

Urine drug test interpretation: What do physicians know?

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ABSTRACT

Objective: To determine the level of urine drug test (UDT) interpretive knowledge of physicians who use these instruments to monitor adherence in their patients on chronic opioid therapy.

Methods: A seven-question instrument consisting of six five-option, single-best-answer multiple choice questions and one yes/no question was completed by 114 physicians (77 who employ UDT and 37 who do not) attending one of three regional opioid education conferences. We calculated frequencies and performed χ^2 analyses to examine bivariate associations between UDT utilization and interpretive knowledge.

Results: The instrument was completed by 80 percent of eligible respondents. None of the physicians who employ UDT answered all seven questions correctly, and only 30 percent answered more than half correctly. Physicians who employ UDT performed no better on any of the questions than physicians who do not employ UDT.

Conclusions: Physicians who employ UDT to monitor patients receiving chronic opioid therapy are not proficient in test interpretation. This study highlights the need for improved physician education; it is imperative for physicians to work closely with certified laboratory professionals when ordering and interpreting these tests.

Key words: urine drug test, chronic opioid therapy, interpretation, physician knowledge

INTRODUCTION

The United States has one of the highest levels of prescription opioid use in the world, and the rate is increasing, accompanied by a parallel increase in abuse of such medications.^{1,2} Abuse of opioids is often associated with concomitant abuse of other drugs, both illicit and unauthorized licit.³⁻⁵ Physicians, apprehensive about clinical, medicolegal, and regulatory risks, are increasingly using urine drug tests (UDTs) as an objective means of

behavioral monitoring in patients on chronic opioid therapy. Little information exists, however, concerning physicians' knowledge of accurate interpretation of these tests. Our objective in this preliminary study was to determine the level of physician proficiency in UDT interpretation, particularly with regard to frequently prescribed opioids and common drugs of abuse.

METHODS

Neither we nor others were able to identify any published, validated psychometric tools purporting to evaluate physicians' UDT interpretive knowledge in the context of the medical clinic.⁶ A seven-question survey comprising six five-option, single-best-answer multiple choice questions and one yes/no question about UDT interpretation was developed by two of the authors, one (GMR) a board-certified pain management specialist and the other (RB) a board-certified clinical chemist and toxicologist. The survey was designed to be used in a preliminary and exploratory study of several aspects of physicians' knowledge about UDT. No formal psychometric validation was conducted on the instrument. The survey content was generated on the basis of the most common and/or critical interpretive errors seen in our tertiary care medical center and community-based primary care clinics. Four questions concerned administration of prescription opioids, one question concerned administration of heroin, one question concerned passive inhalation of marijuana, and one question concerned ingestion of poppy seeds. The questionnaire was vetted by seven experts in the field of clinical and forensic toxicology (including three directors of Substance Abuse and Mental Health Services Administration–certified drug testing laboratories and the chief toxicologist for the state of North Carolina), which led to refinement of the survey questions. The questionnaire can be found in the Appendix. The study was approved by the University of Florida College of Medicine's institutional review board.

Table 2. Knowledge level by UDT ordering status, n (percent)^a

Total # correct on knowledge questions	Order UDT		χ^2 ^b	p
	Yes (n = 77)	No (n = 37)		
0	2 (3)	1 (3)	6.12	0.41
1	12 (16)	4 (11)		
2	17 (22)	12 (32)		
3	22 (29)	8 (22)		
4	18 (23)	5 (14)		
5	5 (6)	5 (14)		
6	1 (1)	2 (5)		
7	0	0		
Percent correct on specific questions	Order UDT		OR ^c	95 percent CI
	Yes (n = 77)	No (n = 37)		
1	29	38	0.66	0.28 to 1.50
2	61	54	1.33	0.60 to 2.94
3	7	5	0.64	0.19 to 2.17
4	22	22	1.02	0.39 to 2.66
5	79	76	1.22	0.48 to 3.11
6	17	32	0.42	0.17 to 1.05
7	52	43	1.41	0.64 to 3.12

^a Total percent may total > 100 due to rounding
^b χ^2 test of difference in proportion of UDT ordering status by total number of correct answers for knowledge questions
^c Odds ratio (OR) modeling UDT testing as “yes” = 1 and “no” = 2

The questionnaires were distributed to all attendees (n = 151) at each of three opioid education conferences sponsored by the Opioid Management Society (Philadelphia, September 16 and 17, 2006; Miami, October 28 and 29, 2006; and Houston, November 11 and 12, 2006). The questionnaires were accompanied by a cover sheet explaining the purpose and voluntary nature of the study. A brief verbal description of the study's aims was given by one of the investigators (GRW or GMR) at the time of questionnaire distribution. The questionnaires were distributed, completed, and collected early in the conference, immediately prior to a presentation on clinical UDTs. Participants had 15 minutes to complete the questionnaire.

Data analysis

Frequencies were calculated for each variable. We then applied χ^2 tests to examine bivariate associations between UDT utilization and UDT interpretive knowledge. The p values, odds ratios, and 95 percent confidence intervals for observed associations are reported.

RESULTS

One hundred and fifty-one questionnaires were distributed, and 121 completed questionnaires were returned. Seven questionnaires were discarded because the respondents were either physicians not involved in

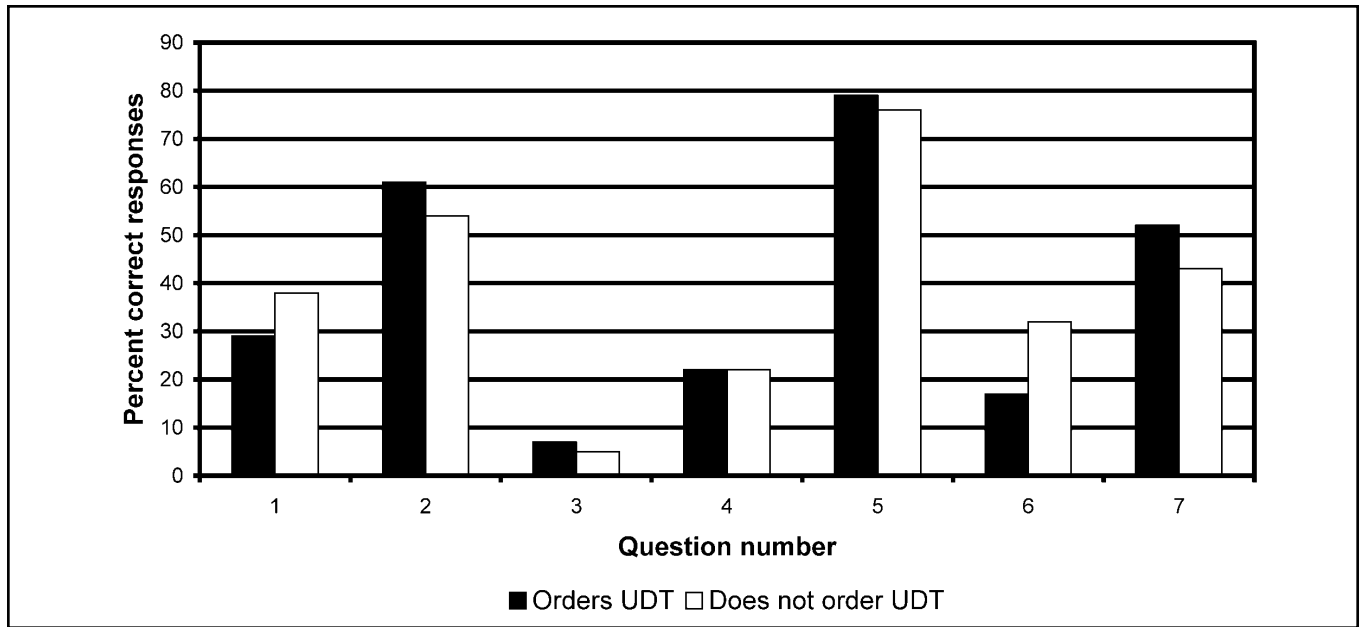


Figure 1.

clinical medicine or nonphysicians who were not responsible for ordering/interpreting UDTs. One hundred and fourteen completed physician questionnaires were returned, for an overall response rate of 80 percent. Seventy-seven respondents (68 percent) indicated that they employ UDT. Seventy-six percent indicated that they prescribe opioids for chronic nonmalignant pain, 19 percent indicated that they were board certified in pain management, and 6 percent indicated that they were board certified in addiction medicine or addiction psychiatry. Table 1 includes the overall number and percentage of questions answered correctly, stratified by physician UDT practice. These data are presented graphically in Figures 1 and 2.

None of the 77 physicians who indicated that they employ UDT answered all seven questions correctly; one (1 percent) answered six questions correctly, five (6 percent) answered five questions correctly, 18 (23 percent) answered four questions correctly, 22 (29 percent) answered three questions correctly, 17 (22 percent) answered two questions correctly, 12 (16 percent) answered one question correctly, and two (3 percent) answered no questions correctly. The percentages of respondents making two or fewer errors did not statistically differ between those who employ UDT and those who do not ($\chi^2 = 3.63$; $p = 0.82$).

Question 1: Codeine administration

Codeine is metabolized in part to morphine by means of the cytochrome P450 2D6 isoenzyme. Consequently, both codeine and morphine are ordinarily detectable in the urine of patients administered codeine-containing

products. Twenty-nine percent of physicians who employ UDT answered this question correctly. Most incorrect respondents failed to recognize that morphine is a metabolite of codeine and/or incorrectly identified dihydrocodeine as a codeine metabolite. Although 38 percent of physicians who do not employ UDT answered this question correctly, the difference in correct response rates between those who employ UDT and those who do not employ UDT was not statistically significant.

Question 2: Morphine administration

Sixty-one percent of respondents who employ UDT recognized that morphine is the only opioid detectable in the urine of patients administered only morphine. Twenty-six percent of respondents believed that morphine, codeine, and dihydrocodeine would be detectable; 10 percent believed that morphine and codeine would be detectable; and 1 percent believed that only dihydrocodeine would be detectable. There were no statistically significant differences in correct response rates between physicians who employ UDT and those who do not.

Question 3: Heroin use

Heroin is metabolized to morphine, 6-monoacetylmorphine, and other metabolites. The parent compound has a half-life of several minutes and therefore is not usually detectable on UDT. The intermediate metabolite, 6-monoacetylmorphine, is generally detectable for several hours after heroin administration.⁶ Nine percent of physicians who employ UDT and 14 percent of those who do

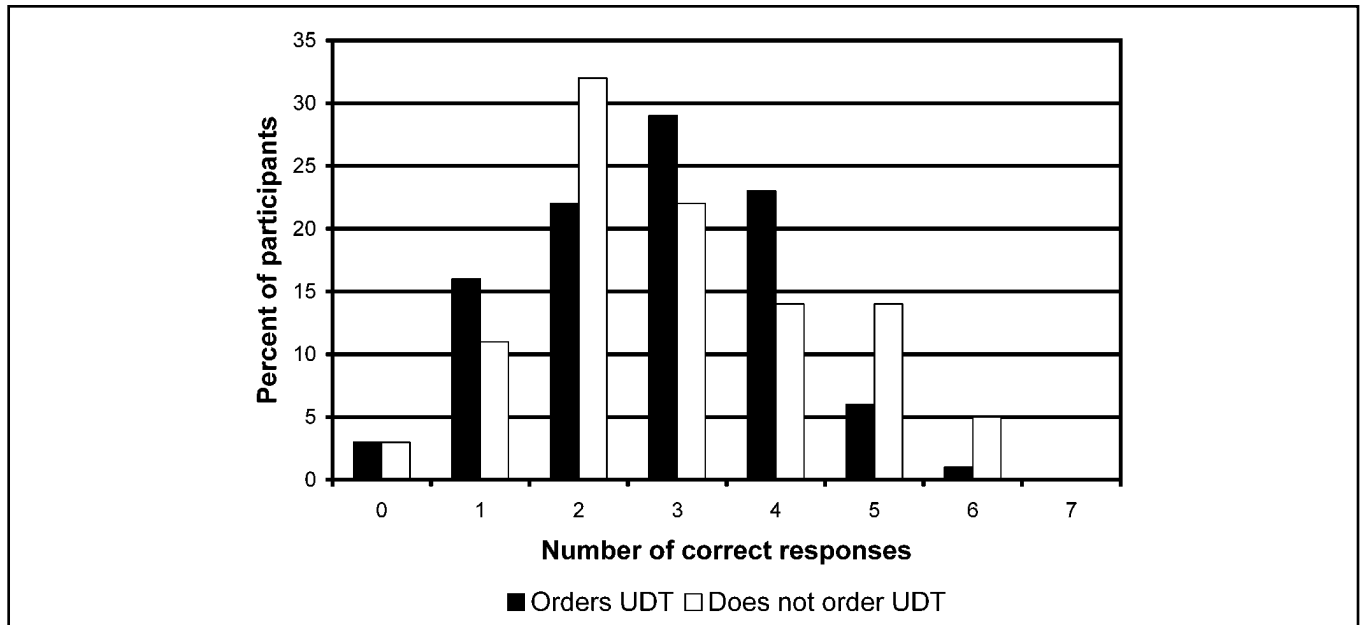


Figure 2.

not recognized that morphine is the only opioid likely to be detected in the urine of people taking only heroin. Most incorrect respondents indicated that heroin and/or hydromorphone would be detected. Although physicians who employ UDT were 36 percent less likely to answer this question correctly than those who do not employ UDT, this difference did not reach statistical significance.

Question 4: Poppy seed consumption

Codeine and morphine are components of poppy seeds, moderate consumption of which can result in positive UDT for both opioids.⁷ Twenty-two percent of physicians who employ UDT recognized this pharmacologic fact. There were no statistically significant differences in correct response rates between physicians who employ UDT and those who do not.

Question 5: Secondhand exposure to marijuana smoke

Casual, passive exposure to marijuana smoke does not cause positive urine screens for Δ^9 -tetrahydrocannabinol (THC) at the federally mandated cutoff of 50 ng/mL.⁷ Seventy-nine percent of physicians who employ UDT answered this question correctly, compared to 76 percent of physicians who do not employ UDT, a difference that was not statistically significant.

Question 6: Explanations for negative screens

Negative urine drug screens in patients taking opioids may be due to several factors, including lack of drug use in the one to three days preceding the UDT, inability of

many screening assays to detect synthetic and semisynthetic opioids in therapeutic doses, and rapid metabolism of the drug (due to, for example, cytochrome P450 enzyme induction).⁷⁻⁹ Seventeen percent of physicians who employ UDT answered this question correctly. Most incorrect responses were due to the failure to recognize rapid opioid metabolism as a cause of negative screens, although a substantial number of physicians failed to recognize a lack of assay sensitivity/specificity and absence of recent use as possible causes of negative screens. Paradoxically, 32 percent of physicians who do not employ UDT answered this question correctly, a difference that was statistically significant ($\chi^2 = 11.23$; $p = 0.04$).

Question 7: Possible false negative hydromorphone screening assays

When administered in therapeutic doses, hydromorphone, a semisynthetic opioid, is not detectable by many opiate screening assays. If patients administered hydromorphone screen negative for opiates on immunoassay, the drug should be detectable by specific confirmatory tests such as gas chromatography/mass spectroscopy. Fifty-two percent of physicians who employ UDT answered this question correctly. Fourteen percent of physicians indicated that they would readminister the same screening assay at the next office visit, 10 percent would taper and discontinue opioid therapy, and 3 percent would refer the patient to an addiction specialist. The difference in correct response rates between physicians who employ UDT and those who do not was not statistically significant.

DISCUSSION

Limited available data indicate that physicians are not truly proficient in UDT interpretation. In a study of primary care physicians engaged in the practice of adolescent medicine, nearly all of whom had used UDT in their practice, Levy et al.⁵ found that the majority lacked essential knowledge regarding proper specimen collection and validation, interpretation of positive and negative results, and the need for confirmatory testing. For example, only 12 percent of the physicians surveyed knew that oxycodone is not detectable by most screening immunoassays, only 40 percent of physicians knew that poppy seeds could produce a positive screen for opioids, and less than 50 percent of physicians knew the temporal limits of detection of THC in the urine of regular marijuana users. Durbach et al.,¹⁰ in a study of emergency medicine physicians, found that only 5 percent were able to correctly identify those substances detectable by the UDT method used in their hospital, and nearly three-quarters of the participants incorrectly believed that all benzodiazepines could be detected.

The present study, involving physicians who attended an opioid education conference and who prescribe opioid therapy for chronic pain, confirms and extends previous work demonstrating a uniformly inadequate physician knowledge base with regard to UDT interpretation. Of the 77 physicians who employ UDT, none were able to answer all seven test questions correctly, and only 30 percent were able to answer more than half correctly. Physicians who employ UDT, as well as physicians who are board certified in pain management, performed no better on any of the seven questions than physicians who do not employ UDT.

Misinterpretation of UDT potentially has important and negative consequences for patients. Misinterpretation of (false) negative test results may lead the clinician to a false sense of confidence that substance abuse does not exist. Misinterpretation of (false) positive tests has potential negative consequences for the patient, including false accusations of abuse, unjustified loss of opioid privileges, deterioration of the physician-patient relationship, painful and possibly dangerous opioid withdrawal, compromised ability to receive appropriate therapy from future physicians, and involvement of law enforcement. UDT misinterpretation may also have ramifications for the physician. While we were unable to identify any published cases, we assert that false accusations of substance misuse based on inaccurate UDT interpretation do have potential medicolegal consequences.

There are several limitations to this study. One is the issue of response bias. It is likely that those physicians who chose not to complete the questionnaire were less likely to employ UDT and/or less confident about their knowledge of UDT interpretation. It is likely, therefore,

that while the response rate (80 percent) was relatively high, the low level of knowledge demonstrated in this article would have been lower still had the physician response rate been more robust. Another limitation involves the structure and content of the test questions. With regard to the former, it is possible that the test questions were suboptimally constructed and hence difficult to answer. While the stem items were highly focused and we avoided the use of negative-stem questions, we did incorporate four “all of the above” options, a practice which some education experts believe to be flawed.¹¹ This type of question, however, is common in medical continuing education, and physicians are highly experienced in answering such questions. With regard to the content, questions were developed based on what the authors determined to be essential core content for interpretation of UDT for patients on chronic opioid therapy in the context of clinical medicine. The questionnaire was vetted by a panel of experts in toxicology and laboratory medicine, but the reliability and validity of the instrument have not been established among clinicians. None of the respondents commented that the questions were ambiguous or unfair. Finally, it might be argued that physicians attending an opioid education conference are not representative of all physicians who employ UDT, as the former group might have attended in order to remedy self-perceived knowledge deficits. This, however, seems unlikely to have biased our results. Limited data from other physician groups who employ UDT—those engaged in the practices of adolescent or emergency medicine—indicate that UDT knowledge is poor in unselected physician groups.^{9,10} Furthermore, a majority of physicians report receiving insufficient chronic pain education in their graduate and postgraduate medical training.^{12,13}

UDT education can be addressed in several ways. Physicians can consult a number of published sources, including a superb monograph published by the California Academy of Family Physicians¹⁴ and *The Medical Review Officer's Manual*.¹⁵ Medical Review Officer certification courses offer two-day comprehensive training in all aspects of UDT, albeit in the context of federally mandated workplace testing, which differs in important respects from clinical testing.

CONCLUSION

This study demonstrates that physicians' knowledge of UDT interpretation is inadequate; physicians who employ UDT are no more proficient in their interpretation than their peers who never employ UDT. Interpretation of UDT results can be highly complex, and the results have potentially serious consequences for both patient and physician. Physicians who employ UDT should have a solid, basic knowledge of interpretation

and should work closely with certified clinical chemistry/toxicology professionals when ordering and interpreting these tests.

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APPENDIX. URINE DRUG TESTING (UDT) QUESTIONNAIRE: KNOWLEDGE QUESTIONS*

1. In a patient prescribed Tylenol #3 (codeine and acetaminophen), one would reasonably expect which of the following to be detected in the urine:
 - a. codeine
 - b. dihydrocodeine
 - c. morphine
 - d. all of the above
 - e. a and c only**
2. In a patient prescribed MS Contin (morphine), one would reasonably expect which of the following to be detected in the urine:
 - a. codeine
 - b. dihydrocodeine
 - c. morphine**
 - d. all of the above
 - e. a and c only
3. In a patient using heroin, one would be likely to detect which of the following in the urine:
 - a. heroin
 - b. hydromorphone
 - c. morphine**
 - d. all of the above
 - e. a and c only
4. A patient on OxyContin (oxycodone) therapy is administered a random urine drug test. He notifies you that he ate a large lemon poppy seed muffin for breakfast. What substances might reasonably be detected in the urine?
 - a. oxycodone
 - b. codeine
 - c. morphine
 - d. all of the above**
 - e. a and c only
5. A patient on chronic opioid therapy tests positive for cannabis on a random urine drug screen. She explains that her husband sometimes smokes pot in their bedroom. Is this a plausible explanation for the test findings?
 - a. yes
 - b. no**
6. Which of the following are plausible explanations for a negative urine opiate drug screen in a patient on chronic opioid therapy:
 - a. Patient ran out of opioid early and has not used any in a few days.
 - b. Patient is a "fast metabolizer."
 - c. Drug screen does not detect that particular opioid.
 - d. a, b, and c**
 - e. a and c only
7. A patient on chronic Dilaudid (hydromorphone) therapy tests negative for opioids on a urine drug screen. The patient claims to be using the medicine as prescribed. The most appropriate next step would be to:
 - a. subject this urine to a different type of test**
 - b. readminister a urine drug screen at the next visit
 - c. taper and discontinue opioid therapy
 - d. refer the patient to a detoxification/rehabilitation program
 - e. notify law enforcement

* Correct responses are bolded.