Evaluation of a Web-based Educational Program to Teach the Identification and Management of Alcohol Withdrawal in the Emergency Department

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ABSTRACT

Background: Ideal management of alcohol withdrawal syndrome (AWS) incorporates a symptom-driven approach, where patients are regularly assessed using a standardized scoring system (Clinical Institute Withdrawal Assessment for Alcohol-Revised [CIWA-Ar]) and treated according to severity. Accurate administration of the CIWA-Ar requires experience, yet there is no training program to teach this competency. The objective of this study was to develop and evaluate a curriculum to teach clinicians how to accurately assess and treat AWS.

Methods: This was a three-phase education program consisting of a series of e-learning modules containing core competency material, an in-person seminar to orient learners to high-fidelity simulation, and a summative evaluation in an objective structured clinical examination setting using a standardized patient. To determine the impact of the AWS curriculum, we recorded how often the CIWA-Ar was appropriately applied in the emergency department (ED) before and after training. A CIWA-Ar protocol breach was defined as inappropriate administration of benzodiazepines (CIWA-Ar < 10) and failure to administer benzodiazepines when required (CIWA-Ar ≥ 10). ED length of stay, amount of benzodiazepines administered in the ED, discharge prescriptions, and unit doses (take-away bottle of four tablets) of benzodiazepine given were recorded.

Results: Seventy-four ED nurses completed the curriculum over an 8-week period. In the 5 months prior to the educational program delivery, we identified 144 of 565 (25.5%) CIWA-Ar protocol breaches, compared to 64 of 547 (11.7%) in the 5 months after training ($\Delta 13.8\%$, 95% confidence interval [CI] = 9.3%–18.3%). Program completion resulted in a reduction in the median total dose of diazepam administered in the ED (40 mg vs. 30 mg, $\Delta 10$ mg, 95% CI = 0–20 mg) and no change was detected in ED length of stay and benzodiazepines prescribed.

Conclusions: Completion of this curriculum resulted in better compliance with the CIWA-Ar protocol by those who administer the CIWA-Ar; however, changes in inappropriate benzodiazepine prescribing practice will require future interdisciplinary initiatives.

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Alcohol is one of the most commonly used mind-altering substances, with more than 50% of the U.S. population over the age of 12 reporting regular consumption.¹ In the United States, it has been estimated that more than 8 million people are alcohol dependent, and half of these individuals will experience withdrawal if consumption is abruptly reduced or stopped.^{2,3}

Alcohol withdrawal syndrome (AWS) is commonly encountered in the ED and can lead to serious complications such as seizures, delirium tremens, and even death.³ Manifestations of AWS typically start within 12 hours of significantly reduced consumption or abstinence; however, the onset of delirium tremens may be up to 48 to 96 hours from the last drink. AWS is best treated with benzodiazepines, preferably those with a long half-life.⁴ Benzodiazepines act on GABA receptors as pharmacologic mimics of alcohol, and when administered early can reduce both the duration and the severity of withdrawal symptoms.⁴ The 90-hour half-life of diazepam and its metabolites makes it an ideal choice for ED use. Patients fully treated in the ED with diazepam are protected from the serious manifestations of alcohol withdrawal and will not require outpatient benzodiazepine prescriptions.⁵

Ideal management of AWS incorporates a symptom-driven approach, whereby patients are regularly assessed using a standardized scoring system.⁶ The severity of alcohol withdrawal can be assessed using the Clinical Institute Withdrawal Assessment for Alcohol–Revised (CIWA-Ar) scale, a validated scale measuring withdrawal symptoms in ten individual domains.^{7,8} Nine domains are scored on a scale of zero to seven (orientation is scored on a scale of 0 to 4), with a maximum score of 67. A total CIWA-Ar score < 10 indicates mild withdrawal, while a score ≥ 10 requires treatment. Using the symptom-guided approach, patients in moderate or severe withdrawal (CIWA-Ar ≥ 10) should be treated with 10 to 20 mg of diazepam orally (if tolerated) or intravenously, with reassessment at least hourly (more frequently if severe withdrawal). Previous randomized controlled trials have shown that compared to a fixed-dose regimen, a symptom-guided approach using the CIWA-Ar protocol results in faster symptom resolution, lower total dose of benzodiazepine administration, and no increase in adverse events.^{9,10}

Accurate administration of the CIWA-Ar requires experience, yet there was no training program at our institution to teach and ascertain this competency.

Prior research by our group demonstrated CIWA-Ar protocol breaches (inappropriate administration of benzodiazepines) occurred in nearly 50% of ED cases.¹¹ To identify important knowledge gaps in the treatment of AWS, we conducted a needs assessment as part of a plan to develop an AWS knowledge translation program for ED staff.¹² Others have reported lack of knowledge, training, and familiarity with existing hospital protocols as important challenges to providing good care to AWS patients.¹³ In response to these reported deficiencies in AWS care, the objective of this study was to develop and evaluate a Web-based curriculum to teach ED clinicians how to accurately assess and treat AWS.

METHODS

Study Design and Setting

This was a single-center study at an academic teaching hospital (annual ED census 65,000). The curriculum was informed by results of a local needs assessment that identified gaps in knowledge and staff confidence regarding the treatment of AWS in the ED.¹² The AWS curriculum was delivered weekly to groups of 7 to 10 nurses from March 1 to April 30, 2016, as part of the mandatory annual education program for all full-time nurses working in our ED. The research protocol was approved by the research ethics board at Sinai Health System prior to the start of this study.

Study Protocol

Our curriculum consisted of a blended learning model, involving e-learning and (in vivo) simulation for deliberate practice mastery and consisted of three phases:

Phase 1. A series of e-learning modules containing core competency material was presented in an interactive, multimedia style. Module 1 consisted of a 20-minute presentation containing core competency material related to the basic pharmacology, identification, and management of AWS in the ED. Module 2 was an introduction to the CIWA-Ar, focusing on how to assess each of its 10 domains, with review of real-patient videos depicting the full spectrum of AWS tremors for learner self-assessment. Instructions were also provided on the use of our smart phone app to assess AWS tremor.¹⁴ Module 3 consisted of standardized patient assessments depicting five common ED scenarios: mild, moderate, and severe AWS; an intoxicated

patient; and a patient with delirium tremens. Learners were asked to assign a diagnosis and CIWA-Ar score if applicable and to provide an ED disposition plan for each case. Learners were able to progress to the next module only after successful completion of the previous module, which on occasion required several attempts.

Phase 2. After completing the e-learning modules, participants attended a 30-minute in-person seminar, facilitated by one of the investigators. This seminar reviewed material learned in the modules and introduced participants to high-fidelity simulation with mental rehearsing, role-playing, and formative assessments.

Phase 3. The final phase consisted of a summative evaluation in an objective structured clinical examination (OSCE) setting, with learner's knowledge and understanding of course material assessed using a simulated encounter with a standardized patient. Summative feedback was given at the end of the session to confirm learned principles and correct any errors.

Outcome Measures

To evaluate the impact of this educational program, we recorded how often the CIWA-Ar protocol was appropriately applied in the ED in the 5 months prior to (October 2015 to February 2016) and following training (May to September 2016) using a standardized data extraction tool. We included assessments of patients identified as having AWS who presented to the ED with a complaint related to alcohol withdrawal. Charts were identified based on a Canadian Emergency Department Information System presenting complaint of "substance withdrawal code 753" or any of the following International Classification of Disease (ICD) 10 codes: F10.0-F10.9; T51.0; T51.2 or T51.9. Patient assessments were excluded if patients were acutely intoxicated, were in withdrawal from a substance other than alcohol, or were not put on the CIWA-Ar protocol in the ED.

Our primary outcome was a breach of the CIWA-Ar protocol. A CIWA-Ar protocol breach was defined inappropriate administration of benzodiazepines (CIWA-Ar < 10) and failure to administer benzodiazepines when required (CIWA-Ar ≥ 10). Our secondary outcomes were ED length of stay, amount of benzodiazepines administered in the ED, prescriptions, and unit doses (take-away bottle of four tablets) of benzodiazepines given at discharge, any adverse

events occurring in the ED (seizure, respiratory depression, delirium tremens), and hospital admission.

Data Analyses

Data were collected and stored in Microsoft Excel (Microsoft Corp.). Descriptive statistics were summarized using means and standard deviations (SDs), medians and interquartile ranges (IQRs), and frequencies with 95% confidence intervals (CIs). Median differences were estimated using the Hodges-Lehman method and proportional differences were determined using the Newcombe-Wilson hybrid score method, where appropriate.¹⁵⁻¹⁷ All statistical analyses were conducted using Stata 15.0 (StataCorp LP).

RESULTS

Seventy-four ED nurses completed the AWS curriculum over an 8-week period. It was delivered weekly to small groups (seven to 10 nurses) from March 1 to April 30, 2016, as part of the mandatory annual education program for all full-time nurses working in our ED. The entire curriculum took approximately 2.5 hours to complete. Median (IQR) time to compete Module 1 was 23 (18–26) minutes, Module 2 was 15 (12–20) minutes, and Module 3 was 31 (29–35) minutes. After completing the e-learning modules, participants attended a 30-minute in-person seminar, followed by a 30-minute OSCE. We identified 130 patient encounters in the pretraining phase, and 126 patient encounters in the posttraining phase that were included in the study (Figure 1). There were no differences detected in demographic characteristics between the pre- and posttraining groups (Table 1). In total, 1112 CIWA-Ar scores were derived for the 256 ED patient encounters included during the study period: 565 (50.8%) in the pretraining period and 547 (49.2%) in the posttraining period (Figure 1). Mean (±SD) numbers of CIWA-Ar scores per patient encounter were 4.3 (±2.9) and 4.3 (±2.9) in the pre- and posttraining groups, respectively.

A comparison of CIWA-Ar protocol breaches between the pre- and posttraining periods is shown in Figure 1. In the 5 months prior to the program delivery, we identified 144 of 565 (25.5%) CIWA-Ar protocol breaches, compared to 64 of 547 (11.7%) in the 5 months after training (Δ13.8%, 95% CI = 9.3%–18.3%).

Program completion resulted in a reduction in the inappropriate administration of benzodiazepines in the

Figure 1. Flow diagram of patients included in the study. AWS = alcohol withdrawal syndrome; CIWA-Ar = Clinical Institute Withdrawal Assessment for Alcohol–Revised.

Table 1
Demographic Characteristics of the 256 Included Patient Encounters

Characteristic	Before Training (<i>n</i> = 130)	After Training (<i>n</i> = 126)	% Difference (95% CI)
Male	98 (75.4)	99 (78.6)	3.2 (−7.2 to 13.4)
Age (years)	44.9 (±12.6)	44.7 (±12.9)	0.2 (−2.9 to 3.3)
No fixed address	19 (14.6)	18 (14.3)	0.3 (−9.0 to 8.4)
Walk-in	49 (37.7)	48 (38.1)	0.4 (−11.3 to 12.1)
CTAS score			
Level 1	2 (1.5)	2 (1.6)	0.1 (−4.0 to 4.2)
Level 2	57 (43.8)	48 (38.1)	5.7 (−6.2 to 17.5)
Level 3	67 (51.5)	74 (58.7)	7.2 (−4.9 to 19.0)
Level 4	4 (3.1)	2 (1.6)	1.5 (−2.9 to 6.2)
Blood EtOH			
No value	9 (6.9)	11 (8.7)	1.8 (−5.0 to 8.8)
≤2 mmol/L (≤9.2 mg/dL)	39 (30.0)	47 (37.3)	7.3 (−4.2 to 18.6)
>2 mmol/L (>9.2 mg/dL)	82 (63.1)	68 (54.0)	9.1 (−2.9 to 20.8)
EtOH > 2 mmol/L (>9.2 mg/dL)	51.3 (±29.6) mmol/L 236.3 (±136.3) mg/dL	45.3 (±29.3) mmol/L 208.7 (±135.0) mg/dL	6.0 (−3.6 to 15.6) mmol/L 27.6 (−16.6 to 71.9) mg/dL

Data are reported as *n* (%) or mean (±SD).

CTAS = Canadian Triage Acuity Scale; EtOH = ethanol.

ED. Before training, 113 of 326 (34.7%) patients with a CIWA-Ar < 10 received benzodiazepines when they were not required, compared to 39 of 346 (11.3%) in

the posttraining group (Δ23.4%, 95% CI = 17.2%–29.5%). For patients in moderate or severe alcohol withdrawal (CIWA-Ar ≥ 10), 31 of 239 (13.0%)

Figure 2. Proportion of CIWA-Ar breaches, by month. CIWA-Ar = Clinical Institute Withdrawal Assessment for Alcohol-Revised.

patients in the pretraining group did not receive benzodiazepines when they were indicated, compared to 25 of 201 (12.4%) in the posttraining group ($\Delta 0.6\%$, 95% CI = -5.9% to 6.7%).

Approximately half of all CIWA-Ar breaches (109/208; 52.4%) occurred in patients with a CIWA-Ar score between 8 and 12, indicating treatment decisions in the range of CIWA-Ar scores close to the treatment threshold are most problematic. In this range (CIWA-Ar score between 8 and 12), there were 73 of 162 (45.1%) protocol breaches in the pretraining group, compared to 36 of 149 (24.2%) in the posttraining group ($\Delta 20.9\%$, 95% CI = 10.4% – 30.8%).

Figure 2 describes the proportion of all CIWA-Ar scores resulting in a breach, on a month-to-month basis. During the 5 months after training, there was a sustained reduction in CIWA-Ar breaches, with no reduction in mean number of CIWA-Ar scores per patient (4.3 in both the pre- and the postintervention groups).

After program completion, there was a reduction in the median total dose of diazepam administered in the ED (40 mg vs. 30 mg, $\Delta 10$ mg, 95% CI = 0 – 20 mg) and no change was detected in ED length of stay and benzodiazepines prescribed (Table 2). Adverse events

occurring in the ED (seizure, respiratory depression, delirium tremens) were similar before and after the AWS curriculum training. There was one incidence of delirium tremens in both the pretraining and the posttraining periods (Table 2). Hospital admission increased by 10.7% (95% CI = 1.4% to 20.0%) from the pretraining to posttraining phase; however, most admissions (75.0% in the pretraining group and 72.4% in the posttraining group) were unrelated to AWS.

DISCUSSION

This study demonstrates that our blended curriculum model improved the care delivered to AWS patients over the 5 months following completion of training by ED staff nurses. Over the course of more than 500 CIWA-Ar assessments, our program significantly reduced errors in benzodiazepine administration as part of a standardized AWS treatment protocol. We found that this educational initiative provided the greatest improvement in the treatment of patients with CIWA-Ar scores in the 8 to 12 range, where discrimination between requiring and not requiring treatment is most difficult. Nurses who completed our program

Table 2
Comparison of ED Management Between Pre and Post AWS Curriculum Training

Characteristic	Before Training (n = 130)	After Training (n = 126)	% Difference (95% CI)
ED LOS (hours)	6.8 (4.8 to 10.4)	6.7 (4.7 to 11.4)	0.1 (−0.8 to 1.0)
Disposition			
Discharged home	99 (76.2)	83 (65.9)	10.2 (−0.1 to 21.1)
Admitted to inpatient	16 (12.3)	29 (23.0)	10.7 (1.4 to 20.0)
Admission related to AWS	4 (3.1)	8 (6.4)	3.3 (−2.2 to 9.2)
Admission not related to AWS	12 (9.2)	21 (16.7)	7.4 (−0.9 to 15.8)
Transferred	12 (9.2)	10 (7.9)	1.3 (−5.9 to 8.5)
LAMA	3 (2.3)	4 (3.2)	0.9 (−3.8 to 5.8)
Social work consultation	41 (31.4)	33 (26.2)	5.4 (−5.8 to 16.2)
CT imaging ordered in the ED	16 (12.3)	16 (12.7)	0.3 (−7.9 to 8.7)
Adverse events in the ED	1 (0.8)	1 (0.8)	0.0 (−3.5 to 3.7)
Received benzodiazepines in the ED	110 (84.6)	96 (76.2)	8.4 (−1.3 to 18.1)
Diazepam (mg)	40 (20 to 60)	30 (20 to 40)	10 (0 to 20)
Lorazepam (mg)	2 (2 to 10)	7 (2 to 10)	5 (−4 to 7)

Data are reported as median (IQR) or *n* (%).

AWS = alcohol withdrawal syndrome; IQR = interquartile range; LAMA = left against medical advice; LOS = length of stay.

were significantly less likely to administer benzodiazepines to patients when such treatment was not indicated.

While undertreatment of AWS patients requiring benzodiazepines is a concern, unnecessary administration of benzodiazepines to patients with mild withdrawal symptoms is also problematic.¹⁸ Excessive benzodiazepine treatment is likely to increase sedation, potentially prolong ED length of stay and divert nursing resources from other ED patients. Additionally, unnecessary benzodiazepine treatment of patients with mild withdrawal may reinforce patient perceptions that they require benzodiazepine treatment for alcohol craving, possibly resulting in benzodiazepine dependence. In our study, reduced benzodiazepine administration to patients with mild withdrawal symptoms (CIWA-Ar scores < 10) was not associated with an increase in adverse events in the ED or admissions specifically related to alcohol withdrawal, suggesting conservative management was appropriate.

In this study, we did not find a change in benzodiazepine prescribing behavior at discharge. Given that only nurses completed the education training program, this finding is not unexpected. Unnecessary benzodiazepine prescriptions and unit dose distribution at discharge are harmful and an important area where patient care could be improved. It remains unknown if this program could influence physician prescribing.

General lack of knowledge around all aspects of the management of AWS is a barrier to providing good

care to these patients in the ED. One of the main challenges is the perceived complexity of how to administer and interpret responses to the questions in the CIWA-Ar protocol. Acquisition of these skills requires experience, yet there is no training program to teach this competency. The resulting lack of confidence may contribute to inconsistent and inappropriate care. Our study shows that an electronically delivered AWS curriculum coupled with a practice seminar and an OSCE (which has an added educational value) is an effective educational tool to teach this competency and improve patient care. The online format of this innovative program makes it an easily distributed electronic resource that can be shared.

Compared to didactic teaching methods, deliberate practice simulation-based education, which provides a thorough background and opportunities for repetition until mastery, has been shown to be more effective when teaching procedural skills.^{19,20} Performance feedback is a key component of this educational model, allowing participants to progress at their own pace toward achieving mastery.²¹ However, the effectiveness of this AWS curriculum in other settings without a local expert/champion to help facilitate knowledge acquisition remains unknown.

LIMITATIONS

This study was conducted in a single-center tertiary care institution, and the results might not be

generalizable to other settings. Due to the retrospective nature of this study, we can only report what was documented in the patient chart, and it is possible clinical management may have been dictated by information not documented in the chart. Importantly, we are unable to comment on patient preferences that may have challenged standard of care and guided a patient's treatment plan. To evaluate the impact of this educational program, we recorded how often the CIWA-Ar protocol was appropriately applied in the ED in the 5 months prior to and following training. Although the curriculum was delivered as part of the mandatory annual education program for all full-time nurses, not all nurses (i.e., part-time nurses) working in our ED completed the AWS training program. Due to the fluctuations of nursing care in the ED (shift change, break coverage, etc.), there was no feasible way to include only patients assessed by nurses who completed the program. This may have resulted in an underestimation of the impact of the training program on ED care, as a number of the nurses in the postintervention period would not have completed the AWS curriculum. Although we believe that this training program contributed to the fewer protocol breaches and improved patient care documented in the 5 months after training, further study is needed to determine if the nurses who completed the AWS curriculum retained the knowledge and competency with the CIWA-Ar protocol beyond this time period.

CONCLUSIONS

Completion of our alcohol withdrawal syndrome curriculum resulted in better compliance with the Clinical Institute Withdrawal Assessment for Alcohol-Revised protocol and significantly reduced errors in benzodiazepine administration as part of a standardized alcohol withdrawal syndrome treatment protocol. This educational initiative improved ED care for patients with alcohol withdrawal syndrome and had the greatest impact in the treatment of patients with Clinical Institute Withdrawal Assessment for Alcohol-Revised scores in the 8 to 12 range, where discrimination between requiring and not requiring treatment is most difficult.

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