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Worth the Risk? Standardized Screening to Identify Substance Use Among Patients Prior to Surgery

This cross-sectional study was conducted on adults (aged ≥18 years) at a preoperative clinic to assess the detection of unhealthy substance use prior to surgery. This study compared the effectiveness of the Tobacco, Alcohol, Prescription medication, and other Substance use (TAPS), a standardized 4-item instrument, with routine clinical documentation in the Electronic Health Record (EHR).

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PREOPERATIVE SCREENING FOR SUBSTANCE USE

Objective: We sought to compare identification of unhealthy substance use before surgery using The Tobacco, Alcohol, Prescription Medication, and Other Substance Use (TAPS), a standardized 4-item instrument, versus routine clinical documentation in the electronic medical record (EHR).

Summary Background Data: Over 20% of individuals exhibit unhealthy substance use before elective surgery. Routine EHR documentation is often based on non-standard questions that may not fully capture the extent of substance use and is subject to bias. In contrast, brief standardized screening could provide a more efficient and systematic approach.

Methods: We conducted a cross-sectional study among adults (≥18 years) at a preoperative clinic from August to September, 2021. Positive screens for unhealthy substances by TAPS were compared to data from the EHR. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were reported. Receiver operating characteristic curves (ROCs) were used to assess diagnostic ability. Multivariable logistic regression was used to estimate the predictors of positive screens by TAPS.

Results: The cohort included 240 surgical patients. TAPS screening identified significantly more positive screens than EHR documentation (43.3% vs. 14.2%). Patients with unhealthy substance use were younger (50.8 vs. 56.7 years; p=0.003), and TAPS revealed alcohol misuse in 30.8% of cases, contrasting with 0% in clinician documentation (p<0.001). Of the 104 TAPS-positive patients, 69.2% were missed by EHR documentation. Sensitivity (31%) and accuracy (AUC= 0.65) of clinician documentation for any unhealthy substance use were lower compared to TAPS.

Conclusion: Standardized TAPS screening detected preoperative unhealthy substance use more frequently than routine clinician documentation, emphasizing the need for integrating standardized measures into surgical practice to ensure safer perioperative care and outcomes.

INTRODUCTION

The unhealthy use of alcohol, marijuana, opioids, and other substances has increased among the general population, as well as among those presenting for surgery. In 2021, an estimated 21.9% of people 12 and older living in the United States reported unhealthy substance use within the past year, while 1 in 6 persons received a diagnosis of substance use disorder.[1] Reports of unhealthy substance use within 12 months grew 0.4% from 2020 to 2021, with an estimated 2 million more people reporting any illicit drug use.[2,3] Moreover, an even larger proportion of the population may experience pre-addiction, or demonstrate early patterns of unhealthy substance use that has the potential to lead to more serious addiction if undetected.[3] Within the surgical field, nearly 40% of individuals presenting for elective surgery report unhealthy substance use prior to surgery and those with any presence of opioid use, regardless of frequency or quantity, are more likely to demonstrate poor pain and opioid-related outcomes following surgery.[4,5,6] Without early screening for unhealthy substance use, patients could be exposed to increased perioperative risk without adequate management of the risks associated with such exposures.

For individuals undergoing surgery, unhealthy substance use confers a higher risk of unfavorable postoperative outcomes, including poorly managed pain, wound healing complications, prolonged opioid use, respiratory complications, and overdose.[7,8,9] A pragmatic screening strategy could improve patient health and mitigate postoperative morbidity and outcomes; however, standardized tools to capture unhealthy substance use prior to surgery lack widespread implementation or use. Substance use is typically documented in electronic health records (EHR), most often when clinicians ask questions about social history. However, the use of non-standardized questions and variation in clinician documentation may introduce bias and fail to capture at-risk persons due to inadequate, inaccurate, or incomplete information.[10] In primary care, brief and efficient tools have been validated to capture unhealthy substance use with strong reliability and accuracy.[11,12] Prior work in non-surgical care settings has shown that brief standardized screening questions have the potential to more accurately identify and understand the extent to which patients use unhealthy substances.[13] Although screening tools and clinician-documented screening are used to assess unhealthy substance use, how EHR documentation compares with the standardized TAPS screening tool in a preoperative setting remains unknown. Identifying gaps in the detection of unhealthy substance use among patients preoperatively could provide important evidence to support the implementation of perioperative screening and prevent patients from potentially escalating unhealthy behaviors that may lead to misuse, addiction, and even death.

To address this gap, we analyzed data from patients undergoing common surgical procedures at a tertiary care institution to compare the accuracy of clinician documentation in the EHR with a set of standardized screening questions that capture unhealthy substance use of alcohol, tobacco, prescription medications, and other substances. We analyzed the social history documented by advanced practice providers extracted from the EHR and positive or negative screening results using the 4-item TAPS tool to examine the presence of unhealthy substance use among patients. We hypothesized that the use of a standardized and efficient screening tool such as the TAPS would identify unhealthy substance use to a greater extent than clinicians based on their routine preoperative documentation of social history in the electronic health record.

METHODS

The Institutional Review Board at the University of Michigan deemed this study to be exempt from review. Reporting follows recommendations from the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[14]

Study cohort: data collection - inclusion and exclusion criteria

This was a cross-sectional study of adults aged ≥ 18 years who were scheduled for surgical care within the Michigan Medicine Health System. Patients who presented for evaluation at a preoperative clinic from August 16, 2021, to September 24, 2021, were included to capture a convenience sample of approximately 400 patients to complete the survey prior to surgery. To be eligible for the study, the patients had to speak English and have an email address available in the electronic health record system. Patients were excluded if they were unable to understand or complete the screening questionnaire.

Electronic Health Record documentation

The EHR documentation was based on current clinical practices for assessing patients' unhealthy substance use, which involved acquiring social history. Social history items in the EHR included patient history of unhealthy substance use pertaining to tobacco, alcohol, or other illicit drugs, including the type of substances used, frequency of use, and when use began and discontinued.[15] Patient responses are documented in the electronic health record as they are reported and typically lack specified thresholds that capture the full extent of unhealthy substance use.

Tobacco, Alcohol, Prescription Medication, and other Substances Instrument

The Tobacco, Alcohol, Prescription Medication, and Other Substance Use (TAPS) tool used questions from the TAPS-1 screening to identify unhealthy substance use, which has been widely studied in primary care settings and community pharmacies. This 4-item survey identifies unhealthy use across four categories: tobacco, alcohol, prescription medications, and other substances (including marijuana, cocaine, heroin, methamphetamine, hallucinogens, and ecstasy). TAPS questions determine the frequency of substance use ("never," "less than monthly," "monthly," "weekly," or "daily or almost daily") over the past 12 months.[17] Unhealthy substance use was then identified based on reports at or above established substance-specific thresholds within 12 months: any patient use of any tobacco products; heavy alcohol consumption, defined as >=5 drinks in one day for men or >=4 in one day for women; or use of drugs (i.e., marijuana, cocaine or crack, heroin, methamphetamine, hallucinogens, ecstasy/MDMA) more than "never".[16]

Comparing the TAPS instrument to Electronic Health Record Documentation

TAPS data were obtained using a Qualtrics screening survey administered to patients within 30 days prior to their preoperative visit to the surgical team. Patients were emailed a link to the TAPS instrument 3 weeks prior to the scheduled clinic appointment, and all instruments were completed within 7 days of the email being sent. Patients whose responses met the respective thresholds required for substance use to be considered unhealthy for each of the 4 substance categories received a positive TAPS screen. Use of the same substance categories was

extracted from clinician-documented social history in the electronic health record and analyzed for comparison with the TAPS measure. To make the data from the electronic health record comparable to TAPS, clinicians' notes on the frequency and type of use of tobacco, alcohol, prescription medications, and other substances among patients were assessed to determine if documentation of unhealthy use was present. Clinician documentation of any patient tobacco use, consumption of more than five drinks per day for men and more than four for women, or misuse of prescription medications with a frequency greater than "never" were assigned a positive screen. Documentation that did not satisfy these requirements was designated a TAPS negative screen. The frequency of positive and negative screenings was compared with an analogous designation given to clinician documentation for accuracy. For additional details, refer to Table 2.

Outcomes:

The primary outcome was performance, as defined by the accurate detection of unhealthy substance use of alcohol, tobacco, prescription medications, and other substances. The TAPS screening tool was considered the gold standard, while clinician documentation in the electronic health record was the comparator. Secondary outcomes were the accuracy of the individual categories of unhealthy substance use of alcohol, tobacco, prescription medications, and other substances.

Patient Covariates:

Patient covariates were extracted from the EHR. Age was categorized as 18–44 years, 45–64 years, and ≥ 65 years. Sex was based on patient self-reports of male or female. Race and ethnicity were categorized into five groups: non-Hispanic White, non-Hispanic Black, Asian, Hispanic, and Declined/Unknown groups. Insurance type was classified as Private, Medicare, Medicaid, or other (including multi-insurance, no insurance, and governmental insurance). Surgical services were abstracted from the EHR and categorized as general surgery, gynecology surgery, Ophthalmology, Orthopedics, Otolaryngology, Plastics, Surgery oncology, urology, and other surgeries.

Statistical Analysis:

We calculated the descriptive statistics for the study population based on unhealthy substance use, as identified by the TAPS. Univariate analysis was performed using chi-square tests or t-tests to illustrate the differences between patients with unhealthy substance use and those without unhealthy substance use. We compared the rates of positively screened unhealthy substance use among patients taken from the electronic health record to positive screens identified by the TAPS using a two-sample test of proportions. To compare the outcomes identified by TAPS versus clinician documentation in the electronic health record, the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were reported. Receiver operating characteristic curves (ROCs) comparing the true positive and false positive rates were also constructed to visualize diagnostic ability. Multivariable logistic regression was used to estimate the predictors of positive screening for unhealthy substance use by the TAPS. Analyses were performed using Stata version 17. P-values were 2-tailed, and significance was set at alpha=0.05.

RESULTS

Patient Characteristics

A total of 430 patients were assessed for eligibility, of whom 240 were eligible for participation. (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/SLA/F127) Among those included, the average age of the cohort was 54.2 years (±15.4), 7.1% were non-Hispanic Black, and 3.3% were Hispanic. Most patients (58.3%) had private insurance, while the others had Medicare (30%), Medicaid (7.5%), or other insurance (4.2%). The surgical specialties for which patients were cared for included general (24.2%), plastic (15.8%), gynecology (15.4%), ophthalmology (10.8%), and otolaryngology (10.0%).

Demographic Characteristics by TAPS Responder Status

We compared the characteristics of the TAPS responders and non-responders (Supplemental Table 2, Supplemental Digital Content 1, http://links.lww.com/SLA/F127). There were no significant differences in age, sex, insurance type, or surgery type between the two groups. More than 50% of both responders and non-responders were privately insured, and general surgery was the most common surgery type, with more than 19% of patients undergoing consultation in both groups. However, the responders group had 84.2% of patients identified as non-Hispanic White compared to 72.1% in the non-responder group ($p = 0.004$). The non-responder group had more non-Hispanic black patients (11.6%) than the responder group (7.1 %). When looking at clinician identification of risky use of any substances, 42 (22.1%) of non-responders received an EHR positive screen for unhealthy substance use compared to 34 (14.2%) of responders.

Standardized screening using the TAPS revealed 136 (56.7%) patients were negative and 104 (43.3%) were positive for unhealthy substance use. Participants who screened TAPS positive for unhealthy substance use were younger, with a mean age of 50.8 (±16.0) compared to 56.7 (±14.5) for those who were TAPS negative ($p = 0.003$). There was a significant difference in the presence of patient unhealthy substance use as per TAPS by surgery type, with more than 24% of patients who had a positive screen undergoing a general surgery procedure ($p < 0.020$).

Unhealthy Substance Use Identified by TAPS versus Documentation in the Electronic Health Record

Standardized screening identified more unhealthy substance use for any type of substance and alcohol use than clinician EHR documentation did. TAPS identified 43.3% of patients with unhealthy use of any substance compared to 14.2% as documented by clinicians (difference of 29.2%, 95% CI 21.5%–36.8%, $p < 0.001$) (Table 1). A total of 30.8% of patients were TAPS positive for alcohol misuse compared to 0% for clinician documentation (difference of 30.8%, 95% CI 25.0% to 36.7%, $p < 0.001$). Differences in unhealthy use of tobacco and other drugs were not significant. Additionally, of the 104 patients who screened TAPS positive for unhealthy substance use, 69.2% were identified as negative for unhealthy substance use by clinician documentation. Most (98.5%) of the 136 patients who screened TAPS negative for unhealthy substance use were also negative based on clinician assessments (Table 2). The highest percentage of patients who screened positive for TAPS, but clinician negative for unhealthy use were aged 45-65 years old (36.0%), males (33.3%), and non-Hispanic Black (35.3%) (Figure 1).

Validity of Clinician Documentation as compared to TAPS.

The performance of substance use screening by clinician documentation, as compared to the TAPS, revealed lower validity and accuracy (Table 3). Clinician documentation of other drugs had the highest sensitivity (51.3%, 95% CI:35.6%, 67.0%), followed by tobacco (50.0%, 95% CI:29.1%, 70.9%), and any positive unhealthy substance use (30.8%, 95% CI:21.9%, 39.6%). Clinician documentation identified 0 cases of alcohol consumption. Specificity values for clinician documentation of unhealthy use were above 97.5% for all substances, including tobacco, alcohol, and other drugs. The negative predictive value for clinician documentation was highest for tobacco (95.1%, 95% CI:92.3%, 97.9%), followed by other drugs (91.2%, 95% CI:87.4%, 95.0%), alcohol (69.2%, 95% CI:63.3%, 75.0%), and any unhealthy substance use (65.0%, 95% CI:58.5%, 71.6%). Positive predictive values were highest for any unhealthy substance use (94.1%, 95% CI:86.2%, 100%), followed by other drugs (80.0%, 95% CI:64.3%, 95.7%), and tobacco use (78.6%, 95% CI:57.1%, 100%). The accuracy of clinician documentation compared to TAPS was highest for tobacco (94.2%, 95% CI:91.2%, 97.1%)], followed by other drugs (90.0%, 95% CI:86.2%, 93.8%), any unhealthy use (69.2%, 95% CI:63.3%, 75.0%), and alcohol (69.2%, 95% CI:63.3%, 75.0%).

Receiver operating characteristic (ROCs) curve results revealed lower accuracy and fitness of clinician documentation as a method of screening unhealthy substance use when compared to TAPS as the standard (Figure 2). Clinicians screening for both tobacco and other drugs had higher area under the ROC curve values at 0.74 for tobacco and 0.74 for other drugs. These area under ROC curve values are considered indicative that clinician documentation is fair but less than good fit when compared to TAPS for screening for these substances.[17] For any clinician positive screen for unhealthy use and alcohol the area under ROC curve values were 0.65 and 0.50; considered as a poor and failed diagnostic test, respectively.

DISCUSSION

In this study, which compared a brief, standardized screening tool with usual care that consisted of clinician documentation in the electronic health record, unhealthy substance use was frequently missed among patients evaluated prior to surgery. Approximately 70% of patients who screened positive for TAPS for unhealthy use of any substance were not captured within the social history documentation in the electronic health record. Although documentation in the electronic medical record is currently the most common method for identifying unhealthy substance use among patients in the preoperative clinic, in an overall comparison against TAPS for any unhealthy substance use, clinician documentation was less useful as a screening method for unhealthy substance use, especially when assessing unhealthy alcohol use. Clinician documentation had a sensitivity of only 31% for positive screening of any substance, demonstrating a lower ability to identify unhealthy substance use among preoperative patients with unhealthy use.

Prior studies have demonstrated the limitations of clinician documentation of unhealthy substance use in electronic health records. Common statements describing documentation of risky substance use, which included examples such as “She does not use any significant tobacco”, “She occasionally uses alcohol” and “He has very rare marijuana use” typically fail to distinguish whether a patient has a risk that warrants further discussion and possible

intervention.[18] Conventional methods for capturing substance use lack temporal context and the ability to discern the threshold for substance-specific use that designates whether unhealthy substance use is present. Additionally, Clinician documentation in the EHR has the potential for duplication of notes, accidental inclusion of notes from previous visits into the documentation of current visits, and admission of misleading information.[19] These unintended consequences of EHR documentation may result in descriptions of unhealthy substance use that do not capture the full extent or result in conflicting treatment plans.[20] The use of a brief standardized screening tool like the TAPS measure has the potential to bypass constraints associated with EHR documentation by offering physicians a more accurate method for documenting patient substance use, more time to interpret results, and refer patients for specialized care if necessary.

Given the applicability of the TAPS screening tool as well-performing, validated measures in primary care, there are clinical implications for the use of standardized screening tools for identifying unhealthy substance use in surgical care. In primary care, TAPS has been well utilized for screening for unhealthy substance use in a setting where treatment of acute pain more commonly leads to the prescription of non-steroidal anti-inflammatory drugs instead of riskier controlled substances such as opioid analgesics.[21] In surgical care, opioids have served as a key analgesic class to treat moderate to severe acute pain associated with the invasive and inflammatory nature of surgery.[22,23] However, the potential for misuse and use disorders associated with prescription opioids may place at-risk patients in a challenging situation should risky use escalate to addiction if not managed appropriately. Additionally, given that patients may not recognize their substance use as unhealthy, the self-administered component of TAPS affords patients increased awareness of the extent of their use and may prompt them to seek care that they otherwise may not have felt necessary to pursue.[24] Thus, the TAPS tool offers an opportunity to screen for unhealthy substance use among patients in preoperative clinics, where prescription management of pain heightens the risk of opioid misuse and related use disorders.

The study findings indicated greater accuracy in detecting positive screening for unhealthy drug use than clinician documentation in the electronic health record. However, our findings should be interpreted considering the study's limitations. We captured only patients who had elective surgery, and our findings may not be generalizable to patients undergoing non-elective or emergent surgery. Additionally, seasonal variations in the types of surgical interventions performed as well as willingness to participate in the TAPS screening by surgery type may exist, and future studies are needed to understand the factors that are correlated with non-response. It is also possible that clinicians may have identified unhealthy substance use during patient encounters but did not document their findings within relevant sections of the electronic health. However, the social history portion of the visit represents the typical location for the documentation of this information, which most clinicians would use when assessing a patient's potential for unhealthy substance use. The nature of clinician documentation requires a focus on patient interaction while simultaneously documenting the discussion and can result in improper EHR use, inadequate documentation, and findings being lost in the transition to the electronic health record.[25] Additionally, given the sensitive nature of substance misuse and the potential for stigmatization, the difference in sensitivity between TAPS and clinician documentation may in part be attributed to clinician concerns for not correctly documenting at-risk use or fear of wrongfully identifying unhealthy substance use in patients who do not demonstrate these tendencies. Patients may also be more reluctant to disclose unhealthy

substance use to their providers through direct conversation than through completion of TAPS screening.[26,27] The potential for selection bias is raised based on differing characteristics among non-respondents, which emphasizes the need to examine results among diverse populations that may not traditionally participate in research. Lastly, the setting of this study was a tertiary care facility, and the findings may not be reflective of patterns of screening for unhealthy use among patients demonstrated in other healthcare settings. Variations in clinician training may also influence the differences in the findings.

CONCLUSION

Standardized screening using a brief and validated assessment of the TAPS tool has a higher sensitivity and accuracy in detecting unhealthy substance use when compared to clinician documentation in electronic medical records. The use of standardized screening tools can identify patients early along the continuum of unhealthy use and aid as the first step towards preventing postoperative mortality and mobility. The ability to identify unhealthy substance use proactively and accurately may prevent the possibility of patients with pre-addictive tendencies escalating to substance use disorders following surgery. Standardized screening tools may offer an opportunity for appropriate tailoring of pain management, further assessment, and referral for specialized care. From a patient perspective, preoperative screening of substance use is favorable with many patients who use substances finding the screening items easy to comprehend, brief, and unburdensome, suggesting that implementation in surgical clinics may be well-received by patients.[28] As rates of substance use rise and these patients continue to present to preoperative clinics, implementation of standard screening with the TAPS tool is imperative for early identification of unhealthy substance use and management of safe preoperative care. The goal of surgical care is to improve the quality of life of patients; however, prescribing prescription pain medications that hold the potential for unhealthy use and addiction without first identifying whether patients have unhealthy substance use before surgery directly contradicts this goal. In the pursuit of fixing a surgical problem, it is incumbent upon clinicians to mitigate the serious risk of developing substance use disorders for patients as they journey through surgical care.

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Figure 1: Risky substance use screening by TAPS and clinician documentation in electronic health records among patients at the preoperative clinic.

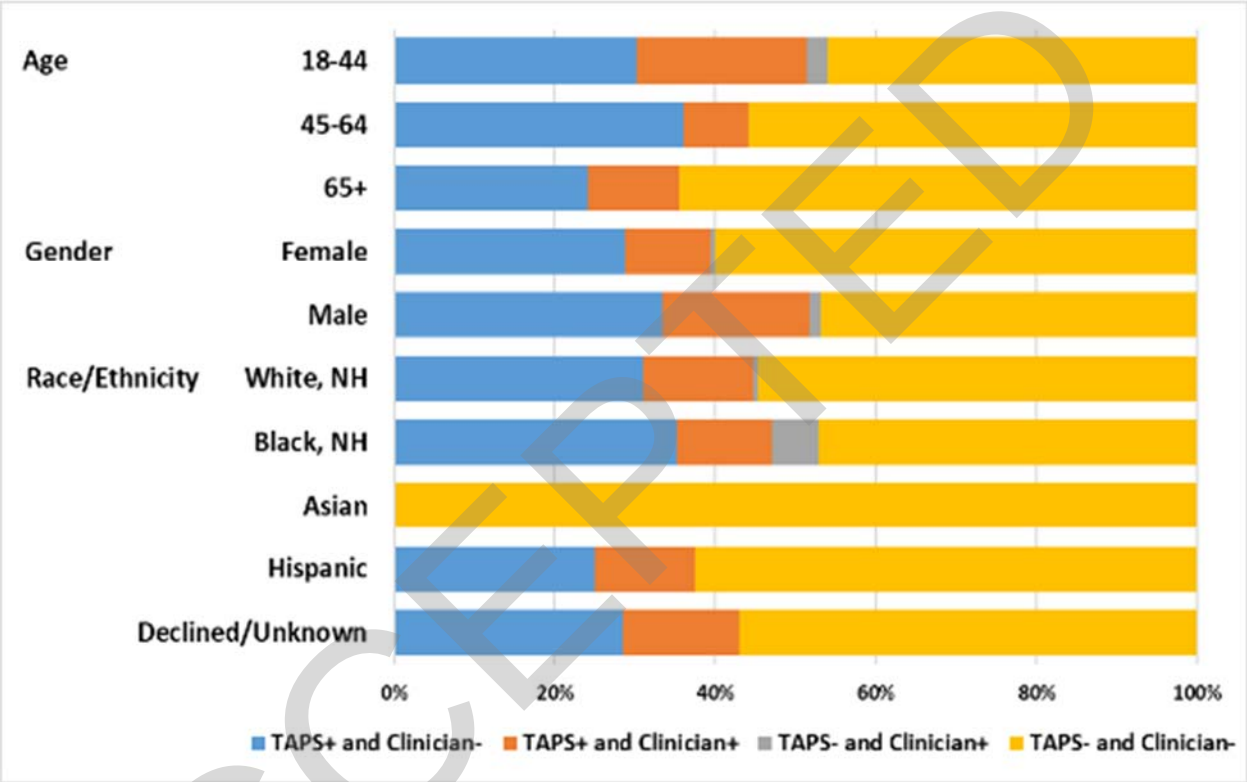

Figure 2: Receiver operating characteristic curves (ROCs) of diagnostic ability of Clinician documentation compared to TAPS. The area under the ROC curve (AUC) results were considered excellent for AUC values between 0.9-1, good for AUC values between 0.8-0.9, fair for AUC values between 0.7-0.8, poor for AUC values between 0.6-0.7 and failed for AUC values between 0.5-0.6.[17]

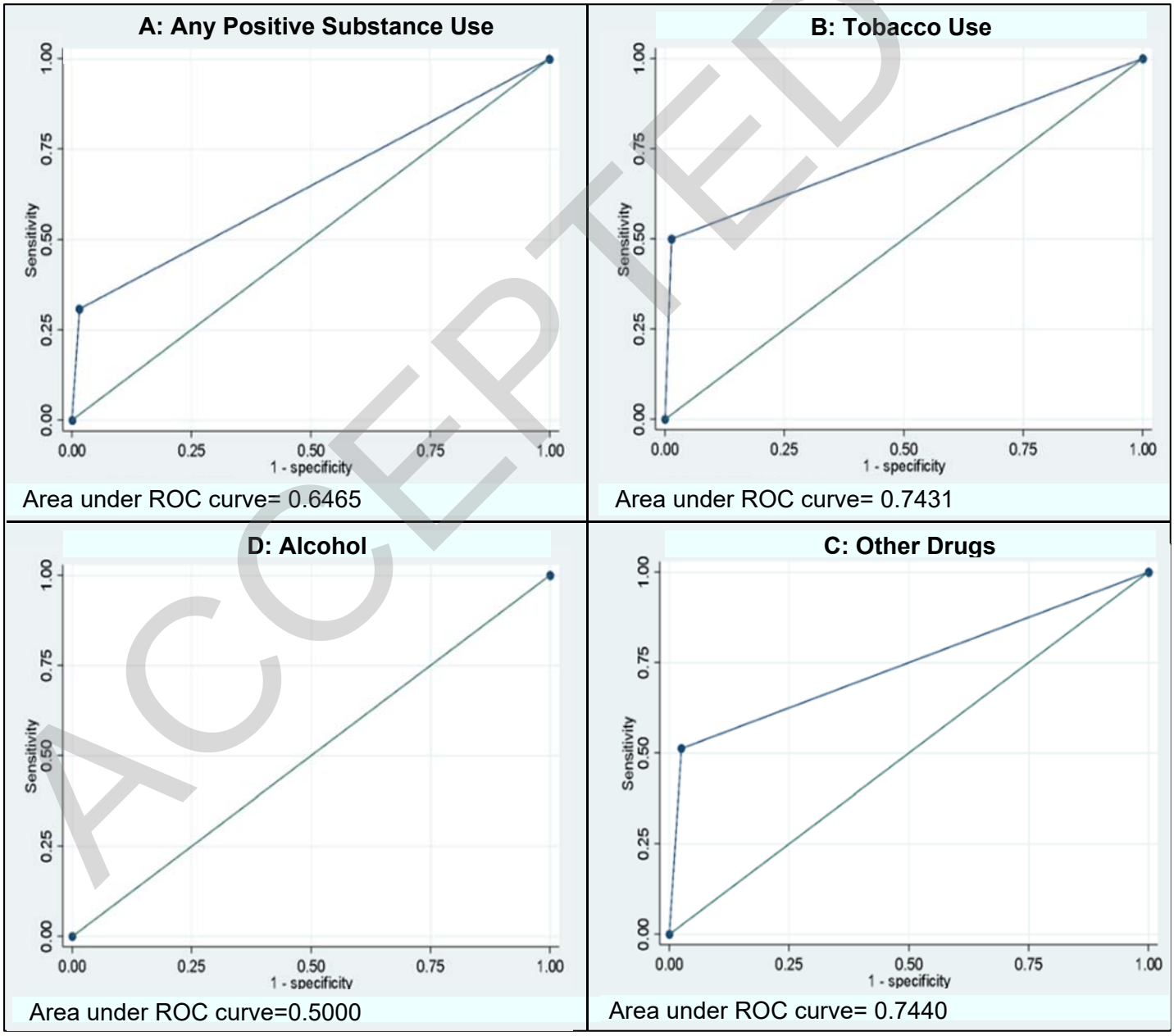

Table 1: Unhealthy substance use identified by TAPS compared to clinician documentation.

	Risky use identified via TAPS	**Risky use identified via Clinician**	**Difference between TAPS and Clinician**	***P* value**
Any positive screen	104 (43.3%)	34 (14.2%)	29.2%, 95% CI: (21.5%, 36.8%)	<0.001
Tobacco	22 (9.2%)	14 (5.8%)	3.3%, 95% CI: (-1.4%, 8.0%)	0.166
Alcohol	74 (30.8%)	0 (0%)	30.8%, 95% CI: (25.0%, 36.7%)	<0.001
Drugs	39 (16.3%)	25 (10.4%)	5.8%, 95% CI: (-0.23%, 11.9%)	0.060

Legend: Unhealthy substance use identified among patients at preoperative clinic based on screening with TAPS versus usual care as documented in electronic health record.

Table 2: Clinician identification of unhealthy substance use for TAPS positive patients

	TAPS positive (n=104)				TAPS negative (n=136)			
	Clinician negative		Clinician positive		Clinician positive		Clinician negative	
	n=72	69.2%	n=32	30.8%	n=2	1.5%	n=134	98.5%
Age								
18-44 years	22	30.6%	16	50.0%	2	100.0%	35	26.1%
45-64 years	31	43.1%	7	21.9%	0	0%	48	35.8%
65+ years	19	26.4%	9	28.1%	0	0%	51	38.1%
Gender								
Female	45	62.5%	17	53.1%	1	50.0%	96	71.6%
Male	27	37.5%	15	46.9%	1	50.0%	38	28.4%
Race								
White, non-Hispanic	62	86.1%	28	87.5%	1	50.0%	111	82.8%
Black, non-Hispanic	6	8.3%	2	6.3%	1	50.0%	8	6.0%
Asian	0	0%	0	0%	0	0%	6	4.5%
Hispanic	2	2.8%	1	3.1%	0	0%	5	3.7%
Declined/Unknown	2	2.8%	1	3.1%	0	0%	4	3.0%

Legend: Patients identified as positive by TAPS were compared against clinician documentation.

Table 3: Performance of substance use screening by clinician documentation as compared to TAPS

	Sensitivity		Specificity		PPV		NPV		Accuracy	
	%	**95% CI**	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**
Any positive screen	30.8%	(21.9%, 39.6%)	98.5%	(96.5%, 100%)	94.1%	(86.2%, 100%)	65.0%	(58.5%, 71.6%)	69.2%	(63.3%, 75.0%)
Tobacco	50.0%	(29.1%, 70.9%)	98.6%	(97.1%, 100%)	78.6%	(57.1%, 100%)	95.1%	(92.3%, 97.9%)	94.2%	(91.2%, 97.1%)
Alcohol	0%	NA	100%	NA	NA	NA	69.2%	(63.3%, 75.0%)	69.2%	(63.3%, 75.0%)
Drugs	51.3%	(35.6%, 67.0%)	97.5%	(95.4%, 99.7%)	80.0%	(64.3%, 95.7%)	91.2%	(87.4%, 95.0%)	90.0%	(86.2%, 93.8%)