



Risk factors associated with 1-week revisit among emergency department patients with alcohol withdrawal

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Abstract

Background Approximately one-quarter of emergency department (ED) visits for alcohol withdrawal result in unscheduled 1-week ED return visits, but it is unclear what patient and clinical factors may impact this outcome

Methods From January 1, 2015, to December 31, 2018, at three urban EDs in Vancouver, Canada, we studied patients who were discharged with a primary or secondary diagnosis of alcohol withdrawal. We performed a structured chart review to ascertain patient characteristics, ED treatments, and the outcome of an ED return within 1 week of discharge. We used univariable and multivariable Bayesian binomial regression to identify characteristics associated with being in the upper quartile of 1-week ED revisits.

Results We collected 935 ED visits among 593 unique patients. Median age was 45 years (interquartile range 34 to 55 years) and 71% were male. The risk of a 1-week ED revisit was 15.0% (IQR 12.3; 19.5%). After adjustment, factors independently associated with a high risk for return included any prior ED visit within 30 days, no fixed address, initial blood alcohol level > 45 mmol/L, and initial Clinical Institute Withdrawal Assessment—alcohol revised score > 23. These factors explained 41% of the overall variance in revisits.

Conclusion Among discharged ED patients with alcohol withdrawal, we describe high-risk patient characteristics associated with 1-week ED revisits, and these findings may assist clinicians to facilitate appropriate discharge planning with access to integrated follow-up support.

Keywords Alcohol use disorder · Alcohol withdrawal

Résumé

Contexte Environ un quart des visites aux urgences pour sevrage alcoolique se traduit par un retour non programmé aux urgences pendant une semaine, mais les facteurs cliniques et relatifs aux patients qui peuvent avoir une incidence sur ce résultat ne sont pas clairs.

Méthodes Du 1er janvier 2015 au 31 décembre 2018, dans trois urgences urbaines de Vancouver, au Canada, nous avons étudié les patients qui sont sortis avec un diagnostic primaire ou secondaire de sevrage alcoolique. Nous avons procédé

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à une analyse structurée des dossiers afin de déterminer les caractéristiques des patients, les traitements aux urgences et l'issue d'un retour aux urgences dans la semaine suivant la sortie. Nous avons utilisé une régression binomiale bayésienne univariable et multivariable pour identifier les caractéristiques associées au fait d'être dans le quartile supérieur des visites aux urgences à une semaine.

Résultats Nous avons recueilli 935 visites aux urgences parmi 593 patients uniques. L'âge médian était de 45 ans (intervalle interquartile de 34 à 55 ans) et 71 % étaient des hommes. Le risque d'une nouvelle visite aux urgences à une semaine était de 15,0% (IQR 12,3 ; 19,5%). Après ajustement, les facteurs indépendamment associés à un risque élevé de retour comprenaient toute visite antérieure à l'urgence dans les 30 jours, aucune adresse fixe, le taux d'alcoolémie initial > 45 mmol/L, et l'évaluation initiale du sevrage de l'Institut clinique – cote d'alcoolémie révisée > 23. Ces facteurs expliquaient 41 % de la variance globale des visites.

Conclusions Parmi les patients sortants des urgences en sevrage alcoolique, nous décrivons les caractéristiques des patients à haut risque associés à la réadmission aux urgences après une semaine de sevrage alcoolique. Ces résultats peuvent aider les cliniciens à planifier de manière appropriée la sortie de l'hôpital et à accéder à un suivi intégré.

Mots clés Troubles liés à l'utilisation d'alcool · Sevrage de l'alcool

Clinician's capsule

What is known about the topic?

ED patients with alcohol withdrawal have a high return rate but factors influencing this are not known

What did this study ask?

What are the factors associated with high risk of 1-week ED revisit?

What did this study find?

Patients with recent ED visits, no fixed address, severe withdrawal, or a high blood alcohol concentration are at higher risk

Why does this study matter to clinicians?

Physicians can estimate return visits based on simple characteristics

population. [11, 12] Short-term ED revisits may be a marker of unmet patient needs, suboptimal ED or community care, or clinical deterioration, and are a marker of increased mortality [13]. In addition, ED revisits ensure further strain on the system; as such, it is critical to attempt to address all patient issues at the index ED visit. Prior research has used administrative databases to identify older age, lack of family or social supports, painful conditions, or chronic disease [14–21] as predictors of short-term revisits.

While patients with substance use are known to frequently attend EDs, their risk factors for short-term revisits are unclear. When managing a patient with alcohol withdrawal who is at high risk of short-term ED return, an emergency physicians (EP) might choose different management—including consultation and follow-up strategies—than for a patient at low risk. We identified demographic and clinical factors associated with 1-week ED revisits for patients with alcohol withdrawal who are discharged from the ED. The impetus for return visits is multifactorial and may depend on elements beyond ED control, [11–21] and we recognized we would only be able to identify some of the factors.

Introduction

Alcohol use disorder is common, with over 77,000 Canadian alcohol-related hospital admissions in 2016 [1]. From 2003 to 2016, the number of alcohol-related emergency department (ED) visits in Ontario increased fourfold relative to the total number of ED visits [2]. Abrupt decrease or cessation of alcohol use often causes withdrawal symptoms ranging from anxiety and insomnia to delirium tremens, seizures, and death [3, 4]. Most ED-based studies have described treatment of patients with severe withdrawal [5–9]. However, most ED patients are not critically ill and are discharged home [10].

Unfortunately, up to one-quarter of ED visits for alcohol withdrawal result in an unscheduled 1-week ED revisit, [10] far higher than the 2–3% reported for the general ED

Methods

Setting and study type

This is a secondary analysis of a prior study investigating benzodiazepines in patients with alcohol withdrawal at three university affiliated EDs in Vancouver [10]. St Paul's Hospital is an urban site with 90,000 annual ED visits; Lions Gate hospital is a suburban community ED with 60,000 visits, and Mount St Joseph's hospital is a community ED with 35,000 visits. Emergency physicians have discretion over testing, treatment, and admitting decisions. Nurses use the Clinical Instrument Withdrawal Assessment—alcohol

revised (CIWA—AR, abbreviated CIWA; [22]) at hourly intervals to grade and manage withdrawal severity, and patients are typically discharged home if they achieve a score of ten within 6 to 8 h, although such patients cannot be directly discharged to a detoxification facility. The University of British Columbia and Providence Healthcare research ethics boards approved.

Patient selection: We have previously described patient selection and medical record review methods, [10] including STROBE criteria [23]. In brief, we used the Vancouver Coastal Health regional database to identify all ED patients at the study sites from January 1, 2015, to December 31, 2018, with a primary or secondary diagnosis of alcohol withdrawal. (ICD 9 291.8) We excluded cases with an acute concurrent medical, traumatic, or psychiatric condition since management is generally determined by the primary condition; those admitted at the index visit; and out-of-province patients since no follow-up was possible.

Data collection

All sites electronically record demographics, ED investigations and results, and ED and hospital discharge summaries. We used a random number generator to select half of all charts for review. We extracted demographics, initial vital signs, laboratory and imaging investigations and results, admission status, and 1-week return visits from hospital databases. Using Kaji criteria, [24] three medical students and a medical resident reviewed charts to identify ED-administered medications, seizures, CIWA scores, concurrent illnesses, and all discharge medications. (See appendix). We estimated quality of chart review by calculating inter-rater agreement for “prior seizure”.

Outcomes

The pre-specified primary outcome was an all-cause return to any of the three sites within 1 week of the index ED visit.

Analysis

We reported discrete variables as percentages and continuous variables as medians with interquartile ranges (IQR). To estimate 1-week return risk, we constructed hierarchical Bayesian binomial regression models for the entire population. The unit of analysis was the unique patient, determined by the unique provincial healthcare number. To account for repeat visits by the same patient and potential clustering effects of each hospital, we clustered by individual patient and hospital site. We generated estimates of baseline risk of returning from a model with no predictors.

We selected the following variables for analysis: age and sex, prior ED visit within 30 days [20, 21], illness severity (measured by seizure presentation, initial vital signs and CIWA score, and laboratory testing), and provision of medications upon discharge, [16] since those might prevent revisit. We first explored the association of binary (prior ED visit, no fixed address, seizure presentation, discharge medication provided) and continuous (vital signs, CIWA score, and laboratory testing) variables with the primary outcome. To assess association of individual predictors, we first added age and an interaction between age and sex to the baseline model, and then added other predictors to allow exploration of potential associations of each predictor independent of age or sex. For continuous predictors, we used spline functions to model a non-linear relationship with the outcome. To avoid inflation of the apparent effect of a predictor due to multiple visits by the same patient, we modeled mixed effects clustered by the individual patient [25]. We generated absolute risk estimates from posterior distributions, holding age and sex constant, which are displayed visually across the range of continuous measures or are reported as the median and interquartile range (IQR) for categorical predictors, representing the most probable risk estimate for 50% of the population.

We examined individual marginal effects and selected high-risk predictors for inclusion into a multivariable model, allowing for the independent marginal effects of the predictors to be estimated. We a priori considered predictors to be “high-risk” if they estimated an ED revisit likelihood within the top quartile. Although our choice is arbitrary, this threshold represents a risk greater than 75% of the baseline population. We generated adjusted absolute risk estimates, holding the other predictors constant, and estimated the proportion of explained variation in new data using all the strong predictors with a Bayesian R². For two predictors with an expected large amount of missing data (for example, CIWA and blood alcohol level), we conducted a separate analysis contrasting the risk among patients with complete data present to those with data missing. In this analysis, similar risk would suggest that the variables were missing at random with respect to the outcome.

We completed analysis using R ‘brms’ packages with Stan for Bayesian modeling. We used prior predictive simulation to select priors and held them constant for all models. For the intercept and each coefficient, we used a normal (0, 1) prior; for the standard deviation, we used a Cauchy (0, 1) prior; for splines, we used a student T (3, 0, 10) prior; and for the correlation between mixed effects, we used an LKJ [2] prior. These are all minimally informative and conservative priors that allow data to inform the estimates.

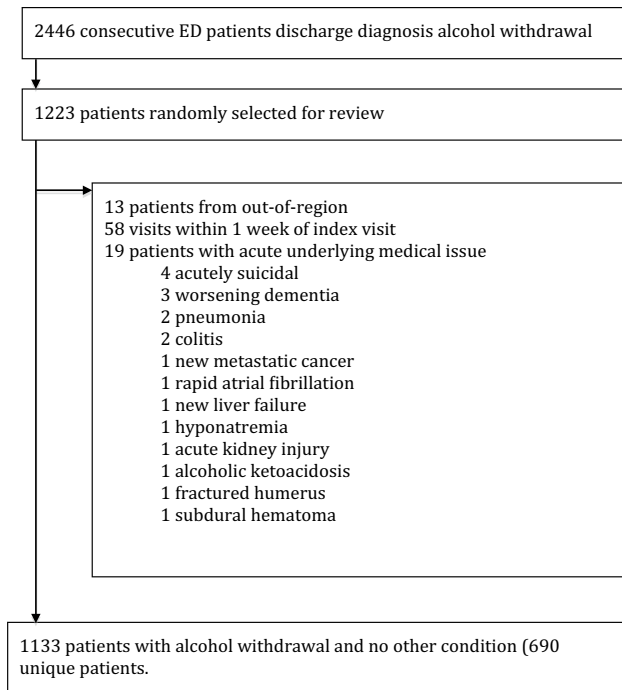


Fig. 1 Study flow diagram

Results

During the study period, 2,446 visits received a diagnosis of alcohol withdrawal, and we collected data on 1,223. We excluded 90 patients, (Fig. 1; 58 patients attended the week prior; 13 were out-of-province; 19 had an acute concurrent illness and the overall agreement for the 19 latter patients with an acute concurrent illness was 80.6%) leaving 1,133 encounters for analysis. For chart review quality, inter-rater agreement for “prior seizure” was 0.85. (95% CI 0.79; 0.90).

Of the 1,133 index ED visits, 197 were admitted to hospital and we analyzed the 935 (593 unique patients) who were discharged home. Median age was 34 (IQR 34; 55), 71.2% male, 15.9% had no fixed address, 40.5% arrived by ambulance, 18.7% had an ED visit in the preceding 30 days, median initial CIWA score was 16 (IQR 12; 22), and 46.2% were provided with a benzodiazepine to-go. (Table 1) Among the 593 unique patients, 89 (15.0%, IQR 12.3; 19.5%) had at least one return visit within 1 week. This risk varied between individuals (standard deviation for difference in odds 3.9 [IQR 3.3; 4.5]) and site (standard deviation for difference in odds 1.8 [IQR 1.4; 2.8]).

In the unadjusted analysis, among categorical predictors, prior ED presentation within 30 days (28.0%) and no fixed address (24.0%) were associated with an upper-quartile ED revisit risk; seizure, ambulance arrival, or

Table 1 Baseline variables ($n=935$)

Variable, n (%) unless indicated	Value
Demographics	
Age median (interquartile range)	46 (35–56)
Male	423 (71.3)
Ambulance arrival to ED	240 (40.5)
No fixed address	94 (15.9)
Prior seizure	167 (28.2)
At least one ED visit in last 30 days	111 (18.7)
Initial ED vital signs, median (IQR) unless noted	
Heart rate, beats/min	100 (89.5–112)
Systolic blood pressure, mm Hg	137 (127–152)
Respiratory rate, breaths/min	18 (16–20)
Oxygen level, % on room air	98 (96–99)
Glasgow Coma Scale less than 15	32 (3.4%)
ED management, median (IQR)	
Blood glucose	6.6 (5.7–8.2)
Blood alcohol level*	5.0 (0–35)
White blood cell count	7.1 (5.5–9.3)
Hemoglobin	138 (128–149)
Serum creatinine	64 (53–76)
Lactate	2.3 (1.5–3.6)
International normalized ratio	1.0 (0.9, 1.1)
Initial CIWA*	16(12, 21)
Difference CIWA*	8 (4, 13)
Benzodiazepine-to-go, n (%)	
No benzodiazepine	384 (55.7)
Lorazepam	132 (19.1)
Diazepam	172 (24.9)

ED emergency department, IQR interquartile range, CIWA Clinical Institute Withdrawal Assessment for Alcohol

*Overall, 321 (34%) patients were missing both alcohol level and CIWA

discharge medications were not associated with increased risk. (Table 2) For continuous predictors, age, sex, and initial vital signs were not associated with higher risk. Otherwise, initial blood alcohol level and CIWA score were associated with higher risk. (Supplementary File 2).

After adjustment, the strongest categorical predictors of revisit were prior ED visit (risk 24.4%, IQR 15.3; 38.6) and no fixed address (risk 22.1%, IQR 12.5; 35.6%). (Table 2) For continuous variables, initial alcohol levels > 45 mmol/L and CIWA scores > 23 were associated with a higher risk. (Appendix 2) Patients with no CIWA score or no blood alcohol level measured had similar risk for ED revisits (median difference – 0.19 IQR – 1.8 to 0.78 for CIWA and 0.58% IQR – 0.27 to 2.4 for alcohol).

Table 2 Marginal estimates for risk factors for 1-week return to ED

Predictor	Crude estimated risk (IQR)	Adjusted probability risk (IQR)
Baseline return risk (all patients)	15.0% (12.3–19.5%)	
ED visit past 30 days	28.0% (22.7–40.3%)	24.2% (15.3–38.6%)
No ED visit past 30 days	13.8% (10.7–21.4%)	15% (9.3–24.9%)
No fixed address	24.0% (18.8–30.6%)	22% (12.5–35.6%)
Fixed address	15.2% (12.3–19.3%)	15% (9.3–24.9%)
Lorazepam “to-go”	19.2% (15.2–25.2%)	
Diazepam “to-go”	15.4% (12.2–20.0%)	
No benzodiazepine to-go	16.7% (13.2–21.4%)	
Prior seizure	18.2% (14.5–23.1%)	
No prior seizure	15.2% (12.2–19.2%)	
Ground ambulance arrival	16.5% (13.2–21.3%)	
No ambulance	15.9% (12.7–20.2%)	

We considered patients to be “high-risk” if the estimated return risk for any predictor exceeded the upper quartile for baseline risk (19.5%)

ED emergency department, IQR interquartile range

Discussion

Interpretation

We reviewed 935 emergency department visits from 593 unique patients discharged for alcohol withdrawal. The strongest predictors of a 1-week return were a prior ED visit within 30 days and no fixed address; both are evident at triage. A high initial blood alcohol level and more severe initial symptoms were also associated with higher risk. No other predictors, including ambulance arrival, seizure, vital signs, additional blood testing, or discharge medications were associated with increased risk. Our sensitivity analysis in patients with complete data demonstrated similar results.

Previous studies

Nearly all studies looking at frequent ED visitors have been conducted with large administrative databases, which are typically unable to incorporate chart review detail such as alcohol levels, CIWA scoring, or discharge medications [5, 9]. However, some patterns have been clearly established. Patients with alcohol use disorder attend EDs disproportionately, [26] as do patients who are underhoused. However, this does not necessarily mean that revisits occur within the next week, and there are few data to inform EPs of the risk of a short-term return in this cohort of patients.

Studies of short-term revisits—again, typically from databases—have investigated populations with undifferentiated illnesses, rather than with a specific condition. To illustrate, Wu theorized that ED revisits were related to illness, patient, and physician factors, but did not consider chronic illness, [14] while Chan [11] and Robinson [17] felt that patient factors drove revisits. Meldon used a five-item tool to predict

risk factors for ED revisits in patients greater than 75 years old; [15] although LaMantia, working with the same age group, was unable to produce a sufficiently discriminating model predicting ED revisits [16]. These conflicting results demonstrate that it is challenging to provide reliable predictors for short-term revisits, but our model allows clinicians to estimate ED returns with simple criteria.

Strengths and limitations

This study was undertaken at three EDs in a single urban Canadian health region and our findings may not apply elsewhere. Our descriptive analysis can only demonstrate associations for measured variables, and some patients, particularly those who were less sick, may not have had blood testing or CIWA scoring. However, our separate analysis on patients with complete data should hopefully mitigate these concerns. While a higher CIWA score and higher alcohol levels might seem counterintuitive, we could not account for time: a patient with a high initial alcohol level might have their first CIWA a few hours later once their alcohol level had decreased. Alcohol withdrawal is a clinical determination, and we cannot estimate the rate of false positive or false negative diagnoses. It is likely some return visits may not have been directly related to alcohol use. As a corollary, we have almost certainly underestimated total downstream contact with medical care, as patients may have sought care in other settings that we could not track. Our designation of the upper quartile of revisit probability as the threshold for “high risk” is arbitrary; had we selected a different threshold, we might have obtained different predictors. Less than half of patients had benzodiazepines provided

at ED discharge; had more patients received to-go medications, the return proportion might have been lower, although such medications can mitigate withdrawal for only a few days and cannot prevent return visits for new withdrawal, or new non-withdrawal concerns. Patients may be brought to the ED against their will, especially if potentially intoxicated, [27] and we could not ascertain when this occurred. We did not consider costs.

Clinical implications

It is uncertain whether EPs use criteria such as mental health comorbidities, substance use disorders, social or financial precarity, marginal housing, ethnocultural background, and inadequate access to outpatient care, to ascertain appropriateness for discharge or transition. Given that patients will likely remain in the ED for 4–6 h, [10] our findings allow EPs to identify at-risk patients very early in their presentation. For high-risk patients, physicians may consider strategies beyond symptom-based disposition. Importantly, EPs should reject a sense of futility [26, 27]. If available, referral to an addictions specialist, even for a seemingly mild case of withdrawal, may be appropriate. EPs may use brief interviews that reduce alcohol use and injuries, [28] while brief intervention and treatment referral appear cost effective in patients with alcohol use disorder [29]. Patients directly referred to treatment may be far more likely to enrol in a formal treatment program as those undergoing standard care [30, 31]. Other options referral to a rapid outpatient clinic: an Ottawa initiative reduced all-cause ED visits by 80% while decreasing alcohol use, anxiety, and depression [32].

Conclusions

Among discharged ED patients with alcohol withdrawal, we describe high-***risk patient characteristics associated with 1-week ED revisits, and these findings may assist clinicians to facilitate appropriate discharge planning with access to integrated follow-up support.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s43678-022-00414-w>.

Author contributions FS conceived the study and designed it with assistance from DL, GI, and BG. EG provided the initial dataset. FS, IS, SD, AY, and IC collected data. DB and AK adjudicated seizure patients. BG and EG reviewed patients with concurrent issues. DL performed Bayesian analysis. SB and AK provided content information from an addictions viewpoint. FS drafted the manuscript and all authors approved. FS takes overall responsibility.

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Data availability De-identified data herein are accessible to other interested parties by application to the corresponding author.

Declarations

Conflict of interest None.

References

1. Canadian Institutes for Health Information. Alcohol Harm in Canada. 2017. Available at <https://www.cihi.ca/sites/default/files/document/report-alcohol-hospitalizations-en-web.pdf>. Accessed August 23, 2022.
2. Myran DT, Hsu AT, Smith G, Tanuseputro P. Rates of emergency department visits attributable to alcohol use in Ontario from 2003 to 2016: a retrospective population-level study. *CMAJ*. 2019;191:804–10. <https://doi.org/10.1503/cmaj.181575>.
3. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Washington: American Psychiatric Publishing 2013DSM; 2013.
4. British Columbia Center for Substance Use. Provincial guidelines for the clinical management of high-risk drinking and alcohol use disorder. 2019. Available at <https://www.bccsu.ca/wp-content/uploads/2020/02/AUD-Guideline.pdf>. Accessed April 27, 2022.
5. Kahan M, Borgundvaag B, Midmer D, et al. Treatment variability and outcome differences in the emergency department management of alcohol withdrawal. *CJEM*. 2005;7:87–92. <https://doi.org/10.1017/s1481803500013038>.
6. D'Onofrio G, Rathley NK, Ulrich AS, et al. Lorazepam for the prevention of recurrent seizures related to alcohol. *NEJM*. 1999;340:915–9. <https://doi.org/10.1056/NEJM199903253401203>.
7. Rosenson J, Clements C, Simon B, et al. Phenobarbital for acute alcohol withdrawal a prospective randomized double-blind placebo-controlled study. *J Emerg Med*. 2013;44:592–98.e2. <https://doi.org/10.1016/j.jemergmed.2012.07.056>.
8. Hendey GW, Dery RA, Barnes RL, et al. A prospective, randomized, trial of phenobarbital versus benzodiazepines for acute alcohol withdrawal. *Am J Emerg Med*. 2011;29:382–5. <https://doi.org/10.1016/j.ajem.2009.10.010>.
9. Nelson AC, Kehoe J, Sankoff J, et al. Benzodiazepines vs barbiturates for alcohol withdrawal: analysis of 3 different treatment protocols. *Am J Emerg Med*. 2019;37:733–6. <https://doi.org/10.1016/j.ajem.2019.01.002>.
10. Scheuermeyer FX, Miles I, Lane DJ, et al. Lorazepam versus diazepam in the management of emergency department patients with alcohol withdrawal. *Ann Emerg Med*. 2020;76:774–81. <https://doi.org/10.1016/j.annemergmed.2020.05.029>.
11. Chan AH, Ho SF, Fook-Cong C, et al. Characteristics of patients who made a return visit within 72 hours to the emergency department of a Singapore tertiary hospital. *Singapore Med J*. 2016;57:301–6. <https://doi.org/10.11622/smedj.2016104>.
12. Verelst S, Pierloot S, Desruelles D, et al. Short-term unscheduled return visits of adult patients to the emergency department. *J Emerg Med*. 2014;47:131–9. <https://doi.org/10.1016/j.jemermed.2014.01.016>.
13. Safwenberg U, Terent A, Lind L. Increased long-term mortality in patients with repeated visits to the emergency department. *Eur J Emerg Med*. 2010;17:274–9. <https://doi.org/10.1097/MEJ.0b013e3283104016>.
14. Wu CL, Wang FT, Chiang YC, et al. Unplanned emergency department revisits within 72 hours to a secondary teaching

- hospital in Taiwan. *J Emerg Med.* 2010;38:512–7. <https://doi.org/10.1016/j.jemermed.2008.03.039>.
15. Meldon SW, Mion LC, Palmer RM, et al. A brief risk-stratification tool to predict repeat emergency department visits and hospitalization in older patients discharged from the emergency department. *Acad Emerg Med.* 2003;10:224–32. <https://doi.org/10.1111/j.1553-2712.2003.tb01996.x>.
 16. LaMantia MA, Platts-Mills TF, Biese K, et al. Predicting hospital admission and returns to the emergency department for elderly patients. *Acad Emerg Med.* 2010;17:252–9. <https://doi.org/10.1111/j.1553-2712.2009.00675.x>.
 17. Robinson K, Lam B. Early emergency department representations. *Emerg Med Australas.* 2013;25:140–6. <https://doi.org/10.1111/1742-6723-12048>.
 18. Imsuwan I. Characteristics of unscheduled emergency department return visit patients within 48 hours in Thammasat University Hospital. *J Med Assoc Thai.* 2011;94:S73–80.
 19. Martin-Gill C, Reiser RC. Risk factors for 72-hour admission to the ED. *Am J Emerg Med.* 2004;22:448–53. <https://doi.org/10.1016/j.ajem.2004.07.023>.
 20. Rowe BH, Villa-Roel C, Sivilotti M, et al. Relapse after emergency department discharge for acute asthma. *Acad Emerg Med.* 2008;15:709–17. <https://doi.org/10.1111/j.1553-2712-2008.00176.x>.
 21. Yan JW, Gushulak KM, Columbus MP, et al. Risk factors for recurrent emergency department visits for hyperglycemia in patients with diabetes mellitus. *Int J Emerg Med.* 2017. <https://doi.org/10.1186/s12245-017-0150-7>.
 22. Sullivan JT, Sykora K, Schneiderman J, et al. Assessment of alcohol withdrawal: the revised clinical institute withdrawal assessment for alcohol scale (CIWA—AR). *Br J Addiction.* 1989;84:1353–7. <https://doi.org/10.1111/j.1360-0044.1989.tb00737.x>.
 23. von Elm E, Altman DG, Egger M, Pocock SJ, Gotsche PC, Vandenbroucke DP. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Ann Inter Med.* 2007;147:573–7. <https://doi.org/10.7326/0003-4819-147-8-200710160-00010>.
 24. Kaji AH, Schriger D, Green S. Looking through the retrospective: reducing bias in emergency medicine chart review studies. *Ann Emerg Med.* 2014;64:292–8. <https://doi.org/10.1016/j.annemergmed.2014.03.025>.
 25. Bull LM, Lunt M, Martin GP, et al. Harnessing repeated measurements of predictor variables for clinical risk prediction: a review of existing methods. *Diagn Progn Res.* 2021;4:9. <https://doi.org/10.1186/s41512-020-0078-z>. Accessed January 31.
 26. Moe J, Wang YE, Schull MJ, et al. Characterizing people with frequent emergency department visits and substance use: a retrospective cohort study of linked administrative data in Ontario, Alberta, and BC Canada. *BMC Emerg Med.* 2022;22:127. <https://doi.org/10.1186/s12873-022-00673-x>.
 27. McCormack RP, Hoffman LF, Norman M, et al. Voices of homeless alcoholics who frequent Bellevue Hospital: a qualitative study. *Ann Emerg Med.* 2015;65:178–86. <https://doi.org/10.1016/j.annemergmed.2014.05.025>.
 28. Hawk K, D’Onofrio G. Emergency department screening and interventions for substance use disorders. *Addict Sci Clin Pract.* 2018. <https://doi.org/10.1186/s13722-018-0117.1>.
 29. D’Onofrio G, Fiellin DA, Pantalon MV, et al. A brief intervention reduces hazardous and harmful drinking in emergency department patients. *Ann Emerg Med.* 2012;60:181–92. <https://doi.org/10.1016/j.annemergmed.2012.02.006>.
 30. Havard A, Shakeshaft A, Sanson-Fisher R. Systematic review and meta-analysis of strategies targeting alcohol problems in the emergency department: interventions reduce alcohol-related injuries. *Addiction.* 2008;103:368–76. <https://doi.org/10.1111/j.1360-0443.2011.03418.x>.
 31. D’Onofrio G, Degutis LC. Integrating Project ASSERT: a screening, intervention, and referral to treatment program for unhealthy alcohol and drug use into an urban emergency department. *Acad Emerg Med.* 2010;17:903–11. <https://doi.org/10.1111/j.1553-2712.2010.00824.x>.
 32. Corace K, Willows M, Schubert N, et al. Alcohol medical intervention clinic: a rapid access addiction medicine model reduces emergency department visits. *J Addict Med.* 2020;14:163–71. <https://doi.org/10.1097/ADM.0000000000000559>.

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