> <p>56. MEDLINE; (hair adj3 "drug test").ti,ab; 0 results.</p> <p>59. MEDLINE; SUBSTANCE ABUSE DETECTION/; 6064 results.</p> <p>60. MEDLINE; 43 OR 45 OR 48 OR 49 OR 50 OR 51 OR 52 OR 53 OR 54 OR 59; 12023 results.</p> <p>61. MEDLINE; EXP SENSITIVITY AND SPECIFICITY/; 371895 results.</p> <p>62. MEDLINE; specificity.tw; 294203 results.</p> <p>63. MEDLINE; (pre-test OR pretest ADJ probability).tw; 3661 results.</p> <p>64. MEDLINE; "post-test probability".tw; 305 results.</p> <p>65. MEDLINE; "likelihood ratio*".tw; 7574 results.</p> <p>66. MEDLINE; "predictive value*".tw; 60397 results.</p> <p>67. MEDLINE; sensitivity.tw; 477780 results.</p> <p>68. MEDLINE; 61 OR 62 OR 63 OR 64 OR 65 OR 66 OR 67; 931039 results.</p> <p>69. MEDLINE; 42 AND 60 AND 68; 689 results.</p>		
Summary	NA	NA	

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