The goal of this research was to investigate, through active-duty Army anesthesia providers, their perceptions on emergence delirium (ED) in US combat veterans. Specifically, the pharmacologic, physiologic, and psychological characteristics associated with ED. An online survey was sent to all active-duty Army anesthesia providers with a response rate of 34%. Results indicated that the providers overwhelmingly agreed that ED was related to type of anesthetic used (67.1%) with potent inhalational agents and ketamine ranking highest (88.6% and 63.6%, respectively). Providers also overwhelmingly considered both physiologic and psychological factors (86.8% and 97.1%, respectively) as producing ED in combat veterans. Young age (57.5%) and traumatic brain injury (54.2%) were believed to be the most likely physiologic factors, with posttraumatic stress disorder (88%) and anxiety (84.8%) rated highest for psychological factors related to ED. This study emphasizes the need to develop a prospective clinical database involving all military anesthesia providers that could collect demographic, pharmacologic, psychological, and physiologic information on all combat veterans undergoing anesthesia. This kind of longitudinal data would provide answers to many of the unanswered questions that we currently have regarding combat veterans and ED.

**Keywords:** Anesthesia, combat veterans, emergence delirium.

Since September 11, 2001, our military has dealt with an extraordinarily high operational tempo as they have pursued US policy interests abroad. This increase in military involvement (largely in Iraq and Afghanistan) has resulted in soldiers, sailors, airmen, and marines being exposed to traumatizing experiences in numbers not seen for some time. Besides the visible wounds frequently seen from battle, exposure to actual combat or being in a combat zone has created a sharp rise in the number of mental health problems seen in our military population. Combat stress and long deployments have been associated with a greater prevalence of mental health disorders, including posttraumatic stress disorder (PTSD), anxiety, and depression. Posttraumatic symptom severity, in turn, has a perceived association with emergence from general anesthesia in a state of delirium.6,7

Depression, PTSD, and other mental health concerns have grown commensurate with the operational commitments of the past decade, leading to much needed research investigating these disorders.2,3,8-10 One such psychological health phenomenon that has largely been understudied in military medicine is emergence delirium (ED). This condition is seen while the patient is emerging from general anesthesia, and its consequences can be harmful to not only the patient but also the staff caring for the patient.6,7,11,12 Typical behaviors seen with ED in the combat veteran include, hyperactive motor behavior, pulling at the monitoring equipment, behavior requiring additional staff, and disruptive movements.6,7

Emergence delirium was first written about in the 1960s and was referred to as postanesthetic excitement.13,14 Since that time, there have been fewer than 15 published ED studies focused on the adult population, with even fewer centered on combat veterans. Most research into emergence from general anesthesia in a state of delirium has focused on extremes of age, with terminology closely resembling ED. The pediatric literature frequently cites problems associated with the emerging phenomenon as emergence agitation.15-18 Emergence in the geriatric literature is often referred to as postoperative delirium and can be seen typically between 24 and 72 hours after anesthetic administration.12,19,20 The synonymous use of emergence agitation, emergence excitement, and postoperative delirium with ED throughout the literature is problematic and adds confusion to the average reader.21 It is therefore vital to distinguish between the various populations and the phenomenon of emergence from general anesthesia, which this study attempted to capture.

The estimated prevalence of ED in adults ranges from 3% to 8.4%.22-25 The exact number of ED cases in adult combat veterans is not known, but a study performed by McGuire6 estimated the number to be as high as 27%. Another recent study attempting to quantify how serious the problem of ED is in the adult military population
found that more than 78% of surveyed active-duty Army anesthesia providers had witnessed ED in their particular practice. It is also hypothesized that ED is more likely in the combat veteran who shows signs of depression, anxiety, and PTSD. Little is known regarding this phenomenon in the combat veteran other than that it exists and to a higher extent than in the civilian population and that ED occurs sometime between the end of surgery and discharge from the postanesthesia care unit (PACU). Thus, ED is a major problem that warrants further research.

The aim of this study was to investigate perceived relationships between pharmacologic, physiologic, and psychological variables and ED. A secondary aim was to examine interventions used by anesthesia providers in ameliorating ED symptoms. The final aim of the study investigated the relationship between the perceived seriousness of ED, the reporting of ED case experience, and the physiologic and psychological factors related to ED.

If a relationship exists, then the goal would be to guide future research into pharmacologic, physiologic, or psychogenic causes as well as mechanisms of action. Factors of corollary importance include lower hospital costs by decreasing the number of operating room (OR) and PACU staff required to care for those with ED and a decrease in patient suffering associated with ED. The most important need for this study is to help find ways to increase the safety margin for not only the patient but also the staff caring for the patient.

Methods

Approval for the study was obtained from the Army’s anesthesiologist and nurse anesthetist consultants to the US Surgeon General, the East Carolina University institutional review board, and the Army Personnel Survey Program of the Army Research Institute. A descriptive correlational study was then designed. This design had at its core a survey constructed to better understand providers’ perceptions on the pharmacologic, physiologic, and psychological characteristics of ED seen with combat veterans.

The survey portion of the study was conducted online to reach the maximum number of participants. Confidentiality was maintained using a third-party online survey distributor. This third-party service blinded the researcher to any identifiable data being returned. Besides the ability to reach large audiences, other distinct benefits of online surveys include low associated costs with the method as well as brevity of time accompanying delivery both to the recipient and then back to the researcher. Electronic means to gather information is especially beneficial in the military due to the large number of anesthesia providers stationed and deployed in remote locations. In today’s fast-paced military environment, the US Department of Defense and, in particular, the Army Medical Command consistently use online means to reach the maximum number of participants. Online data collection via a survey is especially beneficial following September 11, 2001 when the rate of anesthesia providers deploying was at an all-time high to austere environments such as Iraq, Afghanistan, and Africa. These advantages, however, also have a distinct disadvantage since those providers in distant countries may not have the ability to access the Internet and thus cannot take an online survey.

The study used a convenience sample of all active-duty Army anesthesia providers (as of August 2011) that included 156 Certified Registered Nurse Anesthetists (CRNAs) and 98 anesthesiologists. All participants gave consent before starting the survey. Exclusion criteria consisted of practitioners who refused to consent to the survey. It was expected that a response rate between 31% and 46% would occur for this study. These percentages were based on a review of email surveys from 1986 through 2000. Of the 31 studies examined, an average response rate of 36.8% occurred. Thus, the study expected to receive between 85 and 101 responses. Only active-duty personnel who were practicing as anesthesia providers were eligible for the study given the inability to reach other members of the Armed Services (National Guard and Reserves).

- **Pilot Study.** A pilot study was conducted by the researcher at Womack Army Medical Center in Fayetteville, North Carolina. The purpose of the pilot was to test the reliability and validity of the survey instrument. The pilot study participants were anesthesia providers with a minimum experience level of 5 years. Feedback from their participation proved beneficial in a number of ways. First, it helped guide modifications to the questions in the survey. Second, the feedback gained from the pilot led to changes in the order of the questions to improve the logical progression of the survey. Multiple revisions were made throughout the survey design with guidance from the author’s dissertation committee. The final version of the survey, which was sent online in August 2011, consisted of 5 sections and 40 questions.

- **Survey Instrument.** The survey’s first section did not include any questions but rather consisted of operational definitions, which were important to maintain the focus on combat veterans for respondents. The definitions used in the study were derived from the experienced anesthesia providers who participated in the pilot. A combat veteran was defined as any man or woman who has deployed in support of the Global War on Terrorism. The Global War on Terrorism was synonymous with the Overseas Contingency Operation; it started on September 11, 2001, and continues to present day. Emergence delirium was defined as the scenario of a combat veteran who is emerging from general anesthesia and is subsequently seen thrashing around in a violent manner (to include pulling
at monitoring equipment, intravenous [IV] catheters, endotracheal tubes, drains, Foley catheter, etc), screaming, speaking incoherently, hitting, biting, or attempting to leave the OR (fall off narrow bed) encompassing any time from end of surgery to discharge from the PACU. Any one of these displayed behaviors or a combination can constitute ED. This definition applied only to combat veterans who have served in the theater of operations during the Global War on Terrorism.

The ED definition was designed to ensure that the focus of the study was on combat veterans who had deployed during a specific period. The definition was also important so that those being surveyed did not confuse ED with other forms of delirium seen postoperatively, such as that seen in the geriatric population or the agitation seen in the pediatric population.

The second section of the survey included 6 questions on demographic data, including professional designation, gender, experience level, current practice site, and amount of time deployed during the Global War on Terrorism. Experience level was ascertained from questions “How many months or years have you been practicing anesthesia?” and “How many total months have you deployed during the GWOT [Global War on Terrorism] (ie, since 11 Sept 2011)”? Professional designation was classified as either anesthesiologist or nurse anesthetist. Experience level was categorized as years practicing and years on active duty. Years practicing on active duty was further categorized as less than 2 years, 2 to 5 years, and greater than 5 years. Practice sites for anesthesia providers included a medical center in the United States, a medical center abroad, a community hospital in the United States, a community hospital abroad, Iraq, and Afghanistan. Months deployed was determined by an open-ended question, with respondents able to enter any number including 0.

Questions pertaining to potential causes for the appearance of ED in combat veterans followed with specific questions asking the provider if he or she believes ED could be related to the anesthetic used. The answer choices provided were either yes or no. If the provider answered no, he or she would skip the next question and proceed to a subsequent section. Specific anesthesia-related medications routinely used in the OR were given as answer choices, with the provider being able to select any number of answer choices (provider could select all that applied) that he or she believed could cause or be related to causing ED. The answer choices included the following: (1) potent inhalational agents (PIAs); (2) nitrous oxide; (3) total intravenous anesthesia (TIVA) utilizing propofol; (4) benzodiazepines; (5) ketamine; (6) barbiturates; (7) potent opioids; (8) nondepolarizing blocking agents; (9) anticholinergics; and (10) anticholinesterases.

Questions related to the potential physiologic factors related to ED were asked next in the survey. Questions asked the provider if he or she believes ED could be caused by any physiologic factors such as (answer choices): (1) do not believe ED is related to any physiologic factors; (2) traumatic brain injury; (3) type of surgery; (4) long duration of surgery (> 3 hours); (5) short duration of surgery (< 1 hour); (6) pain; (7) young age (30 years old or less); (8) older age (> 30 years old); and (9) medications patient is taking other than the medications associated with the anesthetic.

Potential psychological factors related to ED were asked about next. Information obtained by providers for these questions centered on the potential relationship of ED with various psychological factors. Answer choices were the following: (1) do not believe ED is related to any preexisting psychological factors; (2) posttraumatic stress disorder; (3) pain; (4) anxiety; (5) depression; and (6) medications patient is taking other than anesthetic.

The last portion from this section in the survey focused on interventions providers may have used to treat ED. The first intervention question was a yes or no question regarding whether the provider treated ED. If the provider answered no, he or she did not treat ED, he or she was asked to skip the next set of questions. If the provider answered yes, he or she proceeded to the next question, which asked what the provider did to help alleviate ED in the combat veteran. Answers included the following: (1) administer haloperidol; (2) administer diphenhydramine; (3) talk to the patient during episode (not preoperatively); (4) deepen the anesthetic using induction agent such as propofol; (5) administer analgesic; (6) administer a benzodiazepine; and (7) nothing (allow tincture of time to alleviate signs and symptoms).

The next set of questions honed in on whether the provider used any preoperative interventions to help mitigate ED for future anesthetics. Answers were: (1) talking to the patient with an emphasis on explaining everything you will do from the moment the IV is started to waking up in the OR/PACU; (2) listening to the patient with an emphasis on allowing the patient to verbalize fears of the unknown and of past experiences, which may impact wake up such as bad dreams or flashbacks; (3) giving more of your standard dose of midazolam (Versed); (4) giving less of your standard dose of Versed; (5) eliminating Versed all together; (6) administering ketamine (< 1 mg/kg) IV; (6) administering diphenhydramine; (7) administering haloperidol; and (8) administering droperidol.

All sections (pharmacologic, physiologic, and psychological) had at the end of each question a write-in portion. This was used to allow the provider an opportunity to write in any factor or intervention that he or she thought was important but was not listed as an answer. The remainder of the survey focused on specific ED behaviors and behavior consequences that have been reported previously.7

www.aana.com/aanajournalonline

AANA Journal ▪ October 2014 ▪ Vol. 82, No. 5

357
Results
A total of 254 eligible, active-duty Army anesthesia providers were sent surveys, and 89 responded after 4 invitations were emailed over 1 month. Two surveys were discarded because the respondents started the survey but never completed it. Thus, the overall response rate was 34%, which was within the targeted 31% to 46% range.

The frequencies and percentages pertaining to anesthetics that providers believed were related to the development of ED are represented in Table 1. Of the 68 respondents who had personal experience with ED, 44 (64.7%) reported their belief that ED could be related to the type of anesthetic used. The most frequently cited anesthetics were PIAs (88.6%) and ketamine (63.6%).

Table 2 displays the results for questions related to physiologic factors that anesthesia providers perceived could be related to the development of ED. Of the 68 respondents with a personal experience of ED, 59 (86.8%) reported that they believed ED could be related to a physiologic factor. (The frequencies and percentages in Table 2 are based on the 59 respondents who reported that ED could be related to a physiologic factor.) Most respondents identified age below 30 years, traumatic brain injury (TBI), and pain as possible physiologic factors related to ED.

Table 3 displays the results for questions related to preexisting psychological factors that providers perceived could be related to the development of ED. Of the 68 respondents with a personal experience of ED, 66 (97.1%) reported that they believed ED could be related to a psychological factor. (The frequencies and percentages in Table 3 are based on the 66 respondents who reported that ED could be related to a psychological factor.) More than 80% of the respondents identified PTSD and anxiety as possible psychological factors related to ED.

Table 4 displays the results for questions related to interventions perceived to have helped reduce or prevent ED symptoms while the combat veteran is undergoing anesthesia. Of the 68 respondents with a personal experience of ED, 61 (89.7%) identified one or more interventions. (The frequencies and percentages in Table 4 are based on the 61 respondents who identified 1 or more such interventions.) The interventions that were identified most frequently included talking to the service member during an ED episode, administration of an anxiolytic, or doing nothing and allowing “the tincture of time” to alleviate any signs and symptoms.

Interventions that may reduce or prevent ED before anesthesia are displayed in Table 5. Of the 68 respondents with a personal experience of ED, 54 (79.4%) identified 1 or more interventions. (The frequencies and percentages in Table 5 are based on the 54 respondents who identified one or more such interventions.) The interventions that were identified most frequently included talking to the service member before anesthesia about the upcoming intervention, actively listening to the patient, or increasing the dose of midazolam.

The final aim of the study investigated the relationship between perceived seriousness of ED, the reporting of ED case experience, and physiologic and psychological factors related to ED. Associations between perceived ED severity and physiologic factors reported to be associated with ED are presented in Table 6. Physiologic factors reported most often by both severity groups included traumatic brain injury, pain, and younger age. There were no statistically significant differences between severity groups for any of the physiologic factors.

Associations between perceived ED severity and psychological factors reported to be associated with ED are presented in Table 7. Psychological factors reported most often by both severity groups included posttraumatic stress and anxiety. There were no statistically significant differences between severity groups for any of the psychological factors.

Discussion
Literature documenting ED in the adult population is limited. The dearth of scientific exploration investigating ED in the military population is problematic given the high incidence of ED in this population. This study found that active-duty anesthesia providers identified ED as a problem and related pharmacologic, physiologic, and psychological factors as potential causes for ED in the combat veteran.

Pharmacologic Factors and Emergence Delirium.
More than 88% of those surveyed believed ED was related to potent inhalational agents (PIAs). This coincides with pediatric studies that have reported a link between PIA use and ED. This finding that PIAs are somehow correlated or associated with ED is also found in 2 adult studies. Yu et al found that PIAs were associated with 27.8% of all emergence reactions vs TIVA accounting for only 7.5% (P = .001). A qualitative study by Wilson and Pokorny also found that providers believed that total IV anesthesia was a far superior anesthetic for combat veterans over PIAs. However, Radtke et al found no difference between type of anesthetic used and the occurrence of ED. This link between PIAs and ED in combat veterans warrants further investigation.

Of those who had experienced ED in their practice, almost all of them administer a benzodiazepine, with most giving 1 to 2 mg of midazolam preoperatively to their patients (J. T. Wilson, CRNA, PhD, ANC, USA, unpublished data, December 2011). This finding is important because 2 recent studies found a statistically significant relationship between the administration of a benzodiazepine and the occurrence of ED in adult patients. These findings are in sharp contrast to studies in which patients emerging in a state of delirium are given a benzodiazepine. In fact, this study showed...
that 65% of providers administer a benzodiazepine to help alleviate ED symptoms. This finding is important because more than 27% of those same surveyed providers believed benzodiazepines were related to ED. A remarkable case report by Thurston et al. found that administration of 2 mg of midazolam produced signs and symptoms consistent with today’s definition of ED. After continued dosing of more midazolam followed by lorazepam, the patient continued to worsen. It was not until the administration of flumazenil that the patient became more lucid. More studies with combat veterans are required to substantiate or refute this data regarding benzodiazepines and ED.

The respondents overwhelmingly believed that ketamine was related to ED (63.6%). This finding coincides with a seminal article written by White et al., which detailed the pharmacology and therapeutic use of ketamine.
by providers from the current study corresponds with recent pediatric studies showing the benefits of giving ketamine to prevent emergence agitation.29-31 The Wilson and Pokorny5 study also reveals how providers believe that subanesthetic doses of ketamine given preoperatively can help prevent ED. Other examples where ketamine use is on the rise came from a case report recently published by PACU nurses. The nurses have proposed recommendations for combat veterans with a diagnosis of PTSD who have ED. The authors suggested avoiding benzodiazepines and implementing ketamine for the treatment of ED postoperatively.11 Another recent case report highlighted the use of ketamine with combat veterans experiencing PTSD. This report illustrates the use of IV ketamine to a veteran with PTSD when other treatment modalities were not working. A ketamine infusion was initiated, and the veteran’s PTSD symptoms faded.32

Ketamine has a long history of producing undesirable side effects. However, as this study has shown, much of the side effects have to do with the dose given to patients. A study by McGhee et al33 is contrary to what mainstream anesthesia providers would think concerning the use of ketamine. The study’s goal was to see if those service members who received ketamine intraoperatively would have a higher incidence of PTSD symptoms. The author assumed that because ketamine is associated with both dissociative and psychotic states, it would lead to a higher incidence of PTSD postoperatively. The study investigated 147 Operation Enduring Freedom and Operation Iraqi Freedom military service members. These service members had undergone at least 1 surgery, most had received ketamine (28 had not), and all had completed the PTSD Checklist-Military. Thirty-two of 119 (27%) met inclusion criteria for PTSD (those who received ketamine) where 13 of 28 (46%) in the group not receiving ketamine met PTSD inclusion criteria (P = .044).33 These results were impressive because the ketamine group had more severe burns, underwent more operations, and spent more time in the intensive care unit. More research is required to justify ketamine and its use as a possible effective treatment agent for ED.

While completing the survey, providers had the opportunity to write in answers to various questions. One pharmacologic agent that arose from various write-in questions was dexmedetomidine. Dexmedetomidine (also known as Precedex) was written in as a potential intervention perceived to alleviate ED and as a preoperative intervention for ED. Dexmedetomidine is an α₂-adrenergic agonist that works primarily in the locus coeruleus and has been approved for use in the OR for sedation.34 This medication has also been extensively investigated in the pediatric literature and been shown to significantly reduce emergence agitation.31,35,36 No studies were found inves-

**Table 5.** Preoperative Interventions Perceived to Have Helped Reduce or Prevent Emergence Delirium (n = 54)

<table>
<thead>
<tr>
<th>Intervention</th>
<th>No.</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talk to the service member with an emphasis on explaining everything that will occur from start of IV to waking up</td>
<td>49</td>
<td>(90.7)</td>
</tr>
<tr>
<td>Listen to service member with an emphasis on allowing the service member to verbalize fears of the unknown and of past experiences</td>
<td>44</td>
<td>(81.2)</td>
</tr>
<tr>
<td>Give more midazolam</td>
<td>29</td>
<td>(53.7)</td>
</tr>
<tr>
<td>Ketamine</td>
<td>9</td>
<td>(16.7)</td>
</tr>
<tr>
<td>Give less midazolam</td>
<td>5</td>
<td>(9.2)</td>
</tr>
<tr>
<td>Eliminate midazolam completely</td>
<td>4</td>
<td>(7.4)</td>
</tr>
<tr>
<td>Dihyphenhydramine</td>
<td>1</td>
<td>(1.9)</td>
</tr>
<tr>
<td>Haloperidol</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>Droperidol</td>
<td>1</td>
<td>(1.9)</td>
</tr>
<tr>
<td>Other</td>
<td>12</td>
<td>(22.2)</td>
</tr>
</tbody>
</table>

**Table 6.** Association of Emergence Delirium (ED) Severity and Physiologic Factors Believed Related to ED, as a Percentage (n = 59)

<table>
<thead>
<tr>
<th>Physiologic factor</th>
<th>ED severity</th>
<th>Minor (n = 36)</th>
<th>Moderate (n = 23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 30 y</td>
<td>50.0</td>
<td>65.2</td>
<td></td>
</tr>
<tr>
<td>Traumatic brain injury</td>
<td>50.0</td>
<td>60.9</td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>50.0</td>
<td>56.5</td>
<td></td>
</tr>
<tr>
<td>Medication other than anesthetic used</td>
<td>38.9</td>
<td>39.1</td>
<td></td>
</tr>
<tr>
<td>Long duration of surgery</td>
<td>27.8</td>
<td>30.4</td>
<td></td>
</tr>
<tr>
<td>Type of surgery</td>
<td>13.9</td>
<td>17.4</td>
<td></td>
</tr>
<tr>
<td>Short duration of surgery</td>
<td>5.8</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Age &gt; 30 y</td>
<td>2.8</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>19.4</td>
<td>8.7</td>
<td></td>
</tr>
</tbody>
</table>

**Table 7.** Association of Emergence Delirium (ED) Severity and Psychological Factors Believed Related to ED, as a Percentage (n = 66)

<table>
<thead>
<tr>
<th>Physiologic factor</th>
<th>ED severity</th>
<th>Minor (n = 41)</th>
<th>Moderate (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posttraumatic stress</td>
<td>85.4</td>
<td>92.0</td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>80.5</td>
<td>92.0</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>51.2</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>39.0</td>
<td>56.0</td>
<td></td>
</tr>
<tr>
<td>Medications other than anesthetic</td>
<td>31.7</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2.1</td>
<td>4.0</td>
<td></td>
</tr>
</tbody>
</table>
tigating a direct link between dexmedetomidine use and treatment of ED in the combat veteran.

- Physiologic and Psychological Factors Related to Emergence Delirium. Young age, TBI, and pain were physiologic factors thought to have the greatest impact on ED. Young age and pain are findings consistent with studies investigating ED in adults. Traumatic brain injury has not been investigated in relation to ED in the combat veteran population.

Combat veterans serving during the Global War on Terrorism carry many burdens. Mental health problems such as depression, PTSD, and anxiety rank among the highest in this patient population. As this study demonstrated, providers believe that PTSD, anxiety and depression are overwhelmingly considered to be psychological factors related to ED (88.0%, 84.8%, and 50.0%, respectively). The McGuire study clearly demonstrates a positive correlation between PTSD, anxiety, depression, and PTSD. Regression modeling from that study showed that when all other factors are controlled for, state anxiety is the best predictor for ED. This finding is similar to a pediatric study that found children with preoperative anxiety had a 12.5% increase in what the authors termed “maladaptive behavioral change” following surgery. These maladaptive behaviors are consistent with those seen in adults with ED.

More than 90% of the providers with ED case experience reported that they intervened when their patients showed behaviors related to ED. Most providers said they talked to the patient during the ED episode. Administering an analgesic for pain and doing nothing were used by 41% and 34% of the providers, respectively. Almost 80% of the providers reported that they used preoperative interventions to help prevent ED or minimize the effects of ED. The most common preoperative intervention was talking to the patient about the details of the anesthetic procedure and answering questions about the upcoming intervention. Only a few studies have evaluated interventions for the treatment or prevention of ED in the combat veteran population. Those studies and case reports highlight the complexities that ED shares between pharmacologic, physiologic and psychological spectrums and emphasize why more research is required to better understand the perceived relationships.

- Future Research Implications. Although the evidence from this study of anesthesia providers suggests that ED may be widespread among combat veterans who have served and continue to serve during the Global War on Terrorism, data are lacking from individual cases. Another important step would be a servicewide case review of anesthetic interventions in combat veterans to determine the extent and seriousness of ED among this population of combat veterans. This study also suggests that anesthesia providers believe strongly that TBI and PTSD are related to the development of ED. There is a growing realization in military medicine of the seriousness of TBI and PTSD in combat veterans. Longitudinal cohort studies need to be implemented to provide evidence about TBI and PTSD as moderators of ED risk.

Many of the noted adult studies used a different instrument to evaluate ED. Future direction should focus on developing a well-validated tool to diagnose ED similar to the Pediatric Anesthesia Emergence Delirium Scale. There is also a need to design and test randomized controlled interventions to determine the role of different types of anesthesia on the development of ED. A large multisite trial could include subjects with PTSD, TBI, anxiety, and pain as well as normal controls and different types of anesthetics to determine any differential effects of anesthesia type and patient characteristics on the development of ED. A similar design approach could be applied to the role of confounders such as ancillary drugs and age.

The military healthcare system captures a wealth of information via electronic means. These electronic databases lack the ability to capture information related to ED. Therefore, there is a need to develop a prospective clinical database specifically for capturing ED events. This database would be part of the standard military anesthesia preoperative evaluation and would include demographic, psychological, and physiologic information on all combat veterans undergoing anesthesia. An ED event would be captured by the anesthesia provider during the standard postoperative evaluation and forwarded into the database. In addition, type of anesthesia used, dose, length of anesthesia exposure, type of ED behaviors seen, and length of stay would all be captured. This kind of longitudinal data would provide answers to many of the unanswered questions that we currently have regarding combat veterans and ED.

- Study Limitations. Service from September 11, 2001, does not automatically mean that a service member has seen combat or even been to a theater of operation. This type of knowledge is usually not gained by the anesthesia provider unless the provider specifically asks the patient if he or she has been deployed. Therefore, the estimation by anesthesia providers surveyed may have overestimated or underestimated the number of combat veterans seen. It is also important to recognize how providers typically recall memorable events. The cognitive bias of availability means that people tend to overestimate the prevalence and or severity of memorable events, and 1 or 2 cases per anesthesia provider career does not necessarily constitute a major problem.

REFERENCES
5. Wilson JT, Pokorny M. Experiences of military CRNAs with service personnel who are emerging from general anesthesia. AANA J. 2012;80(4):260-265.

AUTHOR
At the time of submission, MAJ (P) John Tyler Wilson, CRNA, PhD, ANC, USA, was between duty stations. His previous duty assignment was assistant professor at Uniformed Services University of the Health Sciences, Bethesda, Maryland. His current duty assignment is Fort Bragg, North Carolina. Email: john.tyler.wilson@us.army.mil.

ACKNOWLEDGMENTS
Major Wilson would like to acknowledge Dr Melvin Swanson and Dr Marie Pokorny for their expertise and devotion to nursing students.

DISCLAIMER
The views expressed in this paper are those of the authors and do not necessarily reflect the official policy or position of the Department of the Army, Department of Defense or the US Government. Title 17 USC 105 provides that “Copyright protection under this title is not available for any work of the United States Government.” Title 17 USC 101 defines a United States Government work as a work prepared by a military service member or employee of the United States Government as part of that person’s official duties.