

Screening urine for drugs of abuse in the emergency department: Do test results affect physicians' patient care decisions?

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ABSTRACT

Background: Drug abuse is a frequent factor in emergency department (ED) visits. Although commonly performed, qualitative testing of urine for drugs of abuse (u-DOA) is inherently limited in its ability to establish the identity, timing or dose of substances used. Previous studies have demonstrated these limitations, but their designs cannot be used to determine whether the results of u-DOA tests affect physicians' patient care decisions. Our objective was to determine the impact of u-DOA testing on the care of patients who present to the ED.

Methods: All adults 18 years of age or older who had u-DOA testing in 2 urban teaching EDs were eligible. Victims of vehicular trauma or sexual assault were excluded. Just prior to communicating the results of u-DOA testing for a patient, an investigator interviewed the ordering physician or consultant physician about the patient care plans for that patient. Test results were then revealed, and the questions immediately repeated. This design isolated the impact of knowledge of u-DOA test results on physicians' patient care decisions. Any intended changes in patient care plans reported by the interviewed physician were compared to *a priori* criteria for substantive change and then subsequently reviewed by an independent expert to determine whether that change was justified.

Results: Of the 110 u-DOA test results studied and the resultant 133 opportunities to influence physician management plans, there were 4 reported changes in management. One management change was judged to be substantive, but none of the 4 reported changes were considered by the independent expert reviewer to be justified. Urine-DOA testing thus led to a justified change in management in 0/133 instances (95% confidence interval 0%–2.3%).

Conclusions: Urine-DOA is rarely helpful in guiding patient care decisions in the ED. The results of this study call into question the need for this test in the ED setting.

Key words: substance abuse detection; emergency service, hospital; diagnostic tests

RÉSUMÉ

Contexte : La toxicomanie est un facteur souvent en cause lors des visites au département d'urgence (DU). Bien qu'ils soient effectués couramment, les tests qualitatifs urinaires pour le dépistage de drogues illicites sont par nature limités dans leur capacité à établir l'identité, le moment ou la dose des substances utilisées. Des études antérieures ont démontré ces limites, mais

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leurs méthodologies ne permettent pas de déterminer si les résultats des tests urinaires de dépistage de drogues illicites influencent les décisions du médecin face aux soins du patient. Notre objectif était de déterminer l'impact des tests urinaires de dépistage de drogues illicites sur les soins aux patients reçus au DU.

Méthodes : Tous les adultes âgés 18 ans ou plus ayant subi un test urinaire de dépistage de drogues illicites à deux DU d'hôpitaux universitaires urbains étaient admissibles. Les victimes de traumatismes découlant d'un accident de la route ou d'agressions sexuelles furent exclues. Juste avant de communiquer les résultats des tests urinaires pour le dépistage de drogues illicites pour un patient, un chercheur interrogea le médecin ayant demandé le test ou le médecin consultant au sujet du plan thérapeutique pour le patient en question. Les résultats du test furent ensuite révélés et les questions immédiatement répétées. Cette méthodologie permit d'isoler l'impact de la connaissance des résultats des tests urinaires de dépistage de drogues illicites sur les décisions thérapeutiques face aux patients. Tout changement projeté au plan thérapeutique du patient signalé par le médecin interrogé fut comparé à des critères a priori à la recherche de changements substantiels puis étudié par la suite par un expert indépendant afin de déterminer si le changement était justifié.

Résultats : Parmi les 110 résultats de tests urinaires de dépistage de drogues illicites étudiés et les 133 occasions d'influencer le plan thérapeutique des médecins en ayant résulté, il y eut quatre changements de thérapeutique signalés. Un changement fut jugé important, mais aucun des changements signalés ne fut considéré comme justifié par l'examineur expert indépendant. Les tests urinaires de dépistage de drogues illicites menèrent donc à un changement de thérapeutique justifié dans 0/133 cas (intervalle de confiance 95 %, 0,5–2,3 %).

Conclusions : Le test urinaire de dépistage de drogues illicites est rarement utile dans l'orientation des décisions de soins aux patients au DU. Les résultats de la présente étude mettent en doute l'utilité de ce test dans le cadre du DU.

Introduction

A significant proportion of emergency department (ED) patient visits are attributable to drug abuse.¹ One of the most frequently performed toxicologic tests is the “urine drug screen,” an immunoassay for metabolites of common drugs of abuse, both illicit and prescription (u-DOA). Many clinicians order this test either selectively when there is clinical suspicion of drug use, or routinely for patients reporting self-harm. Despite its relatively low per-test cost, the widespread use of u-DOA tests generates a significant expense. Moreover, the imperfect diagnostic accuracy and the limited number of agents identified suggest the information provided is likely to be of marginal benefit.

Although previous studies have demonstrated discrete limitations of u-DOA testing, their design precluded determining whether the test results affect patient care decisions. The purpose of this investigation is to isolate and measure the impact of u-DOA test results on patient management in the ED.

Methods

Subjects

The study was performed in 2 academic EDs with a combined annual census of 100 000 visits, serving a catchment

population of 250 000. All patients 18 years of age or older for whom u-DOA tests were ordered were eligible. Patients undergoing u-DOA tests during forensic work-up following vehicular trauma or sexual assault were excluded, as were the cases in which the u-DOA tests were not ordered by a physician. The experimental unit was the individual physician. All ED physicians were informed of the study at the outset. All participating physicians, including consultants, provided verbal consent at the time of telephone interview. Physicians were asked not to alter their threshold for ordering u-DOA tests during the study period. This study was approved by the institutional Research Ethics Board, including a waiver of patient consent, based in part on minimal risk to the patient.

Urine-DOA testing

The u-DOA test used during this study was the Triage Panel for Drugs of Abuse plus Methadone (Biosite Diagnostics, San Diego, Calif.). This test consists of 8 immunoassays directed against the urinary metabolites of amphetamines, barbiturates, benzodiazepines, cannabinoids, cocaine, methadone, other opiates, phencyclidine (PCP) and tricyclic antidepressants. Results for each assay are qualitatively positive if the amount exceeds a threshold value. This test is performed by the central core laboratory and is therefore subject to standard quality assurance mea-

tures, including daily quality control, and participation in external quality assurance (College of American Pathologists) and proficiency testing (Quality Management Program — Laboratory Services) programs. In addition, there is random verification of u-DOA test results on samples referred out for confirmatory testing by more comprehensive techniques (e.g., high performance liquid or gas chromatography, mass spectrometry).

Results are traditionally reported to the ED by network printer following manual entry by the laboratory technologist into the computerized patient-care database. To establish a baseline rate of u-DOA test ordering and to identify missed cases (i.e., patients not identified by the laboratory as having had u-DOA testing) during the study period, all u-DOA tests performed in the ED were identified in this database and reviewed for the period of one calendar year prior to the study's enrolment period.

Study protocol

For this study, laboratory technologists notified study investigators of the u-DOA test results rather than reporting the result directly to the ordering physician. Enrolment was open 24 hours per day, 7 days per week. The investigator immediately interviewed the ordering physician by telephone using a standardized script, and confirmed eligibility. For excluded patients, or if the laboratory technologist was unable to contact an investigator within 15 minutes, the u-DOA test results were released in the customary fashion.

All remaining patients were enrolled in the study. The ordering physician was asked to specify what u-DOA test results were anticipated, as well as patient disposition and management plans prior to being given the results of the u-DOA test. The investigator then revealed the u-DOA test results, and immediately repeated the query regarding disposition and management plans. If the ordering physician had already referred the patient to a consultant physician prior to obtaining the u-DOA test result, this was coded as "no change in management" for the ordering physician because the disposition decision had been made in the absence of the test results. The consultant physician was subsequently contacted in the same manner and also asked whether the u-DOA test result would influence care management. Once the interview with the treating physician was complete, the laboratory technologist was notified to release the result electronically. A chart review was performed to compare the final patient disposition to that reported to the investigator by the ordering or treating physician. Missed cases were identified by electronic search of the computerized laboratory information system, and u-DOA test results compared to identified cases.

Outcomes and analysis

The primary outcome measure was the number of substantive and justified changes in patient care management resulting from u-DOA testing. Substantive changes were defined *a priori* and included the following: planned referral to consulting service cancelled; new referral to consulting service made; planned admission to hospital cancelled; planned discharge from ED changed to consultation or admission; patient provided with DOA-specific follow-up; drug/agent-specific medical therapy initiated or halted. A planned period of observation that ultimately led to a discharge home (without an intervening referral) from the ED was not considered to be a change in management.

An independent expert, board certified in emergency medicine and medical toxicology, reviewed all cases with any change in management to determine whether the changes were justified based on the u-DOA test result. The reviewer was not explicitly informed of the study hypothesis. Data were compared using Student's *t*-test or one-way analysis of variance (ANOVA) for continuous variables and Pearson's chi-squared or Fisher's exact test for categorical variables. Concordance between physicians' expected u-DOA test findings and actual test results was measured. Based on the assumption that the presence of an altered mental status might affect the utility of u-DOA test results, patients with Glasgow Coma Scale (GCS) scores of 15 were tested separately from those with GCS <15 in a planned subgroup analysis. Analyses were performed using SPSS for Windows, version 11.0 (SPSS Inc., Chicago).

Results

Between July 1, 2001, and Mar. 31, 2002, the central core laboratory performed 271 u-DOA tests on patients who had presented to either of the study hospitals' EDs, and the laboratory technologists notified the investigators in 160 (59.0%) cases. Of these, 110 (68.8%) were enrolled in the study and 50 were excluded (Fig. 1). During the first 8 weeks of the study, 17 patients with a GCS score of <15 were excluded because of delayed Research Ethics Board approval for this subgroup. Table 1 shows demographic data and u-DOA test results for the study patients and the 50 excluded cases, showing that missed patients did not differ substantially from identified cases. Of the 111 missed patients, 75 (67.6%) would have met the inclusion criteria, a rate similar to the actual enrollment rate ($\chi^2 p = 0.84$).

On 4 occasions the ordering physician reported that u-DOA test results led to management changes (3.6%; 95%

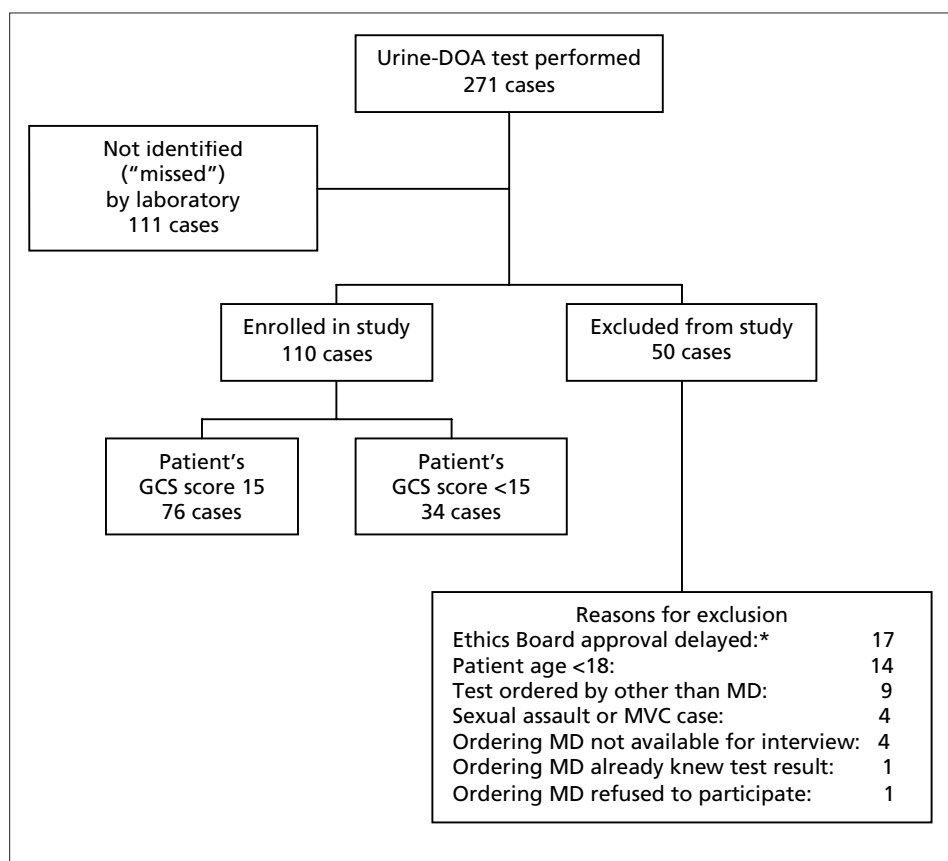


Fig. 1. Case disposition for patients who had testing of urine for drugs of abuse (u-DOA) during the study period. GCS = Glasgow Coma Scale; MVC – motor vehicle collision.

Table 1. Patient demographic data and results of testing of urine for drugs of abuse (u-DOA)

	Included		<i>p</i> value, GCS score 15 v. <15	Excluded <i>n</i> = 50	Missed <i>n</i> = 111	<i>p</i> value, Notified v. missed
	GCS score 15 <i>n</i> = 76	GCS score <15 <i>n</i> = 34				
Age, mean ± SD	39.0 ± 14.0	39.4 ± 12.2	0.54	37.3 ± 20.5	33.8 ± 15.2	0.02
Female gender, no. (and %)	33 (43.4)	16 (47.1)	0.72	32 (64.0)	54 (50.9)*	0.96
Test ordered by						
ED physician	41 (53.9)	25 (73.5)		31 (62.0)	66 (80.5)†	
Psychiatrist	22 (28.9)	2 (5.9)	0.03	2 (4.0)	8 (9.8)	0.04‡
Other consulting service§	13 (17.1)	7 (20.6)		8 (16.0)	8 (9.8)	
Non-physician	N/A	N/A		9 (18.0)	N/A	
Test result positive for any of substances listed below	46 (60.5)	16 (47.1)	0.19	31 (62.0)	46 (48.4)¶	0.13
Amphetamines	6 (7.9)	3 (8.8)	0.87	4 (8.0)	9 (9.5)	0.71
Barbiturates	0 (0)	2 (5.9)	0.64	1 (2.0)	1 (1.1)	0.20
Benzodiazepines	21 (27.6)	5 (14.7)	0.14	16 (32.0)	25 (26.3)	0.99
Cocaine metabolite	7 (9.2)	2 (5.9)	0.56	3 (6.0)	6 (6.3)	0.72
Methadone	2 (2.6)	2 (5.9)	0.59	1 (2.0)	4 (4.2)	0.65
Other opiates	18 (23.7)	10 (29.4)	0.52	10 (20.0)	16 (16.8)	0.19
Tricyclic antidepressants	5 (6.6)	2 (5.9)	0.63	6 (12.0)	8 (8.4)	0.93
THC	15 (19.7)	4 (11.8)	0.31	14 (28.0)	17 (17.9)	0.60

GCS = Glasgow Coma Scale; SD = standard deviation; ED = emergency department; THC = tetrahydrocannabinol-containing compounds (e.g., marijuana, hashish). **n* = 106; †*n* = 82; ‡Analysis excludes tests ordered by non-physician; §Most often, Internal Medicine; ¶*n* = 95.

confidence interval [CI] 0.1%–7.1%; Table 2), but only 1 of these changes was substantive (as defined *a priori*), and none were considered justified by the independent expert reviewer. There was no difference in the reported number of management changes between the GCS 15 ($n = 3$; 3.9%) and GCS <15 ($n = 1$; 2.9%) groups (Fisher's exact test, $p = 0.64$).

Of the 110 cases studied, there were 23 cases in which a second treating physician was also queried regarding management plans before and after being advised of u-DOA test results. In this group there were no reported management changes in any patients. Thus, overall, u-DOA testing led to no justified management changes in 133 instances (0.0%; 95% CI 0%–2.3%).

Table 3 summarizes the results of secondary outcome analyses. Of the 110 u-DOA tests ordered in the ED, the ordering physician was able to completely predict the results of the test in 48 cases (43.6%). In 73 cases (66.4%),

the patient was referred to a consulting service before the u-DOA test result was available.

On retrospective assessment, actual patient disposition differed from the reported disposition plans in only 7 cases (5.3%). In 5 of these, a planned period of observation ultimately led to a referral (3 to psychiatry, 1 to internal medicine) or an admission (1 to internal medicine). In 2 other cases where the ordering physician was initially uncertain regarding patient disposition, 1 patient was ultimately referred to psychiatry and the other was admitted by an internal medicine consultant.

To assess the possibility of a Hawthorne effect, we reviewed previous u-DOA testing patterns. During the corresponding months of the year that preceded the study (i.e., July 1, 2000, to Mar. 31, 2001) we identified 386 u-DOA screens ordered on ED patients (v. 271 in the study period; $p < 0.001$; Fig. 2). Two hundred and twenty-nine of these patients (59.3%) had at least 1 positive finding, a rate com-

Table 2. Cases in which the treating physician reported a change in care management after learning of u-DOA test results

Patient's age / sex	Presentation	GCS score	Urine-DOA test result	Change in management	Assessment of management change*
23 / M	Bizarre behaviour	<15	Amphetamines, cocaine metabolite, THC	Planned CT of the head was cancelled	Not substantive / Unjustified
49 / F	"Neurologic symptoms"	15	Negative	Consult to Internal Medicine changed to Psychiatry	Not substantive / Unjustified
46 / M	New onset psychosis	15	Other opiates, THC	Physician was unsure which consultant was required; Medicine consulted	Not substantive / Unjustified
19 / M	Confusion; fell in lake	15	THC	Psychiatry referral cancelled; patient confronted about THC use, which he admitted; observed in ED	Substantive / Unjustified

u-DOA test = testing of urine for drugs of abuse; GCS = Glasgow Coma Scale; THC = tetrahydrocannabinol-containing compounds (e.g., marijuana, hashish); ED = emergency department
*Assessment was done by independent expert reviewer.

Table 3. Subgroup analysis of study outcomes

Outcome	Subgroup; no. of patients (and %)	
	GCS score 15 $n = 76$	GCS <15 $n = 34$
Any unexpected result of u-DOA test	42 (58.3)	20 (58.8)
Patient referred to consultant before ordering physician learned of u-DOA test result	54 (71.1)	19 (55.9)
Changes in patient care management due to results of u-DOA test		
Change made by ordering physician	3 (3.9)	1 (2.9)
Change made by consulting physician	0 (0)	0 (0)
Change in management viewed as substantive*	1/3 (33.3)	0/1 (0)
Change in management judged as substantive and justified*	0/3 (0)	0/1 (0)

GCS = Glasgow Coma Scale; u-DOA test = testing of urine for drugs of abuse
*Changes were deemed "substantive" and/or "justified" by an independent expert reviewer.

parable to that seen during the study period ($\chi^2 p = 0.23$). Patients from the 2 periods were of similar age, and the pattern of positive results was also similar; however, there was a higher proportion of men in the preceding corresponding period compared to the study period (58.1% v. 49.2%, $\chi^2 p = 0.02$).

Discussion

Previous literature has shown that, even in alert, communicative patients, medical histories are often inaccurate with regard to substance use.²⁻⁷ In one ED-based study, Elango and colleagues found that the Structured Clinical Interview for DSM-III-R (SCID) failed to identify 55% of patients abusing cocaine.⁷ In a psychiatric emergency setting, physician clinical suspicion of substance use was correct only 39% of the time,² and in another psychiatric ED, physicians were only able to correctly identify 44% of recent substance users.⁸ Accordingly, laboratory testing is often needed to confirm or refute a suspicion of substance abuse.

Qualitative u-DOA testing provides rapid results but imperfect analytical sensitivity and specificity; this is described adequately in previous literature.^{6,9,10} Sensitivity is limited by the small number of drug classes tested, the structural heterogeneity within a class, and the threshold of the assay; consequently, negative assays do not rule out clinically important drug intoxication. Specificity is often poor due to cross-reactivity and the absence of confirmatory testing.¹¹ Perhaps the most significant clinical limitation of u-DOA testing, however, lies in the fact that a drug

or its metabolites may remain detectable in the urine long after the acute intoxicating effects of the drug have resolved. Accordingly, a positive u-DOA test result may be completely unrelated to the patient's current presentation, and, particularly in habitual users, this may mislead the unwary physician.

Several studies have demonstrated these shortcomings and concluded that u-DOA testing seldom leads to significant changes in patient management,^{2,9,10,12} however, these studies are limited by their retrospective nature, by considering only psychiatric patients, by failing to control for the dynamic changes in patient condition over the course of their presentation, and by failing to isolate the effect of u-DOA from other clinical and laboratory information on management decisions. The present study was designed to overcome these limitations.

At our institution, u-DOA tests are not generally ordered in the routine management of patients who have overdosed, psychiatric cases, or in patients with chest pain or other clinical syndromes in which substance use might be contributory. This explains the relatively low rate of u-DOA testing seen in this study. During the 9-month study period, there were at least 194 acute psychiatry admissions, 261 intentional overdoses and 65 self-inflicted wrist lacerations seen in the ED, suggesting that u-DOA screens are selectively ordered at the discretion of the treating physician. In the absence of uniform guidelines, it is likely that individual physician testing behaviour is highly variable. The wholesale cost of the u-DOA test at our centre is \$28.64, and the labour cost is estimated to be about \$3. At a rate of over 300 tests per year, this cost is not inconsequential.

Our review of u-DOA testing patterns suggests that physicians ordered fewer u-DOA during the trial year compared to the prior year; nevertheless, the testing rate remained relatively constant throughout the study and the proportion of positive tests was similar, suggesting a minimal Hawthorne effect. Despite relatively stable, selective use of u-DOA testing there was still minimal utility to the u-DOA test.

The physicians who ordered u-DOA testing in our study rarely reported a change in management after learning of the test results. Even in the very few cases where a change was attributed to the u-DOA test results, this change was not justified, as adjudicated by expert review. Among adult patients not involved in vehicular trauma or sexual assault, we were unable to identify a single justified change in management due to u-DOA test results over the 9-month period. Since the completion of this study, our centre has replaced the immunoassay u-DOA test with comprehensive toxicology testing based on high performance liquid

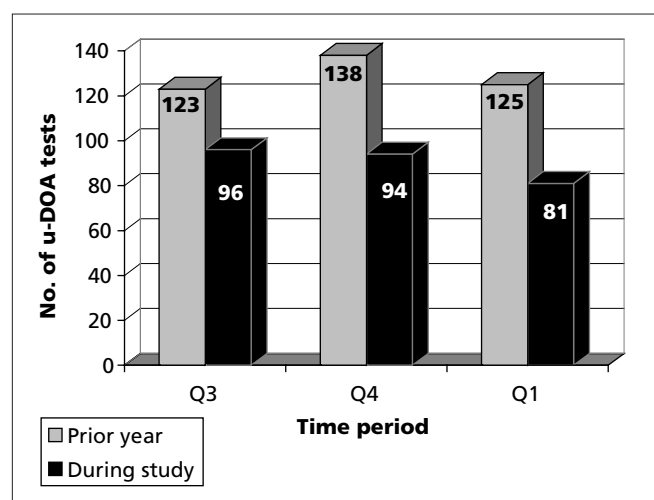


Fig. 2. Rate of ordering of testing of urine for drugs of abuse (u-DOA) during the same calendar quarter during the study period and for the preceding year's equivalent time period. Q3 = July 1 to September 30, Q4 = October 1 to December 31, Q1 = January 1 to March 31.

chromatography (REMEDI-HS, BIO-RAD Laboratories, Hercules, Calif.). This latter assay allows positive identification of a large number of medications and drugs, and would be expected to provide clinically useful information to the ED physician, especially for patients with altered mental status.

The common feature in the purported management changes appears to involve mistaken interpretation of the u-DOA test results because of a failure to appreciate the limitations of the assay. The u-DOA test is based on antibody detection of a class of compounds, which means that parent drug, metabolites, and occasionally structurally related compounds (exogenous or endogenous) are detected without discrimination. Result interpretation is further complicated by lack of confirmatory testing and by complex pharmacokinetic considerations. Hence the u-DOA test cannot be used to either definitively rule-in or rule-out a toxicologic cause for a patient's condition, and decisions about management based on these findings are rarely justified. In the cases of reported change in management, the overall management was appropriate and there were no adverse outcomes; it was the use of the u-DOA test result as the reason for the change that was not justified.

These findings should not be extrapolated beyond the ED management for patients whose presentation is related to substance use. For example, psychiatric disorders can be mimicked or exacerbated by substance use, and the long-term treatment that follows disposition from the ED may be affected. These concerns have been raised in the literature,¹³ but the limitations of a qualitative u-DOA test preclude ascribing the etiology of such an episode to the substance detected. Some centres have established protocols or pathways to provide brief intervention or referral to substance abuse counselling programs for suspected drug users.¹⁴ Whether the use of u-DOA testing provides meaningful long-term benefit by identifying candidates for these interventions was not assessed in our study. Although referral and counselling are available, no physician reported such a planned intervention or referral.

Limitations

This study is limited by the high rate of missed cases. In most missed cases, laboratory technologists failed to notify the investigators of eligible cases despite several varied attempts to promote study awareness in the laboratory. This error would be expected to be reasonably independent of the main outcome, and thus contribute little bias. Missed patients were similar to identified patients in terms of gender and u-DOA test results, but were younger. The age difference might be attributed to the fact that as the study pro-

gressed, the laboratory technologists became aware of the fact that patients under the age of 18 were being excluded and they may have elected not to notify the investigators of the younger patients. As well, there were a large number of cases in which we were unable to interview the physician. This situation generally occurred when the physician could not be interviewed within the 15-minute window prior to electronic u-DOA test result release.

Another limitation relates to the fact that the primary outcome measure (justified changes in management) was determined by expert opinion. A potential source of bias is that the interviewers were not blinded to the study hypothesis. Although not explicitly told, ordering physicians may have surmised the hypothesis, and thus been biased to report no effect of the u-DOA test results on their management plan. Despite this, there were very few discrepancies between reported and actual management plan identified at chart review.

"Substantive change in management" is a concept that is difficult to operationalize. We created our definition based on the notion that a significant determinant of a patient's length of stay in the ED and hospital is the need for specialist consultation. As well, one of the main intentions of ordering drug screening is to know what specific drug is the cause of a patient's presentation, so that therapy can be tailored to that agent. These 2 groups of management changes, therefore, informed our classification of substantive change. Other elements of patient care were felt to be less consequential. For example, the marginal cost of deferring discharge from the ED without consultation, or the cost savings of cancelling a planned CT were not felt to be substantive when we designed the study. Moreover, the specific details of the management change are subordinate to the fact that the u-DOA test does not provide adequate justification to make the change.

Management plans were only ascertained at one point in time, namely when the u-DOA test results became available. It is possible that the delay to get the result obliged the treating physician to make a decision before the u-DOA test result was reported. Since the study was designed to not substantially alter this delay, our findings are representative of the real-world effectiveness of u-DOA testing in the ED. Finally, the pre-planned exclusion of children, and of patients involved in sexual assault or vehicular trauma limits the applicability of study findings to these groups.

Conclusion

Urine drugs-of-abuse screens rarely affect physician deci-

sions regarding patient disposition and management in the ED. In the few cases when a treating physician changes ED management based on u-DOA test results, that decision is usually not justified given the test limitations. Thus, qualitative urine testing for drugs of abuse should rarely, if ever, be ordered for the ED management of adult patients.

Competing interests: None declared.

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