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An Initial Assessment of the Utility of Validated Alcohol and Drug Screening Tools in Predicting 30-Day Readmission to Adult General Medicine Wards

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Abstract

Previous studies have identified drug and alcohol use as risk factors for readmission using claims data, but not by using substance use screening scores. This preliminary study tested the hypothesis that prevalence of 30-day readmission would be higher among patients screening positive on the 10-item Alcohol Use Disorders Identification Test (AUDIT-10) or the 10-item Drug Abuse Screening Test (DAST-10) tools at intake than among the general patient population. Social workers screened 4708 adult inpatients using prescreening questions followed by the AUDIT-10 and/or DAST-10. Patients with positive screens were followed for readmissions within 30 days of discharge. A positive screening score on the AUDIT-10 or DAST-10 instrument at intake was associated with higher risk of readmission to the general medicine wards within 30 days; this relationship appears complex and subject to mediation. Post hoc chart review found that the majority of readmissions among patients with positive screens were not immediately attributable to substance use. Further study is needed to verify these preliminary findings.

Keywords

alcohol; drug use; hospital; readmission

Achieving reductions in the rate of 30-day hospital read-missions in the US medical system has long been a federal priority.¹ Recently, however, the Hospital Read-missions Reduction Program² and financial incentives instituted by the Centers for Medicare & Medicaid Services have prompted a major effort in American hospital management to reduce the

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numbers of patients readmitted to the hospital after an initial hospitalization. Unplanned readmissions represent a systemic financial burden to the Medicare system, estimated at \$17.4 billion for 2004 alone.³ Numerous studies have attempted to address this problem, often by assessing patients for their likelihood for readmission.⁴ The goal of these assessments is to stratify patients according to their risk of potentially avoidable readmission.⁵ Then, in theory, the care system can provide an increased number and variety of services to those patients, such as case management, chronic care, or discharge management, though the form these services should take is often unclear or subject to debate, even among individual care teams.^{6,7} Such interventions have met with varying degrees of success that “rarely demonstrated unequivocally positive effects” in a very recent umbrella review of reviews.⁸ This remains a complex area in which continued research into cost-effective mechanisms to decrease 30-day readmissions is needed.

A variety of researchers have worked to develop data-driven prediction models as a step toward mitigating this problem. These studies often use administrative data to generate a risk score; among the most known are the HOSPITAL,^{5,9} LACE,¹⁰ and the Full-Stay¹¹ scoring models. However, those models do not include substance use or related sociobehavioral risk factors. A systematic review of 30 hospital readmission prediction studies found that only 11 studies included alcohol or substance use in the final model,⁴ and of those, most relied on claims data (eg, Holman et al,¹² QualityNet¹³). Furthermore, readmission studies often focus on specific subpopulations (eg, age 65+),^{8,14-17} on certain conditions leading to readmission (eg, congestive heart failure,^{14,17-19} pneumonia¹⁶), or on special populations,^{20,21} somewhat limiting model generalizability to general adult inpatient populations. Claims data or other administrative data sources may be especially problematic mechanisms for assessing substance-related risk factors, as they often substantially under-report dependence or harmful use.^{22,23} Patients rarely disclose problematic substance use with their health care providers,²⁴ and providers use validated screening questions to identify severity of patients' use infrequently.²⁵ In addition, physicians are more likely to address addictive behaviors in cases where patients are in better health.²⁶ Lack of easy access to substance-related risk variables for inclusion in predictive readmission models is unfortunate because the presumptive health burden associated with substance use is high. Population-level alcohol abuse rates exceed 10% in the United States,²⁷ as does the rate of use and abuse of illicit drugs (including illicit use of controlled prescription drugs).²⁸ Furthermore, 30% of the US adult population is estimated to drink at risky levels, some of whose use may be asymptomatic.²⁹

Given the need to reduce unplanned 30-day hospital readmissions, the prevalence of substance use in the US population, and the concomitant exclusion or minimization of substance-related risk factors from most predictive models of readmission, a reasonable next step is to investigate mechanisms that might bolster the accuracy of predictive readmissions models by incorporating stronger data related to substance-related risks. One mechanism for doing so is by incorporating data from validated alcohol and other substance use screening tools. These instruments, such as the 10-item Alcohol Use Disorders Identification Test (AUDIT-10) and the 10-item Drug Abuse Screening Test (DAST-10), often serve as an initial or secondary point of contact in Screening, Brief Intervention, and Referral to Treatment (SBIRT) protocols³⁰; screening for alcohol and substance use also recently

became a National Hospital Inpatient Quality Measure.³¹ The study team's safety net hospital system has trained medical residents,^{32,33} social workers, and nurse practitioners³⁴ in these techniques over the past 6 years, and has established screening processes for alcohol and other substance use in the study institution's primary care clinics. The team recently published a comparison of rates of likely alcohol misuse using the single question alcohol prescreen (SQS—described in the Methods section) in inpatient and outpatient settings and found a rate of 11% for outpatients, but a rate more than twice as high for inpatients (24.6%), along with significantly higher AUDIT-10 scores for inpatients.³⁵

Based on their prior work, the study team suspected that patients whose AUDIT-10 or DAST-10 scores exceeded predetermined thresholds at the time of admission to the general medicine wards would be more likely to be readmitted within 30 days than those who did not score in such a manner, but that the reasons for readmissions would not necessarily be attributable to substance use. As such, this retrospective study tested the hypothesis that the prevalence of inpatients readmitted within 30 days would be significantly higher in the subpopulation of patients who screened positive on the AUDIT-10 and/ or the DAST-10 than in the population of all adult patients admitted during the same period of time. Regardless of the specific reason for readmission, if a positive screening score is associated with risk of readmission, then its utility as a tool to allocate resources to prevent readmission could be investigated in future work, potentially facilitating cost savings for hospitals.

Methods

Setting

The study team evaluated patients admitted to the general medicine wards of an urban safety net hospital serving a metropolitan area of about 1.5 million residents. This system provides more than 1 million outpatient visits per year (to primary and specialty care, the emergency department, and mental health clinics) and is the major provider of mental health services in the county. The overall patient demographics are approximately 58% African American, 38% white, and 23% Hispanic/Latino; 60% of patients are female.

Screening and Follow-up

Patients were screened by social workers during their inpatient admission over an 18-month period. Screening was done between the hours of 8:30 am and 5:00 pm, Monday through Friday (excluding holidays), and included patients admitted overnight and on weekends. Each patient was prescreened using the SQS for alcohol and other substance use; both questions have been validated for use in primary care: “How many times in the past 12 months have you had 5 or more (4 or more for females) drinks in a day?”³⁶ and “How many times in the past 12 months have you used an illegal drug or used a prescription drug for nonmedical reasons?”³⁷

Those who prescreened positive were then screened with the AUDIT-10³⁸ and DAST-10³⁹ questionnaires, as appropriate. The AUDIT-10 was developed by the World Health Organization and contains 10 items with frequency responses; for example, “How often during the last year have you found that you were not able to stop drinking once you had

started?" with responses ranging from 0 (*Never*) to 4 (*Daily or almost daily*). The AUDIT-10 has excellent sensitivity to detect drinking beyond recommended levels in inpatients⁴⁰ and general medical patients³⁸ and has been used as a standard to validate other alcohol screening tools.⁴¹ A positive screen for alcohol was defined as an AUDIT-10 score greater than 7 (out of a possible 40). The DAST-10 was developed by Dr Harvey Skinner³⁹ and consists of 10 items with binary (yes/no) responses (eg, "Have you neglected your family because of your use of drugs?"). A review of the instrument's psychometric properties using studies from 1982 to 2005 found that it had modest to good levels of sensitivity and specificity,⁴² a finding that has been replicated even among psychiatric emergency patients.⁴³ A positive screen for other substance use was defined as a DAST-10 score greater than 0 (out of a possible 10). If patients screened positive on either questionnaire, they received a targeted service immediately after screening, the type of which depended on the screening outcome and the provider's clinical judgment. These patients were followed for 30 days from the index discharge using manual chart review to identify readmissions to the study hospital. The study team did not track admissions to other hospitals.

Analysis

Data regarding total hospital admissions and readmissions to the general medical service during the periods of this study (excluding admissions to the intensive care unit [ICU]) were derived from hospital billing records. This study extended the previously reported³⁵ screening time frame to 18 months to increase the sample size, avoid potential effects of seasonal readmissions (eg, respiratory infections), and because of the potential confounding effect of ongoing projects to reduce readmissions, to determine if the readmission rates were stable. The study team conducted interim analyses at 12 months and, finding results to be similar to the full analysis at 18 months, suggest longitudinal readmission rate stability. The team used nonparametric χ^2 goodness-of-fit tests to compare readmission rates for samples of patients identified by screening outcome to the population of all admitted patients. A critical α of 0.01 rather than 0.05 was used to account for multiple pairwise comparisons via Bonferroni's correction.

A hospitalist in the health care system (SPG) completed a review of patients' charts for reasons for readmission and other metrics. Instances were judged to be alcohol related if the readmission was for alcohol withdrawal syndrome, alcohol intoxication, alcoholic hepatitis, alcoholic ketoacidosis, alcoholic gastritis, or decompensated liver disease. Readmissions were judged to be drug related if the readmission was for an overdose, a withdrawal syndrome, cannabis hyperemesis syndrome, or an infectious complication of intravenous drug use: bacteremia, infective endocarditis, or soft tissue abscess.

Results

The study team admitted 9639 patients to the non-intensive care adult medical services during the 18-month study period and screened 4708 (48.8%) of those patients (an average of about 260 patients per month, ranging between 135 and 350, owing to fluctuations in social work manpower available and in the hospital census). Nearly 22% of the patients screened at admission had a positive screen for either alcohol use (AUDIT >7) or drug use

(DAST >0); more than 9% were positive for either alcohol use alone or drug abuse alone, and more than 3% were positive for combined alcohol use and drug misuse (Table 1).

Of the 9639 patients admitted, almost 15% were readmitted within 30 days. However, among the sample of 1027 patients who screened positive at admission, more than 20% were readmitted within 30 days. If those 1027 patients were randomly sampled from the total population of patients, one would expect a readmission rate statistically similar to 14.9%. However, the observed rate was significantly higher for the sample of patients who screened positive than for the population ($\chi^2 = 19.77$, degree of freedom = 1, observed/expected = 1.359, $P < .001$; Table 2). At the same time, among the sample of 3681 patients who screened negative at admission, 13.4% were readmitted within 30 days, which was lower, but not significantly so, than the rate for the total population (Table 2).

Of the 432 patients who screened positive for alcohol alone, 93 were readmitted within 30 days, which was significantly higher than the population rate ($P < .001$; Table 2). Furthermore, of the 436 patients who screened positive for drug misuse alone, 91 were readmitted within 30 days, which was significantly higher than the population rate ($P = .001$). However, of the 159 patients who screened positive for both alcohol use and drug misuse, 24 were readmitted within 30 days, which was similar to the population rate (Table 2).

After reviewing the quantitative results, the study team manually reviewed the charts to understand the reasons for admission/readmission. Of the 117 patients who were readmitted who screened positive on the AUDIT-10 at first admission, 43 (36.8%) were readmitted for an alcohol-related diagnosis. Then, of 115 patients readmitted who initially screened positive on the DAST-10, 13 (11.3%) were readmitted with a drug-related diagnosis (data are not additive because the nature of this analysis required comorbid positive screens to be assessed in each category). The team also reviewed a random sample of 92 patients from the substance-positive cohort who were readmitted to obtain LACE scores, which, as already noted, are standardized risk of readmission scores but do not incorporate substance use in the calculation. The mean score was 10.4 ± 3 , corresponding to an expected probability of readmission of 12.2% (8.7% to 20.2%) per the original LACE trial validation group. The total cohort (1027) was at the upper end of this confidence interval, at 20.2%. However, the original validation group included both readmitted and non-readmitted patients.

Discussion

This study provides preliminary evidence that positive results on the AUDIT-10 and DAST-10 screening instruments at inpatient intake may be associated with higher risk of unplanned readmission within 30 days to non-intensive care. This study is different from prior work that utilized claims data for alcohol and other substance use as a means of assessing readmission risk, as well as studies that have developed risk of unplanned readmission models that do not incorporate substance use at all. Universal validated substance use screening produces data that are different than claims data. First, the AUDIT-10, in particular, has a wide spread of possible scores (0 to 40) and so can infer risky/harmful but nondiagnostic alcohol use, which is very prevalent in the United States.²⁹

Second, in a study of 569 inpatients in Midwestern teaching hospitals, 42 (7%) patients were identified as alcohol dependent through the Self-Administered Alcohol Screening Test. However, only 3 of the patients identified as having alcohol dependence were coded as having this diagnosis at discharge.²² A study using a combination of prescreening (CAGE) and screening questionnaires (SMAST [Short Michigan Alcohol Screening Test]) extended this observation to other patient populations, where the detection rate for alcoholism without systematic screening was estimated to be 25% to 50%.²³ These and other studies show a high prevalence of substance use among hospitalized patients and low rates of identifying these cases via coding or billing mechanisms. In the study health care system, partly because of the electronic health record being used at the time of the study, and partly because of the very high mean number of diagnoses per patient (nearly 20), many diagnoses are not included on the bill as an *International Classification of Diseases, 10th Revision* code. Thus, attempting to extract administrative data to estimate substance use for a risk of readmission score would not prove especially useful. Based on the results reported in prior studies,^{22,23} this does not seem atypical and speaks to the need for an alternate metric.

The present study has several limitations that preclude definitive conclusions. First, self-reported alcohol and drug use is subject to patients minimizing their use (eg, social desirability bias); adding toxicological testing likely would increase detection rates in some instances. Second, for practical reasons—primarily staffing availability—only about half of the admitted patients were screened, and only those admitted to the general medicine service. Doubtless some patients were discharged prior being screened; this may have introduced the bias that sicker patients, hospitalized longer, were more likely to be screened. At the same time, although the readmission rate for patients screening positive was significantly higher than the total population readmission rate, the readmission rate for those who screened negative was lower than the population rate, but not significantly so, suggesting that relative to readmission risk, whether or not a patient was screened may have been mathematically random. Third, the study team did not attempt to account for readmissions to other hospitals in the city. Fourth, the retrospective nature of this analysis precluded a multi-variate approach to this issue given the extant data set (eg, use of LACE scores linked to screening information), though results of this article may be utilized to justify resource investment in a more thorough study of this topic. Finally, patients with communication barriers were excluded from this study, including patients not fluent in English and patients with altered mental status, dementia, or impaired speaking ability, and patients who were heavily sedated. Patients admitted to the ICU were excluded because the majority fell into one of these categories.

The study team proposes that additional research be conducted regarding the utility of these validated screening tools as means to predict risk of readmission. These studies also might wish to control for LACE scores as a covariate. If the finding that patients who screen positive have higher readmission rates is confirmed, it also will be important to determine the mechanisms for this effect. From this study, the increased readmission rates cannot be attributed to alcohol use and illicit/prescription drug use/misuse; this was solely a test of the screening tools' association with readmission. In fact, the chart review would suggest that 1 or more unmeasured characteristics not directly relatable to substance use is a possible mechanism of influence. Some theoretical possibilities include the effects of drug and

alcohol use on dietary and medication adherence, ability to afford medication, and rates of postdischarge follow-up visits. Additional possibilities include the pharmacological effects of alcohol and drugs (for instance, on the cardiovascular or immune systems). The effect of substance use also could be mediated by dual diagnoses with other behavioral problems such as depression, post-traumatic stress disorder, and anxiety. It was surprising that the subset of patients with combined AUDIT-10 and DAST-10 did not have a significantly higher rate of readmission compared with the total population. Although this study cannot identify the cause, it is possible that this comorbidity made it more likely that these patients had already been identified as dependent or high-risk users, and so had been engaged more often in treatment either pre or post discharge. The study team also cannot exclude higher rates of readmission to other hospitals in the region, or admission to ICUs.

This study also raises the question of whether drug use and alcohol misuse can be mitigated within 30 days. All of the study patients received recommended interventions based on their screening scores and clinical judgment. The fact that positive AUDIT-10 and DAST-10 scores predicted readmission despite these interventions likely indicates a complex relationship among these factors—including unmeasured latent factors associated with substance use and the difficulty of implementing a harm reduction pathway for patients within 30 days. Most studies on the effectiveness of SBIRT have been conducted in emergency departments and outpatient clinics, and the effects have generally been assessed over longer periods of time. The recent cross-site evaluation from the Substance Abuse and Mental Health Services Administration SBIRT program reported small positive standardized effects 6 months post intervention.⁴⁴ Broyles et al have pioneered nurse-driven approaches to screening inpatients; however, their studies investigated effectiveness on decreasing substance use rates, not readmission rates.⁴⁵⁻⁴⁷ Similarly, Makdissi and Stewart have advocated screening for alcohol abuse among inpatients⁴⁸ but have not investigated a relationship with readmission. Furthermore, the evidence for the effectiveness of brief intervention itself for drug use is not conclusive.⁴⁹ Mdege et al systematically reviewed 22 studies and concluded that a single intervention had no effect, but multiple interventions might be beneficial for those with alcohol use disorders.⁵⁰ Use of medication-assisted treatment with drugs, shown to be efficacious in reducing drinking, has not been studied in this setting. More intensive interventions may be needed to alter drug and alcohol use quickly enough to affect 30-day readmission rates. Furthermore, hazardous alcohol or drug use might need to be incorporated into risk-stratification schemes that direct interventions to prevent readmission, such as warm handoffs to outpatient care managers.

Conclusion

In conclusion, this study found high prevalence of alcohol and drug use by systematically screening patients admitted to general medicine wards; the rates of 30-day readmission were significantly higher for these patients than for the total patient population. There is a critical need to understand how AUDIT-10 and DAST-10 scores predict heightened risk and, pending further investigation, to learn the extent to which drug and alcohol use precipitates these readmissions.

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Table 1

Frequency of Positive Screens for Substance Abuse Among Admitted Adult Internal Medicine Inpatients, 18 Months^a.

Category	n	Readmission Rate	% of Total Admissions
Total hospital admissions	9639	14.9%	100
Total screens performed	4708	-	48.8
% of Total Screens			
Total negative screens	3681	13.4%	78.2
Total positive screens	1027	20.2%	21.8
Positive screens, AUDIT-10 only	432	21.5%	9.2
Positive screens, DAST-10 only	436	20.9%	9.3
Positive screens, AUDIT-10 + DAST-10	159	15.1%	3.4

Abbreviations: AUDIT-10, Alcohol Use Disorders Identification Test; DAST-10, Drug Abuse Screening Test.

^aA positive screen denotes an AUDIT-10 >7 or a DAST-10 score > 0.

Table 2

Observed and Expected Frequency of 30-Day Readmission by Category Among Admitted Adult Internal Medicine Inpatients, 18 Months^a.

	Observed	Expected	O/E Ratio (95% CI)	χ^2 (P)
Readmitted patients with positive screens at initial admission	208	153	1.359 (1.184, 1.554)	19.77 * ($P < .001$)
Readmitted patients with negative screens at initial admission	493	548	0.900 (0.823, 0.982)	5.52 ($P = .019$)
Readmitted patients with positive AUDIT-10 screens (only) at initial admission	93	64	1.453 (1.180, 1.772)	13.14 * ($P < .001$)
Readmitted patients with positive DAST-10 screens (only) at initial admission	91	65	1.400 (1.134, 1.711)	10.40 * ($P = .001$)
Readmitted patients with positive DAST-10 and AUDIT-10 at initial admission	24	24	1.000 (0.656, 1.465)	0.00 ($P = 1.00$)

Abbreviations: AUDIT-10, Alcohol Use Disorders Identification Test; CI, confidence interval; DAST-10, Drug Abuse Screening Test; O/E, observed/expected.

^aThe expected value for each category is the population proportion for all adult patients admitted during this time period.

* Indicates statistically significant result at a modified critical α of 0.01.