Nursing Perceptions and Workload Impact of a Standardized Emergence Delirium Assessment Scale in a Postanesthesia Care Unit

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Purpose: *Emergence delirium (EDL) is a psychomotor behavioral phenomenon that occurs immediately after emergence from general anesthesia. EDL is nearly 1.5 times more common among military than nonmilitary patients. Indirect delirium scales have precluded understanding of EDL in military patients. This quality improvement project assesses the feasibility of adopting a population-specific scale, the Emergence Delirium in the Wounded Warrior (ED-WW) Tool.*
Design: *Pre-post implementation design.*
Methods: *Postanesthesia care unit (PACU) nurses were surveyed on the clinical utility of the ED-WW Tool and its impact on their workload. The incidence of EDL behaviors in a Veterans Administration PACU was also recorded using the ED-WW Tool.*
Findings: *PACU nurses agreed the ED-WW Tool was of clinical value to military patients and had a very low workload impact. Twenty-one percent of patients demonstrated at least one behavior associated with EDL.*
Conclusions: *ED-WW Tool adoption is clinically feasible and recommended for practice.*

Keywords: *emergence delirium, postanesthesia care unit, veterans, delirium scale.*
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EMERGENCE DELIRIUM (EDL) is a psychomotor behavioral phenomenon ranging from nonpurposeful movement to physical aggression that occurs immediately after general anesthesia.[1,2] EDL lasts minutes to hours, is self-limited, and is frequently witnessed in the postanesthesia care unit (PACU).[1,3] Although more commonly witnessed in children (57%), EDL is present in up to 21% of adults and 27% of combat veterans.[2,4] Although its cause is unknown, the higher incidence of EDL among military patients is attributed to higher rates of pre-existing anxiety, depression, and post-traumatic stress disorder (PTSD).[2] Yet, there is limited understanding of the relationship between military patients and EDL. This lack of knowledge is in part because of use of unvalidated delirium scales for this population. The Emergence Delirium in the Wounded

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Warrior (ED-WW) Tool is a standardized, population-specific scale used to identify and quantify EDL among military patients.[5] The purpose of this quality improvement project was threefold: to evaluate the current method of EDL assessment in the PACU of a Veterans Administration Medical Center (VAMC), to assess the feasibility of ED-WW Tool adoption, and to develop a recommendation for evidence-based practice change based on project findings.

Literature Review

EDL can impact the safety and postoperative recovery of the military patient. At its most extreme, EDL can result in inadvertent removal of the endotracheal tube, intravenous lines, and monitors, and require additional staff to manage the patient's hyperactive behavior.[6-8] These behaviors can pose significant consequences, including harm to both perioperative personnel and the patient,[6] increased postoperative length of stay, and incurred hospital costs.[7-9] Among military patients with pre-existing PTSD, EDL in the PACU has trended toward higher rates of mortality, postoperative respiratory failure, and kidney dysfunction.[10]

Military anesthesia providers report witnessing EDL more often in combat and noncombat veterans than the general adult population, and most frequently in combat veterans with pre-existing PTSD.[2,10] Moreover, over a third of surveyed active-duty anesthesia providers believe EDL is a moderate to serious problem, and nearly 80% report witnessing EDL in their practice.[6]

The incidence and quality of behaviors associated with EDL are currently measured using the Richmond Agitation Sedation Scale (RASS),[3,8,11,12] the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU),[3] and the Pediatric Anesthesia Emergence Delirium (PAED) Scale.[2] The RASS is validated for quality and depth of sedation over time in the adult ICU.[13,14] On this scale, severity of agitation is scored; agitation, however, is not the only behavior associated with EDL, making this scale largely inaccurate in the military population.[4] Similarly, the CAM-ICU is validated for monitoring the development of delirium over time in adult ICU patients.[13] Neither of these

scales account for the acuity and relative brevity of the perioperative period. By comparison, the PAED Scale is considered a more reliable measure of EDL in military patients because the pediatric population demonstrates similar behavioral responses to anesthesia.[2,15] However, the PAED Scale does not account for the safety risk posed by the delirious adult, nor does it include changes in cognition or the ability to reorient the patient.

ED-WW Tool

The ED-WW Tool is specifically designed for objective measurement of behaviors associated with EDL among military patients (Table 1).[5] In developing the ED-WW Tool, 70 unique behaviors were identified by military anesthesia providers as associated with EDL. These behaviors were prioritized for inclusion on the scale using the Delphi process, cross-referenced to the RASS and PAED scales for redundancy, and evaluated for content validity. The behaviors were then organized into four diagnostic dimensions of EDL according to the *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition, Text Revision (DSM-IV-TR) and *International Classification of Diseases*, Tenth Edition (ICD-10). This process generated a specific, population-based tool that distinguishes EDL in military patients as a separate phenomenon than that experienced by nonmilitary adults.[5] Each behavioral dimension is graded by the observer using their own clinical judgment on a four-point Likert scale: affect/emotion, orientation/cognition, manageability/psychomotor behavior, and aggressiveness/psychomotor behavior. A fifth dimension measures the safety risk posed to the patient or staff. For this project, a score greater than 0, which indicates the display of some degree of the behavior in any one of the five categories, was defined as presence of EDL.

Methods

Study Design and Ethical Considerations

A pre-post implementation design quality improvement project was conducted between July and August 2017. This project was formally evaluated using a quality improvement project checklist by the university and the assistant chief of research in the Department of Anesthesiology at the

Table 1. Emergence Delirium in the Wounded Warrior (ED-WW) Clinical Rating Tool

Directions: Circle the <u>ONE</u> answer choice, which, in your clinical judgment, describes patient behaviors as he/she emerged from general anesthesia

AFFECT/EMOTION			
0	1	2	3
Unremarkable/Typical	Apprehensive/Anxious	Frightened/Fearful	Terrified/Panic stricken

ORIENTATION/COGNITION			
0	1	2	3
Unremarkable/ Typical	Disoriented/ Disassociated	Flashback to traumatic event/Can be reoriented	Flashback to traumatic event/Cannot reorient

MANAGEABILITY/PSYCHOMOTOR BEHAVIOR			
0	1	2	3
Unremarkable/ Typical	Uncooperative	Fights restraints/ Difficult to manage	Uncontrollable/ Cannot restrain

AGGRESSIVENESS/PSYCHOMOTOR BEHAVIOR			
0	1	2	3
Unremarkable/ Typical	Agitated/ Angry	Threatening/Verbally aggressive	Physically aggressive/ Combative

PATIENT/STAFF SAFETY RISK			
0	1	2	3
No safety risk	Minimal safety risk	Marked safety risk	High safety risk

VAMC and determined to not be human subjects' research.

Organizational Setting and Sample

This project took place at a VAMC PACU in the Southeastern United States. The institution is a 270 bed, tertiary care facility that performs 5,600 surgeries per year (C. West, personal communication, March 27, 2017.) The PACU has nine patient beds and eight staff nurses who perform all Phase 1 postoperative recoveries. All eight PACU nurses were surveyed before and after ED-WW Tool implementation regarding their perceptions of EDL and clinical utility of the tool.

The nurses used the ED-WW Tool to score a convenience sample of 76 patients who required general anesthesia for surgery. Patients who recovered outside the PACU at the conclusion of surgery were excluded.

Implementation

Before ED-WW Tool implementation, the PACU nursing staff anonymously completed a survey to determine the current method of EDL assessment in the PACU and their perceptions of EDL (Table 2). This survey was constructed from previously validated surveys used in similar ICU studies.[16-18] Permission to use adaptations of these validated surveys was obtained before their use (B. Pun, personal communication, May 8, 2017; J. Devlin, personal communication, May 6, 2017; P. Scott, personal communication, May 16, 2017).

After the initial survey period, the nursing staff began using the ED-WW Tool to score every qualifying patient once on their arrival to the PACU over a 2-week period. The project lead collected the completed ED-WW Tool from the bedside and recorded the patient's numerical scores for each behavioral dimension. Patients were deidentified and anonymized to the project authors. No patient protected health information was collected or recorded. Completed ED-WW Tools were shredded immediately after data entry.

After implementation, all PACU staff nurses were again anonymously surveyed regarding their

Table 2. Preimplementation Survey

Nursing Perceptions Toward Emergence Delirium (EDL) in the Postanesthesia Care Unit

1. The PACU has a delirium protocol or guideline (please circle)
   YES   NO   NOT SURE
2. Does your PACU protocol specify a frequency by which delirium should be assessed?
   YES   NO   NOT SURE
3. Please indicate your agreement with the following statements that pertain to emergence delirium (EDL) in
   the PACU by placing an X in the column that most closely aligns with your agreement.

	Strongly Agree	Moderately Agree	Strongly Disagree	Moderately Disagree	Neither Agree nor Disagree
EDL is an underdiagnosed problem among veterans					
EDL is a common occurrence in the VA PACU environment					
EDL is challenging to assess in VA PACU patients					

perception of EDL and the clinical utility of the ED-WW Tool (Table 3). This postimplementation survey was also constructed from previously validated surveys with the permission of their authors.[16-18] In addition, the PACU nurses completed the National Aeronautics Space Administration Task Load Index (NASA-TLX)[19] survey to measure the

subjective workload impact of the ED-WW Tool (Figure 1).

NASA-TLX Survey

The NASA-TLX is regarded as the strongest tool available to measure subjective task workload.[20,21]

Table 3. Postimplementation Survey

Nursing Perceptions Toward Emergence Delirium (EDL) in the Postanesthesia Care Unit

1. Please indicate your agreement with the following statements that pertain to emergence delirium (EDL) in the PACU by placing an X in the column that most closely aligns with your agreement.

	Strongly Agree	Moderately Agree	Strongly Disagree	Moderately Disagree	Neither Agree nor Disagree
EDL is an underdiagnosed problem					
EDL is a common occurrence in the VA PACU environment					
EDL is challenging to assess in VA PACU patients					
The ED-WW Tool is easy to administer					
I feel confident in my ability to use the ED-WW Tool					
Monitoring for delirium has helped me perform a more comprehensive patient assessment					
I can better recognize behaviors associated with EDL because of the ED-WW Tool					
The ED-WW Tool is of clinical value for the veteran population					

Is there anything else you would like to say about delirium assessment in the VA PACU setting?

NASA Task Load Index

Hart and Staveland's NASA Task Load Index (TLX) method assesses work load on five 7-point scales. Increments of high, medium and low estimates for each point result in 21 gradations on the scales.

Name	Task	Date

Mental Demand   How mentally demanding was the task?

Very Low   Very High

Physical Demand   How physically demanding was the task?

Very Low   Very High

Temporal Demand   How hurried or rushed was the pace of the task?

Very Low   Very High

Performance   How successful were you in accomplishing what you were asked to do?

Perfect   Failure

Effort   How hard did you have to work to accomplish your level of performance?

Very Low   Very High

Frustration   How insecure, discouraged, irritated, stressed, and annoyed wereyou?

Very Low   Very High

Figure 1. National Aeronautics and Space Administration Task Load Index (NASA-TLX).

The tool has demonstrated validity and reliability as a measure of workload in a variety of high-stress environments in which the operator's perceived workload can cause negative outcomes, particularly medical errors.[22] The NASA-TLX is designed to measure six variables that affect the workload of a human operator while he or she is performing a task.[21] These variables include mental, physical, and temporal demands, frustration, effort, and performance. The subject ranks these variables on six separate subscales from 0 (very low) to 20 (very high). The numerical scores given to each variable are averaged to generate a raw estimate (RTLX) of overall workload (RTLX = SUM/6).[23]

Data Collection

Statistical Analysis and Outcome Measures

Statistical analyses were conducted using IBM SPSS v.24. The value of α was set at 0.05 for comparative analyses. Descriptive statistics were conducted on the following survey items: the presence of a delirium assessment scale and frequency of delirium assessment, nurses' perception of EDL, nurses' perceived utility of the ED-WW, and workload impact as determined by the NASA-TLX survey. Descriptive statistical analysis was also conducted on the incidence of EDL behaviors. Three separate Mann-Whitney U tests were conducted to determine significant differences between preimplementation and postimplementation responses.

Results

Nursing Perceptions

Results of the preimplementation survey demonstrated that the VAMC had no delirium protocol in place for PACU use, nor was there a specified frequency with which nurses should assess for the presence of delirium in the PACU (N = 8, 100%).

The preimplementation survey indicated 63% of nurses agreed or strongly agreed EDL is underdiagnosed among veterans (n = 5). In addition, most nurses disagreed that EDL is a common occurrence in the VA PACU environment (n = 5, 63%). Most nurses also disagreed that EDL is challenging to assess in VA PACU patients (n = 5, 63%).

A Mann-Whitney U test suggested that nurses perceived EDL as underdiagnosed more so before tool implementation (median = 2) than after tool implementation; however, this difference did not reach statistical significance (median = 4, U = 16.5, P = .089) (Table 4). There was no significant difference in nurses' perceived ability to assess EDL between pre- (median = 4) and post- (median = 2.5, U = 18, P = .102) tool implementation groups. There was no significant difference in the perception of EDL as a common problem between pre- (median = 4) and post- (median = 3, U = 31.5, P = .956) tool implementation groups.

Nurses' perceived utility of the ED-WW Tool was measured on five quality indicators. They strongly agreed the ED-WW Tool was easy to administer and were confident in their ability to complete the tool (median = 1, range = 1 to 2). Nurses also agreed that monitoring patients for signs of EDL helped them generate a more comprehensive patient assessment (median = 2, range = 1 to 4), was of clinical value to the veteran population (median = 2, range = 1 to 5), and aided them in recognition of EDL behaviors (median = 2, range = 1 to 5).

The overall workload impact of the ED-WW Tool as measured by the NASA-TLX survey was very low (RTLX = 3.1, SD = 0.7, range = 0 to 10). The

Table 4. Comparison of Pre- and Post- Nursing Perception Responses

Perception	Median—Pre	Median—Post	U	P
Underdiagnosed problem	2	4	16.5	.089
Common occurrence	4	3	31.5	.956
Challenging to assess	4	2.5	18	.102

Note. Perception responses were measured using a Likert scale of 1 = strongly agree, 2 = moderately agree, 3 = neither agree nor disagree, 4 = moderately disagree, 5 = strongly disagree. Significant at $P < .05$.

ED-WW Tool posed a very low mental demand (median = 3, range = 1 to 10), a very low physical demand (median = 2, range = 1 to 10), and very low temporal demand (median = 3, range = 1 to 7). Nurses rated their performance regarding completion of the ED-WW Tool as nearly perfect while attending to patient care (median = 3.5, range = 0 to 6). Nurses required low effort to complete the ED-WW Tool (median = 3.5, range = 0 to 5) and experienced little to no frustration (median = 1, range = 0 to 5).

EDL Behaviors

Sixteen patients (21%) exhibited at least one behavior associated with EDL. Derangements in affect/emotion were noted in 11 patients (14%), with apprehension or anxiety being most commonly observed (n = 8, 73%). Changes in orientation/cognition occurred in 11 patients (14%) with disorientation or disassociation noted in 73% (n = 8) of these patients, and 3 (27%) had a suspected flashback to a traumatic event. Disturbances in the manageability of a patient's psychomotor behavior occurred in four patients (5%) with only one patient that was difficult to manage or fought restraints. Aggression was observed in three patients (4%), and one of these patients (33%) was physically combative. Eight patients (11%) posed a safety risk to themselves or staff;

six (75%) were graded as a minimal safety risk and two (33.3%) were a moderate safety risk.

The incidence of behavioral derangements for these 16 patients is depicted in Table 5. Fifty percent were determined to be a safety risk to themselves or staff (n = 8), and 88% of the patients who were graded as a safety risk also had a change in affect/emotion or orientation/cognition categories (n = 7). Disturbances in manageability or aggressiveness were associated with being a safety risk in three patients, although the inverse was not true.

Discussion

The purpose of this quality improvement project was threefold: to evaluate the current method of EDL assessment in a VAMC PACU, to assess the feasibility of ED-WW Tool adoption, and to develop a recommendation for evidence-based practice change based on project findings. The results of this quality improvement project demonstrated that there was neither a delirium assessment scale in use nor a specified frequency with which delirium should be assessed. Second, adoption of the ED-WW Tool is clinically feasible based on the results of the PACU nursing surveys: nurses found the ED-WW Tool easy to use, beneficial to completing physical assessments, helpful in recognizing EDL behaviors, and clinically valuable

Table 5. Incidence of Emergence Delirium Behaviors by Patient and Category (n = 16)

Patient	Affect/Emotion	Orientation/Cognition	Manageability	Aggressiveness	Safety Risk
1	x	x	x		
2	x	x			
3		x			x
4		x			x
5		x			
6	x				
7	x	x	x	x	x
8	x				x
9	x	x			
10	x	x	x	x	x
11	x	x	x	x	x
12		x			
13					x
14	x	x			
15	x				
16	x				x

Note. "x" denotes a score greater than zero. "Patient number" designates the 16 patients that demonstrated behaviors. No identifying numbers were assigned to these patients during project implementation.

to military patients. Nurses' perceptions of EDL did not change with ED-WW Tool implementation. In addition, the ED-WW Tool had a very low impact on the nurses' ability to provide patient care as determined by the NASA-TLX. Third, 21% of the observed sample demonstrated at least one behavior associated with EDL, which is comparable to the reported incidence rate among military patients measured on the PAED scale.[2] On the basis of these results, the ED-WW Tool is of low risk and high clinical benefit to the veteran population, and thus recommended for clinical adoption in the VAMC PACU setting.

Results of this project corroborate the perception that EDL, although relatively uncommon, is a unique, and perhaps underdiagnosed problem in the military population,[6] thus emphasizing the clinical need for a population-specific scale. Studies have demonstrated that delirium detection improves when caregivers use a valid and reliable assessment scale.[13] Although this VA PACU did not have a delirium protocol in place, Critical Care Clinical Practice Guidelines recommend routine monitoring for the presence of delirium in adults in the ICU at least once per nursing shift.[13] Thus, routine monitoring of EDL on a valid and reliable scale can improve detection of EDL and accurately measure its incidence rate.

Delirium scale adoption is dependent on user perception and value. Similar studies regarding the implementation of ICU delirium scales have demonstrated that ease of administration and nursing staff's perceived clinical value are vital to delirium scale sustainability.[16-18] Nurses may be more likely to use the scale if it is of value to the nurse. Furthermore, delirium scale implementation has been shown to enhance patient care by improving patient assessment.[16,18]

Use of the NASA-TLX survey in the perianesthesia environment may alert administrative personnel of tasks or equipment that negatively impact patient care or staff morale.[22] The PACU nurses rated the ED-WW Tool as having a very low impact on their overall workload, suggesting that patient care would not be compromised by tool adoption.

The incidence of EDL behaviors as measured by the ED-WW Tool suggests that this tool may be of clinical benefit to military patients. The ED-WW

Tool is unique in that it quantifies the safety risk posed to the patient and staff, which can be significantly deleterious in military patients.[24,25] One patient was deemed a safety risk but did not exhibit any other behavior on the tool, suggesting that the ED-WW Tool is not inclusive of all patient behaviors that define EDL or that threaten patient or staff safety.

Limitations

The results of this project are limited by the small sample of PACU nurses and the potential for observer effect bias. The project lead's daily presence in the PACU during implementation may have influenced nurses to favor ED-WW Tool implementation or record EDL behaviors that were not actually demonstrated by the patient.

The preimplementation and postimplementation surveys completed by the nurses were previously validated in similar studies conducted in the ICU.[16,17] Use of these surveys in the PACU may decrease the reliability of the nurses' responses.

The ED-WW Tool is currently undergoing validation and field testing, which limits the strength of these results and the interpretation of the behavioral scores. The developers of this study determined that any behavior greater than 0 would be definitive of EDL, because EDL encompasses a spectrum of behaviors. This approach measures the incidence of observed EDL behaviors without accounting for their severity: the patient who scored greater than 0 in all five behavioral categories and the patient who scored greater than 0 in only one behavioral category accounted for two observed incidences of EDL for this project. The significance of a score greater than 0 in one or multiple behavioral categories is yet to be determined.

In addition, the type and length of surgical cases that are recovered in this VAMC PACU may affect the observed incidence rate of EDL. This PACU does not recover general anesthetics of longer duration, such as open abdominal or vascular cases. The effect of surgical duration on incidence of EDL remains undetermined.[7,12] This PACU also does not recover any patient with a pre-existing diagnosis of obstructive sleep apnea. Although obstructive sleep apnea has not been directly associated with the presence of EDL in adults, it has

been associated with higher rates of EDL in children.[26] Therefore, the recovery of these patients outside the PACU may have affected the incidence of EDL recorded in this project.

Furthermore, combat history was not discerned in the patient sample. Combat veterans demonstrate a higher incidence of EDL than noncombat veterans,[2] which may also have affected the measured incidence of EDL.

Finally, the perioperative administration of dexmedetomidine may have had an uncontrolled impact on the incidence of EDL in this PACU. Studies suggest dexmedetomidine may be beneficial in reducing EDL, although it has not been formally studied in the military population.[27-30] Anecdotally, however, anesthesia providers at this VAMC frequently administer dexmedetomidine during the intraoperative period to patients they suspect to be at risk for EDL. In addition, administration of dexmedetomidine was witnessed during this study to patients who exhibited EDL behaviors in the PACU. The timing of dexmedetomidine administration suggests that anesthesia providers use it both preventatively and remedially. Both of these scenarios may have affected the rate and severity of witnessed EDL behaviors in the PACU.

Implications and Conclusions

This project and the future validation of the ED-WW Tool provide additional avenues for investigation. Research results regarding prevention and treatment of EDL in military patients remain inconclusive.[29] The ED-WW Tool could be beneficial in comparing postoperative behavioral scores between intervention and placebo groups or comparing behavioral scores over time after pharmacologic intervention. In addition, military patients often revisit VA hospitals for repeated surgeries. If a patient scored greater than 0 in multiple categories on the ED-WW Tool after one surgery, it would be valuable to see how or if the anesthesia plan changed with subsequent surgeries. Higher scores may also have implications for PACU staffing: patients with higher scores may warrant additional staff to be on standby to ensure their safety during emergence.

Although the evidence generated by this quality improvement project is low, the benefits of using the ED-WW Tool as demonstrated by the nursing responses, the NASA-TLX survey, and the results of the ED-WW Tool, strongly outweigh the undesirable effects. The ED-WW Tool has the potential to guide providers and improve perioperative care for military patients.

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