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Intra-operative Awareness with Recall under General Anesthesia

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TABLE OF CONTENTS

Abstract

Intra-operative awareness with recall (AWR) is a well-studied risk of general anesthesia (GA) accepted by anesthesia practitioners. A gap was identified between the perceived knowledge and practice related to AWR. The purpose of this quality improvement project (QIP) was to attempt to improve perceived knowledge and comfort related to assessment, evaluation and treatment of patients with AWR. To accomplish this, we disseminated an educational voice over power point (VOPP) to anesthesia practitioners at NorthShore University HealthSystem, including the following content: 1) a tool to assess for AWR 2) establish an appropriate timeline for assessment and 3) present resources available to assist in treatment of AWR sequelae. The efficacy of the educational VOPP was measured by comparing results from Likert-type pre and post-education surveys. Recommendations for current practice change are discussed in this paper.

Introduction

Background

Awareness with recall (AWR), originally coined as intra-operative awareness, is a recognized risk of general anesthesia (GA). Based on individual factors, patients respond differently to GA. The safety of GA has increased drastically over the past 20 years; however, there is continued opportunity for assessment, evaluation and treatment of AWR. Gibbs, Gibbs and Lennox (1937) first identified AWR in 1937 (p. 155). They proposed that a recorded "tape" of heart and brain waveforms would indicate when patients were aware, but the interpretation of such waveforms was too complex to undertake at that time (Avidan & Mashour, 2013).

The Joint Commission (JC) defined AWR as "an unintended intra-operative awareness" occurring under GA (2004). "The patient becomes cognizant of some or all events during surgery or a procedure, and has direct recall of those events. Because of the routine use of neuromuscular blocking agents… the patient is often unable to communicate with the surgical team if this occurs," (JC, 2004). It is estimated that AWR happens in 0.1-0.9 percent of all patients undergoing GA (JC, 2004). In 2004, the JC issued a sentinel event alert in order to notify anesthesia practitioners of the severity of this problem. The American Association of Nurse Anesthetists (AANA) responded, defining AWR as "explicit recall of sensory perceptions that occurs during general anesthesia. With specific reference to explicit recall as a determining factor for anesthesia awareness…" (2005).

The AANA and the American Society of Anesthesiologists (ASA) have provided specific recommendations for practitioners to prevent AWR since 2000; however, following the JC sentinel event notification, AWR received new attention. In 2005, the AANA, ASA and the American Academy of Anesthesiologist Assistants (AAAA) published a brochure educating

patients on AWR. These professional organizations continue to revise their recommendations based on current research, continuing to stress the importance and reality of this anesthetic complication.

Multiple studies have shown AWR incidence to be between 1:1,000 and 1:20,000, dependent on patients and procedures (Cook et al., 2014, p. 2; AANA, 2012). However, unidentified populations who experience AWR exist. The latency of memory consolidation in the immediate post-operative time can mask the experience of AWR. In the event that AWR is assessed, it is assessed immediately post-operatively in current practice. Patients are more likely to have hyper-amnesia immediately following anesthesia, and the AWR memories can be suppressed for up to two weeks (Cook et al., 2014). Similar to other traumatic memories, the incidence of AWR can be repressed and uncovered much later (Cook et al., 2014). However, the late recognition of AWR is usually not included in documented cases of AWR. Electronic data registries have become increasingly common as a self-reporting avenue for these patients.

An occurrence of AWR can be devastating to patients. Reported AWR experiences include pain, paralysis, tactile and auditory sensations, increased work of breathing, and feelings of impending death. Psychological sequelae can vary in severity based on the patient's perception of events. Patient distress is increased when pain and paralysis are present together (Cook et al, 2014). The subsequent impact of AWR for the patient includes nightmares, anxiety, depression, post-traumatic stress disorder (PTSD) and avoidance of future surgical intervention. "Recent data suggests incidence of PTSD is as high as 70% in patients who have experienced AWR. Given the potentially catastrophic, psychological sequelae of AWR and the difficulty treating PTSD, there is a strong motivation to prevent AWR from ever occurring,"

(Avidan & Mashour, 2013, p. 449). Long- term psychological distress of PTSD can negatively affect an individual's personal and professional lives and relationships.

Problem Statement

A gap exists between anesthesia practitioners perceived knowledge of AWR and their practice. Particularly, there is a lack of assessment, evaluation, and treatment of AWR by anesthesia practitioners. While most anesthesia practitioners are familiar with AWR as a phenomenon, research has shown it is inadequately assessed, evaluated, and treated in patients receiving GA.

Purpose of the Study

The purpose of this quality improvement project (QIP) was to attempt to improve the knowledge and comfort of anesthesia practitioners relative to the assessment, evaluation, and treatment of patients with AWR. To accomplish this, we created an educational voice over power point (VOPP) that included the following content: 1) an assessment tool for AWR, 2) a recommended timeframe for assessment of AWR, and 3) resources to assist in the treatment of AWR sequelae. The information gleaned from the results of this QIP sought improve the pre-operative and post-operative assessment of AWR and treatment of its sequelae.

Clinical Questions

This QIP sought to answer the following clinical questions:

1. What is the current perceived knowledge of anesthesia practitioners regarding AWR?
2. What tools are currently available for anesthesia practitioners to help guide their assessment of AWR?
3. What are the appropriate time frames? for evaluation of AWR?

4. What resources are available for the treatment of AWR and its sequelae and how do anesthesia practitioners access them?

Conceptual framework

The educational VOPP format was chosen based on Clark and Paivio's Dual Coding Theory. They define that the dual coding theory "explains human behavior and experience in terms of dynamic associative processes that operate on a rich network of modality-specific verbal and nonverbal (or imagery) representations" (Clark & Paivio, 1991, p. 156). An educational VOPP format reaches learners on a visual and verbal level. "For meaningful learning, that supports problem solving transfer, the learner must build an internal verbal representation from the presented verbal information and an internal visual representation from the presented visual information, and referential connections between these verbal and visual representations" (Mayer & Sims, 1994, p. 392). When verbal and visual materials are used contiguously, the anesthesia practitioners will build better referential connections as opposed to when materials are presented separately (Mayer & Sims, 1994, p. 393).

The goals of the program are modeled after the Hildegard Peplau's Interpersonal Theory and is defined as a "human relationship between an individual who is sick or in need of health services and a healthcare professional, specially educated to recognize and to respond to the need for help" (Wayne, 2014). The phases of her theory coincide with the series of behaviors presented in the educational video. Assessment, evaluation, and treatment of AWR are reflected in: 1) Orientation Phase, when the practitioners and patient establish a relationship by assessing and defining the problem, 2) Identification Phase, happens as there is continued communication between practitioners and patient and the appropriate professional assistance is evaluated 3) Exploitation Phase, is when the patient utilizes available treatment resources when needed and 4)

Resolution Phase where there is a termination of the professional relationship (Wayne, 2014). The Interpersonal Theory organized our educational video, as we aimed to improve assessment, evaluation and treatment of AWR.

Literature Review

A comprehensive literature review was performed using CINAHL, PubMed, ProQuest and OVID to examine the knowledge gap that exists supporting the need for this project. Keywords including anesthesia, awareness, intra-operative, assessment tools, PTSD, and Brice were used singularly and in combination. In an additional search, combinations of keywords such as anesthesia practitioners/providers, knowledge, attitudes, awareness with recall and education, no results were yielded, thus supporting the purpose and mission of our project. A search was conducted between the years of 2000-current including peer reviewed journals, organizational websites, and studies performed. Older literature was only included for historical purposes.

Incidence of AWR

In the 1960's, the incidence of AWR was estimated to be between 0.8-1.2% (Ghoneim, Block, Haffarnan & Matthews, 2009). In 1990, the subject of AWR reignited interest by anesthesia practitioners due to an increased incidence and notable sequelae of AWR due to the introduction of brain wave monitoring and increased litigation against practitioners (Ghoneim, Block, Haffarnan & Matthews, 2009). Characteristic electroencephalogram (EEG) changes associated with GA were appreciated and described more than 75 years ago (Avidan & Mashour, 2013). However, a definitive monitor or an assessment tool that allows for accurate identification of AWR had yet to be created.

AWR is classified by Mashour, Tremper and Avidan (2009) as definite awareness in which events are confirmed or had a high likelihood of occurring in the intra-operative period. A report by the ASA Task Force on intra-operative awareness led by Apfelbaum et al. (2006) defined AWR as consciousness during GA with subsequent memory recall of these events. It does not include any other forms of anesthesia or the time before induction or emergence of GA, when AWR is acceptable for patient to return to a state of consciousness.

In 1996, the JC created a formal Sentinel Event Policy to signal the need for attention and investigation related to "…events not primarily related to the natural course of the patient's illness or underlying condition…" posing safety risks to patients (JC, 2016). Patient safety events can include permanent harm or severe temporary harm with interventions to sustain life and death (JC, 2016). In 2004, the JC issued a sentinel event warning in response to surfacing research, citing that AWR incidence was 0.1-0.9% of all patients receiving GA (JC, 2004). Although the AANA and the ASA published guidelines in 2000 to prevent AWR, the alert prompted the groups to revisit the subject. In 2005, the AANA, ASA and the AAAA published a joint brochure educating patients on AWR. These professional organizations continue to revise their recommendations and resources for patients and practitioners regarding AWR with continued stress on the importance and reality of this anesthetic complication.

Multiple randomized control trials have shown AWR occurs in 1:1,000 or 0.1% of all adults undergoing GA and may be as high as 0.9%. One hypothesis for the variation in results is that different post-operative times were used to ask patients about AWR. Brice questionnaires were developed to be used to interview patients immediately post-operatively and 1-2 additional times after the operation. Sandin et al. (2000) interviewed patients in the post-anesthesia care unit (PACU), 1-3 days post-operatively and 7-14 days after surgery. They reported an incidence

of 19/11,785 patients or 0.16% in a prospective study of AWR (Sandin et al., 2000). Sebel et al., (2004) interviewed patients in the PACU and 1-2 weeks post-operatively and corroborated findings in their prospective multicenter study in the United States showing an incidence of 25/19,575 patients or 0.13%. In 2008, Errando and colleagues conducted a prospective observational study interviewing patients in the PACU and at 7 and 30 days post-operatively. They found AWR incidence was 39/3921, or 1.0% and that incidence decreased to 0.8% when high risk patients were excluded (Errando et al., 2008). Pandit et al. (2014) cited the outlying study of AWR, conducted by Pollard in 2007, that showed AWR incidence occurring in only 1: 14,500 or 0.007%. Pollard (2007) limited their interview of patients to 48 hours post-operatively, possibly missing one third of AWR reports (Pandit et al., 2014).

In 2014, the largest study of AWR was published and had much lower incidence of AWR overall. The 5th National Audit study (NAP5) retrospectively reviewed three million GAs in every public hospital in the United Kingdom and Ireland and found the incidence to be 1:19,600 or 0.005% (Cook et al., 2014). The authors address this discrepancy by explaining previous randomized control trial results may have been skewed due to their high-risk subject inclusion criteria (Pryor & Hemmings, 2014). However, when assessing high risk populations such as obstetric and those undergoing cardiac surgery, the NAP5 had similar incidence of AWR (Pryor & Hemmings, 2014).

AWR High Risk Factors and Populations

Several studies have reported the causes and risks of AWR. According to Almeida (2015) depth of anesthesia, opiate resistant patients, total intravenous anesthesia (TIVA), and the use of neuromuscular blocking agents (NMB) are major risk factors of AWR under GA. Ghoneim, Block, Haffarnan and Matthews, (2009) also reported that anesthetic misuse and

malfunction of anesthesia machines also played a role in AWR. The depth of anesthesia is controlled and assessed by the anesthesia practitioners. The NAP5 study identified that the epidemiology of AWR is a consequence of human error in 68% of the cases (Pandit et al., 2014). Population-based alerting in the prevention of AWR is important to consider because retrospective evidence shows that approximately 87% of all AWR cases are attributable to insufficient anesthesia (Shanks et al., 2015). Using appropriate monitors, checking equipment and balancing anesthetics appropriately are the responsibility of the practitioner in order to prevent AWR. This data supports the need for an educational forum for anesthesia practitioners to be aware of incidence and tools available to reduce the occurrences of AWR.

In addition to these findings, additional patient specific risk factors for AWR have been identified. These risks include, women, pediatric, addiction history, history of AWR, ASA class III and IV, cardiac surgery, obstetric, emergency and multi-trauma patients (Ghoneim et al., 2009; Nunes, Porto, Miranda, Quezado de Andrade & Carneiro, 2012). Women experience AWR three times more than men because they recover from anesthesia faster (Nunes et al., 2012). Pediatric patients are also more likely to experience AWR due to their higher anesthetic requirement and more rapid metabolism of drugs (Nunes et al., 2012). Patients with substance abuse problems have higher tolerance and therefore require more anesthetic. ASA classes III and IV pose a challenge to anesthetic practitioners. ASA III includes patients having systemic disease while ASA IV patients have systemic disease that is a constant threat to life. These patients are often given lower dose anesthetics due to an intolerance to physiologic changes. ASA III and IV patients tend to be on anti-hypertensives and beta blockers which would mask sympathetic responses of awareness, thereby not alerting the practitioner of patient discomfort (Nunes et al., 2012).

Furthermore, patients undergoing cardiac and trauma surgery experience higher rates of AWR, especially ASA III and IV patients, due to their hemodynamic instability and intolerance of physiologic changes related to anesthetics (Nunes et al., 2012). These patients tend to require TIVA and NMBs for their surgical procedure, orchestrating a trifecta risk for AWR. Finally, incidence increases up to 1.3% in obstetrical patients due to a low anesthetic concentration in relation to major surgical stimulus. This occurs because of the intentional decreased dosage of opiates to prevent respiratory depression in the newborn, and a reduction in inhaled anesthetic concentration to avoid tocolytic effects in the uterus (Nunes et al., 2012).

AWR Anesthesia Practitioners Assessment

When research conducted regarding anesthesia practitioners perceived knowledge, familiarity, and comfort in assessment, evaluation and treatment of AWR, no studies or literature was found. In practice, no discussions of potential for AWR has been witnessed by the primary investigators (PIs). Anesthesia practitioners describe AWR as being a complication they wish to avoid, second only to death (Cook et al., 2014). However, when asked, 83.3% of practitioners scored themselves as 'not knowledgeable at all' regarding the Brice questionnaire. They may assume that questions regarding AWR creates false recall in patients. According to Sebel et al. (2004) AWR is generally underestimated and attribute this to several factors, some anesthetists aren't concerned about AWR because it has never happened to them before and responds to this by saying "It's never happened to you because you haven't looked for it" (Sebel et al., 2004, p. 837). It is also noted that 35% of patients who said they had experienced AWR never told their anesthesiologist because they were frightened and did not want to be viewed as crazy (Sebel et al., 2004). Unfortunately, twelve years later, this mentality appears to be unchanged with limited assessment and an extreme lack of knowledge related to evaluation and treatment of AWR.

AWR Assessment Tools

Several intra-operative monitors are available to assess for AWR in patients undergoing GA. The two commonly used tools include bispectral index monitoring (BIS) monitoring and end tidal anesthetic concentration (ETAC) monitoring of volatile gases. These two monitors are widely accepted and utilized. The BIS is a monitor that assesses adequate depth of anesthesia based on EEG analysis of burst suppression, spectral power of the beta bandwidth, and bispectral coherence (Mashour, Tremper & Avidan 2009). According to Ekman et al. (2004) the incidence of AWR in cases where the BIS was used was 0.04% compared with 0.18% in historical control group of 7826 patients from a previous study of AWR in which no cerebral function monitoring was used. In the B-aware trial, BIS-guided anesthesia was found to reduce the risk of AWR by 82% (Myles, Leslie, McNeil, Forbes & Chan, 2004). Measurement of exhaled anesthetic gas, ETAC monitoring, can also help assess the level of anesthesia. Avidan et al. (2011), reported AWR to be as low as 0.07% when ETAC was used.

The Brice questionnaire is a tool to that is used to assess AWR post operatively. It includes the following questions: 1). What was the last thing you remember before going to sleep? 2). What was the first thing you remember after waking up? 3). Do you remember anything between going to sleep and waking up? 4). Did you dream during your procedure? 5). What was the worst thing about your operation? (Mashour, Tremper & Avidan 2009). The patient's answers to the Brice questionnaire allows the identification of patients who experienced AWR occurred during GA.

When considering cost of prevention of AWR one must agree with Ouellette (2004), if the technology is available, why not use it? Consider having the technology available, opting not to use it, and then having a patient who experienced AWR. Currently, the cost of a BIS monitor

is approximately $1,000; the single use sensor strip is $13.00. A cost benefit analysis review of monitoring tools and AWR could further support or discredit the effectiveness versus cost of these tools.

AWR Litigation

AWR is a significant area of malpractice lawsuits filed against anesthesia practitioners. Although most claims are limited access or closed claims to spare the public acknowledgement of wrong doing a few cases and analysis of findings were available. A closed claim analysis noting the rate of claims for AWR and awake paralysis was similar to rates of claims for myocardial infarction, aspiration, pneumonia, back pain and hepatic dysfunction following anesthesia (Domino, 1996). Anesthesia practitioners must recognize that AWR is a real possible source for litigation. One patient filed a $275,000 law suit for inadequate anesthesia, claiming to have heard comments about their weight during their surgery (Kole, 1993). Despite not knowing whom the comments came from and testimony alleging the surgeon to be the one who made the comments, the anesthesia practitioner was named as the sole responsible party for the claim (Kole, 1993).

Claims of AWR are on bottom of the ASA list of malpractice payout claims. The median payment for AWR during GA is $18,000, compared to the median payment for non-awareness claims of $100,000. However, substantial sums of money are involved in AWR claims, with the highest payments in patients who experienced AWR along with additional anesthetic complications (e.g., $600,000 for a case complicated by aspiration pneumonitis) or severe permanent disability (e.g., $125,000 for PTSD) (Kole, 1993). This does not take into consideration the lifelong emotional toll and cost it can have on a patient.

AWR and PTSD

Post-traumatic stress disorder (PTSD) can develop following traumatic events and experiences, possibly permanently disabling the victims. It is characterized by 1) re-experiencing the event, 2) avoidance of similar situations, and 3) physiological hyperarousal and may be correlated with poor health choices and physical health symptoms (Osterman, Hopper, Heran, Keane & van der Kolk, 2001). Some prevalent sequelae of PTSD include but are not limited to sleep disturbances, irritable bowel syndrome, chronic pain complaints and multiple cancers as well as negative health behaviors such as smoking, substance abuse and poor eating habits (Shiphred, Clum, Suvak & Resick, 2014). Long term sequela of AWR was not considered previously, in fact, "…it became a common clinically accepted belief that patients who were conscious during surgery did not suffer significant long-term consequences" (Osterman et al., 2001, p. 200). Osterman et al. (2001) found that six of their 16 subjects met criteria for PTSD. Leslie et al. (2010) followed confirmed cases of AWR and assessed the incidence of PTSD. "Six of 13 confirmed awareness patients had died. Five of the seven confirmed AWR patients and three of the 25 controls, fulfilled the criteria for PTSD at the time of the interview" (Leslie et al., 2010, p. 825). The median onset of symptoms was 14 days and the median duration of symptoms was 4.7 years (Leslie et al., 2010). PTSD has a significant incidence in patients who experienced AWR and can have long term health consequences. Therefore, the recognition, acknowledgement and treatment of AWR are imperative.

AWR Resources

It is important that anesthesia practitioners are aware of the available AWR resources in the event that AWR has occurred. In a majority of cases, patients are looking for an acknowledgment that their recall is real and that they are not crazy. As a practitioner, it can be very devastating to accept an occurrence of AWR and deal with it on a professional

level. Resources and helpful tools are available to deal with the recognition and recovery for both patients and the practitioners. In 2004, the JC deemed intra-operative awareness a sentinel event. One year later the AANA published a brochure "Patient Awareness under General Anesthesia-What Is It?" (Andrews & Johnstone, 2010). The brochure was revised in 2009 with a groundbreaking collaboration of the AAAA, AANA, ASA and Anesthesia Awareness Campaign (AAC) because of substantial new data on AWR (Andrews & Johnstone, 2010). The brochure is a useful tool to help start a discussion with a patient about the possibility of AWR. It also provides them with the information and resources needed to seek help and provide a safe forum to express their experience in the event that AWR occurs.

In summary, the goal of the anesthesia practitioner is to deliver safe effective care for patients during a surgical procedure where GA is required. AWR is a recognized and devastating risk of GA as evidenced by research studies on AWR In the event AWR occurs, the patient and the practitioner need to know what to do and must have access to resources that support appropriate treatment in a timely manner. Thus, this QIP project was conducted to describe the perceived knowledge and attitudes on AWR among anesthesia practitioners before and after an educational intervention.

Methods

Design

The objective of this QIP was to attempt to improve anesthesia practitioner's perceived knowledge and comfort relative to the assessment, evaluation and treatment of AWR. The QIP utilized an online, quasi-experimental pre-and post-test design. Anesthesia practitioners were surveyed prior to the VOPP (Appendix B) in order to gather baseline perceived knowledge and comfort regarding AWR. Second, those surveyed viewed an online educational VOPP

(Appendix F). Following the educational VOPP, a post-survey (Appendix C) was administered in order to assess whether or not there was improvement in their perceived knowledge and comfort related to AWR.

Sample

A convenience sampling method was used to gain input from an accessible population. The target population included nurse anesthesia trainees (NAT) in at least their first clinical rotation, anesthesia residents, certified registered nurse anesthetists (CRNAs) and attending anesthesiologists between the ages of 25 and 70 years, at a NorthShore University HealthSystem (NUHS) clinical site. Exclusion criteria included: anesthesia residents and NATs lacking clinical experience in administration of GA and practitioners who do not provide GA. One hundred and twenty NUHS anesthesia practitioners and learners met the inclusion criteria. An additional 30 non-NUHS NATs and anesthesia residents assigned to a NUHS site also met the inclusion criteria, for a total of 150 practitioners and learners.

Setting

Voluntary participants were recruited from NUHS in Evanston, Highland Park, Glenbrook and Skokie, Illinois. NUHS employs 120 anesthesia practitioners, and hosts around 30 anesthesia residents and NATs, providing anesthesia for about 10,000 patients a year (US News and World Report, 2016). Dr. Karen Kapanke, assistant program director at NUHS School of Nurse Anesthesia, disseminated e-mails to the anesthesia practitioners, NATs and residents from her department list server. The email included a description of the project, provided contact information for the PIs, a statement of voluntary and anonymous participation as well as a complete information sheet reinforcing the anonymous and voluntary nature of our QIP

(Appendices D and E). Due to the electronic nature of the QIP, participants were allowed to complete the surveys and educational VOPP in the setting of their choice.

Data Collection

A Likert-type survey (Appendices B and C) was adapted from a survey created by Adams, Hill and Watson (2013), and used to evaluate improvement of perceived knowledge and comfort related to AWR after the educational VOPP. The authors of the original survey granted permission to adapt this survey for the current QIP (Appendix G). Survey questions were divided into pre-and post-surveys as well as demographic information. The adapted survey questions and VOPP were distributed to two NUHS School of Nurse Anesthesia and one DePaul University faculty members who serve as expert panel for content validity. Both surveys were revised using the expert panel's feedback.

A recruitment e-mail and information sheet (Appendices D and E), including secure links to the validated surveys and the VOPP was given to Dr. Kapanke to disseminate amongst anesthesia practitioners, NATs and residents that met inclusion criteria. A reminder e-mail was sent to the same recipients by Dr. Kapanke two weeks and one month after the initial request. The Qualtrics program, provided by DePaul University, was utilized to provide a secure survey link, allowing password protection and ensuring IP addresses were not linked to respondents. A demographic questionnaire was included in order to describe the demographic characteristics of study participants (Appendix A). The sociodemographic questionnaire included questions pertaining to age, practice role, (CRNA, MD, resident, NAT), years of anesthesia practice or educational residency, gender, and whether or not they had prior experience with patient that experienced AWR. No confidential information was collected as part of this QIP. The demographic questionnaire did not include any identifiable information. Potential participants

were given the opportunity to refuse to participate before beginning the pre-survey and were allowed to terminate participation at any time. The recruitment email and the pre-survey explicitly state that by proceeding, they were agreeing to be voluntary participants. Completion of the survey implied voluntary consent.

Benefits and Risks

Due to the quality improvement nature of the project, approval from the Institutional Review Board was not required. In order to protect human subjects, anonymity was maintained by using Qualtrics for data collection and analysis. The PIs did not have any access to the department email list servers. The method of survey and educational VOPP distribution described above ensured voluntary participation. The recruitment email and the pre-survey explicitly stated that by proceeding, they agreed to be voluntary participants. Potential participants were provided with an opportunity to decide not to participate and to terminate participation at any time. The benefit of the educational VOPP to participants includes improvement of their knowledge on the assessment, evaluation, and treatment surrounding AWR, which could potentially bring positive change in their practice. The practitioners were not exposed to physical or psychological risks as a result of the QIP.

Statistical Analysis

Descriptive and inferential statistics were used to analyze all survey data. The frequencies and percentages were used to summarize the sociodemographic characteristics of study participants and describe the individual item in the pre-and post-test surveys. Independent sample *t* test was used to explore differences in the mean scores for perceived knowledge and comfort on AWR between dichotomous sociodemographic groupings of study participants. Cronbach's alpha coefficient was used to analyze the internal consistency of pre- and post-

surveys. A paired *t* test was performed to determine the overall statistically significant differences between the pre-and post-survey mean scores in perceived knowledge, comfort and attitudes on AWR after completing the VOPP AWR educational intervention. Pre-and post-survey results were matched using dates and time of survey completion. Unmatched surveys were regarded as incomplete and were not included in the final analysis.

Sociodemographic variables were dichotomized to make meaningful comparison with adequate *n* size for each group. For example, ages were consolidated to groups less than 40 and greater than 41. Years of experience were consolidated to the groups less than 5 and greater than 5. A Cohen's *d* was calculated to determine the effect size of the VOPP intervention. All statistical analyses of survey data were performed using International Business Machines (IBM) SPSS Statistics version 22 (IBM, 2017). Statistical significance was set at 0.05 level using a 2-tailed test. All assumptions of parametric testing (independent samples and paired samples *t* tests) were met such as homogeneity of the group variances and normality of data distribution using the skewness statistics for studies with an N = 20 or higher (Doane & Seward, 2011).

Results

Twenty-four valid pre-and posttest surveys were included in the final analysis (27% overall response rate). There were twenty-eight valid responses to the demographic survey at pre-test. The majority of the participants were female (*n*=21; 75%), had not seen a case of AWR (*n*=26; 92.9%), and had not received educational training on AWR in the past (*n*=20; 71.4%). A detailed description of study participants' sociodemographic features including age and years of clinical experience are outlined in Table 1.

Pre-and post-survey questions were categorized as perceived knowledge (6 items), comfort (2 items) and attitude (2 items). Detailed descriptors for all the items in each category

can be seen in Appendix A. The perceived knowledge and comfort on AWR in current practice were scored in a 4-point Likert-type scale: 1 = *not knowledgeable/comfortable at all*, 2 = *aware but do not know much about*, 3 = *knowledgeable/comfortable,* and 4 = *very knowledgeable/very comfortable*. For the attitude survey, a 5-point Likert-type scale was used: 1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, and 5 = *strongly agree*. At pre-test, the overall perceived knowledge, comfort and attitudes on AWR (M = 2.59; SD = 0.45) was suboptimal for current practice. At post-test, the overall perceived knowledge, comfort and attitudes on AWR (M = 3.41; SD = .29) was optimal. Detailed descriptive statistics on mean scores at pre-and post-test surveys are summarized in Table 2.

Subset analyses

The sample was split by age (40 and under and over 41) and by years of experience (5 or less and more than 5) to examine if age and years of experience had a bearing on anesthesia practitioner's knowledge, practice, and attitudes towards AWR. Fifty-seven percent of sample were less than 40 and 43% were 41 and greater. Fifty-four percent of sample had less than 5 years of experience and 46% had greater than 5 years of experience. Independent sample t test was conducted to examine differences in means. There was no statistically significant difference in perceived knowledge of AWR by either age (t =*-0.090; df =23; p =0.090*) or experience (t= *-7.185; df =23; p =0.975*). Statistical differences in the mean scores by gender, prior AWR education, and involvement with patients experiencing AWR under their care were not analyzed due to n sample size bias.

Perceived Knowledge on AWR

The perceived knowledge on AWR was measured through pre-and post-surveys which included the topics, AWR (Q1.1), Brice questionnaire (Q1.2), BIS (Q1.3), ETAC (Q1.4), AWR

evaluation time intervals (Q1.5) and AWR treatment options (Q1.6). Descriptive statistics for the individual items on perceived knowledge on AWR at pre-and post-test can be seen in Tables 4 and 5, respectively. To determine the effect size of VOPP on perceived knowledge, a subset analysis of pre-and post- survey means (*M = 3.71; SD = 2.61,* respectively) and Cohen *d* statistics (*d* = 1.466). The Cronbach's alpha coefficient was 0.72 for the 6 items in the perceived knowledge on AWR subscale. The Cohen *d* value above 0.8 indicates a large effect size supporting the effectiveness of VOPP as a tool to improve perceived knowledge related to AWR (Magnusson, 2014).

Comfort in Current Practice.

Comfort in pre-operative discussion and post-operative assessment of AWR in current practice (Q2) was measured through pre-and post-surveys which included the topics, pre-operative discussion of AWR as a risk of GA (Q2.1) and post-operative assessment of AWR (Q2.2). Descriptive statistics for the individual items on perceived comfort on AWR at pre-and post-test can be seen in Tables 3 and 4, respectively. To determine the effect size of VOPP on comfort in practice, a subset analysis of pre-and post- survey means (*M = 3.71; SD = 1.86,* respectively) and Cohen *d* statistics (*d* = 1.17). The Cronbach's alpha coefficient for this subscale was 0.85, indicating adequate reliability of the 2 items in this subscale. The Cohen *d* value of above 0.8 supports the effectiveness of the VOPP as a tool to improve comfort in pre-operative discussion and post-operative assessment of AWR in current practice.

Attitudes about AWR.

Attitudes towards AWR had an inadequate Cronbach's alpha coefficient value of less than 0.7. No subset analysis was performed on this variable.

Discussion

Results from the pre-and post-survey revealed that the mean scores improved after practitioners viewed the AWR VOPP. This supports an increase in perceived knowledge and comfort, closing the gap between knowledge and practice concerning AWR. The QIP did not evaluate if the increased knowledge and comfort resulted in changes in practice; this is possible area future research.

This QIP reports the results of a survey of anesthesia practitioners and learners at NUHS and their perceived knowledge, practice behaviors and attitudes towards AWR. The survey yielded all positive and statistically significant data in regards to perceived knowledge and practice change related to the assessment, evaluation and treatment of AWR. However, a change in attitude towards AWR could not be distinguished from survey results.

Despite the fact that an AWR brochure exists, anesthesia practitioners and learners reported low scores related to comfort in providing their patients with information regarding AWR. As our literature review showed patients with AWR have decreased sequelae when anesthesia practitioners discuss AWR as a risk of GA and assess for AWR postoperatively. Anesthesia practitioners reported improved perceived knowledge and comfort regarding AWR following our VOPP supporting its use as a standard educational protocol to reduce the current practice gap.

Attitudes of anesthesia practitioners regarding AWR is missing from the literature. It is important to note that although the surveys regarding attitude were not found to be valid, they provided insight into the need for further research. When comparing pre-and post-surveys regarding attitudes toward long term effects of AWR, after viewing the VOPP, anesthesia practitioners agreed more strongly that the potential for long term sequela is present. Similarly,

anesthesia practitioners were in agreement that a standard educational protocol regarding AWR was necessary.

Limitations

The recruitment process involved contacting the entire network of 150 anesthesia practitioners at NUSH. Although the entire network received the recruitment e-mail, the response rate was low, n=24, or 16% of the target population. This sample may not be representative of the population of anesthesia practitioners in other health systems in the United States. Pre-and post-surveys relied on self- reporting and may not reflect actual practice behaviors. Nonetheless, this does provide insight to the perceived knowledge and practice behaviors related to assessment, evaluation and treatment of AWR among NUSH anesthesia practitioners. However, the QIP was designed to establish baseline feedback that may assist in designing potential future QIPs and standard protocols addressing AWR.

Conclusion

This QIP showed that the VOPP on AWR was affective in improving the perceived knowledge and comfort of NUSH anesthesia practitioners regarding assessment, evaluation and treatment of AWR. The results are useful indicator for communication and training needs. Although an AWR brochure exists, our VOPP is an enhanced and updated educational module; its electronic nature, improves accessibility by additional and future NUHS anesthesia practitioners. Additional research in alternate settings is needed to provide a broader representation of anesthesia practitioners in the United States. Furthermore, a future analysis would provide insight into experiences of patients and anesthesia practitioners and their communication regarding AWR after initiation of our VOPP educational program as a standard protocol in a local practice setting.

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Table 1. Sociodemographic Characteristics of Study Participants			
Demographic	N	Valid %	N
Age in years			
Less than 40	16	57.1	
Over 40	11	42.9	27
Gender			
Female	21	75	
Male	7	25	28
Years of experience			
Less than 5	15	53.6	
Over 5	12	46.4	27
Did you receive AWR education in school and/or residency?			
Yes	20	71.4	
No	8	28.6	28
Have you had a patient who has experienced AWR?			
Yes	2	7.1	
No	26	92.9	28

Table 2. Pre-test and Post-Test Mean Scores on AWR			Statistic	Std. Error
Mean Score Pre Test VOPPT on AWR	**Mean**		**2.5958**	.09138
	95% Confidence Interval for Mean	Lower Bound	2.4068	
		Upper Bound	2.7849	
	5% Trimmed Mean		2.5759	
	Median		2.5500	
	Variance		.200	
	Std. Deviation		**.44768**	
	Minimum		1.90	
	Maximum		3.70	
	Range		1.80	
	Interquartile Range		.70	
	Skewness		.648	.472
	Kurtosis		.081	.918
Mean Score Post Test VOPPT on AWR	**Mean**		**3.4083**	.06017
	95% Confidence Interval for Mean	Lower Bound	3.2839	
		Upper Bound	3.5328	
	5% Trimmed Mean		3.4139	
	Median		3.4000	
	Variance		.087	
	Std. Deviation		**.29476**	
	Minimum		2.80	
	Maximum		3.90	
	Range		1.10	
	Interquartile Range		.40	
	Skewness		-.211	.472
	Kurtosis		-.400	.918

Table 3. Pre-Test Descriptive Frequencies and Percentages of Answers to the Individual Item in the Questionnaire

Perceived Knowledge Question	Answer Score	Frequency	Cumulative	Percentage (%)
Q1.1 AWR	1 2 3 4	4 10 9 1	4 14 23 24	16.6 41.6 37.5 4.1
Q1.2 Brice Questionnaire	1 2 3 4	20 3 0 1	20 23 23 24	83.3 12.5 0 4.1
Q1.3 BIS	1 2 3 4	0 0 18 6	0 0 18 24	0 0 75 25
Q1.4 ETAC	1 2 3 4	0 0 15 9	0 0 15 24	0 0 62.5 37.5
Q1.5 Recommended time intervals for AWR	1 2 3 4	12 8 4 0	12 20 24 24	50 33.3 16.6 0
Q1.6 Treatment options for AWR	1 2 3 4	8 10 5 1	8 18 23 24	33.3 41.6 20.8 4.1
Comfort and AWR Practice Behaviors				
Q2.1 Pre-operative discussion with patient about AWR as a risk of GA	1 2 3 4	12 5 4 3	12 17 21 24	50 20.8 16.6 12.5
Post-operative assessment of AWR	1 2 3 4	14 5 4 1	14 19 23 24	58.3 20.8 16.6 4.1
Legend	1 = *not knowledgeable/comfortable at all*, 2 = *aware but do not know much about*, 3 = *knowledgeable/comfortable*, 4 = *very knowledgeable/very comfortable*			

Table 4. Post-Test Descriptive Frequencies and Percentages of Answers to the Individual Item in the Questionnaire

Perceived Knowledge Question	Answer Score	Frequency	Cumulative	Percentage (%)
Q1.1 AWR	1 2 3 3	0 0 18 6	0 0 18 24	0 0 75 25
Q1.2 Brice Questionnaire	1 2 3 4	0 2 18 4	0 2 20 24	0 8.3 75 16.6
Q1.3 BIS	1 2 3 4	0 1 11 12	0 1 12 24	0 4.1 45.8 50
Q1.4 ETAC	1 2 3 4	1 1 9 13	1 2 11 24	4.1 4.1 37.5 54.1
Q1.5 Recommended time intervals for AWR	1 2 3 4	0 3 15 6	0 3 18 24	0 12.5 62.5 25
Q1.6 Treatment options for AR	1 2 3 4	0 2 17 5	0 2 19 24	0 8.3 70.8 20.8
Comfort and AWR Practice Behaviors				
Q2.1 Pre-operative discussion with patient about AWR as a risk of GA	1 2 3 4	0 7 15 2	0 7 22 24	0 29.1 62.5 8.3
Post-operative assessment of AWR	1 2 3 4	0 8 16 0	0 8 24 24	0 33.3 66.6 0
Legend	1 = *not knowledgeable/comfortable at all*, 2 = *aware but do not know much about*, 3 = *knowledgeable/comfortable*, 4 = *very knowledgeable/very comfortable*			

Appendix A

Demographic Questions:

1. What is your age? 1. <30 2. 30-40 3. 41-50 4. 51-60 5. > 60

2. How many years of anesthesia experience do you have providing general anesthesia?

1.<5 2. 5-10 3. 10-20 4. 20-30

3. What is your gender? 1. Male__ 2. Female____

4. Did your anesthesia school or residency program provide education on AWR? 1. Yes 2. N

5. Have you ever had a patient under your care experience AWR? 1. Yes 2. No

Appendix B

Your participation is both voluntary and anonymous. By completing the survey, you are implying consent to be in our QIP (see information sheet for further information regarding our QIP). You may also choose not to continue at this time without any repercussions. Please answer the following questions using the scale: very, somewhat, neutral, not very or not at all.

Pre-Survey

1) How would you describe your knowledge on the following topics regarding intra-operative awareness with recall under general anesthesia (AWR)?

	Not at all knowledgeable	Aware but do not know much about	Knowledgeable	Very knowledgeable
Anesthesia awareness with recall (AWR)				
Brice Questionnaire				
BIS monitoring				
End tidal anesthetic concentration monitoring				
Recommended time intervals for evaluation of AWR				
Treatment options for patients that experience (AWR)				

2) How would you describe your comfort level with the following topics regarding intra-operative awareness with recall under general anesthesia (AWR)?

	Not at all comfortable	Somewhat comfortable	Comfortable	Very comfortable
Pre-operative discussion with the patient about AWR as a risk of general anesthesia				
Post-operative assessment of AWR				

3) How much do you agree or disagree with the following statements about Anesthesia Awareness with Recall (AWR)?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
AWR has a long term impact on a patient's psychological and mental health					
A standard protocol should be implemented regarding AWR					

APPENDIX C

Post-survey

The post-survey is to completed after viewing the voice over power point education.

1) How would you describe your knowledge on the following topics regarding intra-operative awareness with recall under general anesthesia (AWR)?

	Not at all knowledgeable	Aware but do not know much about	Knowledgeable	Very knowledgeable
Anesthesia awareness with recall (AWR)				
Brice Questionnaire				
BIS monitoring				
End tidal anesthetic concentration monitoring				
Recommended time intervals for evaluation of AWR				
Treatment options for patients that experience (AWR)				

2) How would you describe your comfort level with the following topics regarding intra-operative awareness with recall under general anesthesia (AWR)?

	Not at all comfortable	Somewhat comfortable	Comfortable	Very comfortable
Pre-operative discussion with the patient about AWR as a risk of general anesthesia				
Post-operative assessment of AWR				

3) How much do you agree or disagree with the following statements about Anesthesia Awareness with Recall? (AWR)

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
AWR has a long term impact on a patient's psychological and mental health					
A standard protocol should be implemented regarding AWR					

APPENDIX D

Recruitment Email

Dear fellow anesthesia providers,

You are receiving an email with the intent of asking you to participate in our DNP quality improvement project. The project consists of a 2 minute pre-educational voice over power point survey, followed by a 15 minute educational voice over power point and concluded by a 2 minute post-educational voice over power point survey. The goal of surveys and educational voice over power point is to fill the gap between perceived knowledge and practice regarding the subject of awareness with recall under general anesthesia (AWR). We aim to educate anesthesia practitioners about the appropriate assessment, evaluation and treatment options for AWR.

Your participation is both voluntary and anonymous. We ask that only certified registered nurse anesthetists, anesthesiologists, student registered nurse anesthetists and anesthesia residents currently practicing general anesthesia participate. Qualtrics, the program used to gather data, ensures anonymity. Surveys will not be linked to any one participant or any IP address. In the event that you choose not to participate at any time during the survey and/or video, you may exit the link. However, once the surveys are submitted, we will be unable to extract your responses because all data is anonymous. There will be no professional, financial, or scholarly consequences for deciding not to participate.

We have attached an information sheet explaining the study and your participation. You may review it prior to participating in the study. Thank you for your time.

Best regards,

Kelly Lannert, RN, BSN, CCRN, NAT
Dulcie Robinson, RN, BSN, CCRN, NAT

Steps:

1. Fill out the demographics survey
   http://depaul.qualtrics.com/SE/?SID=SV_8eHNesKwr0oKBh3demographics

2. Fill out the pre-survey
   http://depaul.qualtrics.com/SE/?SID=SV_ehqhPsIY1oWbfEh>http://depaul.qualtrics.com/SE/?SID=SV_ehqhPsIY1oWbfEhpresurvey

3. Watch the voice over power point
   https://www.youtube.com/watch?v=SRfB3JhQAq8

4. Fill out the post-survey
   http://depaul.qualtrics.com/SE/?SID=SV_51QWsWrtgiF1AG1>http://depaul.qualtrics.com/SE/?SID=SV_51QWsWrtgiF1AG1postsurvey

APPENDIX E

Information Sheet

Information Sheet for Participation in Quality Improvement Project

Intra-operative Awareness with Recall under General Anesthesia

Principal Investigator: Kelly Lannert RN, BSN, CCRN, NAT, graduate student and Dulcie Schippa RN, BSN, CCRN, NAT, graduate student

Institution: DePaul University, USA

Faculty Advisor: Bernadette Roche CRNA, EdD and Karen Kapanke DNP, CRNA

Research Team: NA

Collaborators: NorthShore University HealthSystem

We are conducting a quality improvement project (QIP) because we are trying to learn more about the gap between anesthesia provider's perceived knowledge of awareness with recall and their practice. The goal is to attempt to improve assessment and treatment of patients with awareness with recall. We are asking you to be a part of this QIP because you are a current student of anesthesia in clinical or a licensed medical or nursing practitioner in Illinois, currently practicing general anesthesia. If you agree to participate in the QIP, you will be asked to fill out a pre-survey, watch an educational video, and fill out a post survey. The surveys will include questions about comfort and knowledge of assessment, evaluation, and treatment of awareness with recall. We will also collect some personal information about you such as age, gender, years of anesthesia experience, institutional bed capacity, experience in practice with awareness with recall, and previous education about awareness with recall. You will receive an email with a link to the surveys and educational video to be completed. If there is a question you do not want to answer, you may skip it.

This QIP will take about 20 minutes of your time. The pre-survey will take 2 minutes, the educational video will be 15 minutes in length, and the post survey will take 2 minutes. Data collected will be anonymous.

Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences if you decide not to participate or change your mind later after you begin.

You can withdraw your participation at any time prior to submitting your survey. If you change your mind later while answering the survey, you may simply exit the survey. Once you submit your responses, we will be unable to remove your data later from the study because all data is anonymous and we will not know which data belongs to you.

Your decision whether or not to be in the QIP will not affect your grades, evaluation, status, or employment within DePaul University, NorthShore University HealthSystem, or NorthShore University HealthSystem School of Nurse Anesthesia.

If you have questions, concerns, or complaints about this study or you want to get additional information or provide input about this QIP, please contact Kelly Lannert, 773-593-0595, kellylannert@gmail.com or Dulcie Schippa, 312-446-7804, dulcieschippa@msn.com.

If you have questions about your rights as a research subject, you may contact Susan Loess-Perez, DePaul University's Director of Research Compliance, in the Office of Research Services at 312-362-7593 or by email at sloesspe@depaul.edu. You may also contact DePaul's Office of Research Services if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.

You may keep [or print] this information for your records.

By completing the survey, you are indicating your agreement to be in the research.

APPENDIX F

SLIDE 1

Intra-operative Awareness with Recall under General Anesthesia
By Kelly Lannert RN, BSN, CCRN, DNPC &
Dulcie Schippa RN, BSN, CCRN, DNPC

SCRIPT: Thank you for viewing our voice over power point. We will be presenting information regarding Intra-operative awareness with recall under general anesthesia which will now be referred to as AWR throughout the presentation. While some content may be review our intent is to attempt to improve knowledge and practice regarding assessment, evaluation, and treatment of AWR.

SLIDE 2

Abbreviation definitions:
AAAA- American Academy of Anesthesia Assistants
AANA- American Association of Nurse Anesthetists
ASA- American Society of Anesthesiologists
AWR - Awareness with Recall (anytime AWR is in power point will refer to Awareness with Recall under GA)
BIS – Bispectral Index Monitoring
ETAC- End tidal anesthetic concentration
GA – General Anesthesia
JC- Joint Commission
MAC – Minimal Alveolar Concentration
NMB – Neuromuscular Blocker
PACU- Post anesthesia care unit
PTSD – Post Traumatic Stress Disorder

SCRIPT: Here is a list of some common abbreviations used throughout presentation for your reference.

SLIDE 3

Objectives
Discuss the current gap between knowledge of AWR under GA and practice by anesthesia providers
Identify areas where practice can change to close the gap
Present tools available to assess for AWR under GA
Describe appropriate and effective time intervals for evaluation of AWR under GA
Present resources available to assist in treatment of AWR under GA sequelae

SCRIPT: Our objectives are to; Discuss the current gap between knowledge of AWR and practice by anesthesia practitioners. Identify areas where practice can change to close the gap.

Present tools available to assess for AWR. Describe appropriate and effective time intervals for evaluation of AWR. Present resources available to assist in treatment of AWR sequelae.

SLIDE 4

Problem statement: A gap exists between anesthesia providers perceived knowledge of AWR under GA and their practice. Particularly, there is a lack of assessment, evaluation, and treatment of AWR by anesthesia providers. While most anesthesia providers are familiar with AWR as a phenomenon, research has shown it is inadequately assessed, evaluated, and treated in patients receiving GA.

SCRIPT: Through an extensive literature review we identified a gap exists between anesthesia practitioners perceived knowledge of AWR and their practice. Particularly, there is a lack of assessment, evaluation, and treatment of AWR by anesthesia practitioners. While most anesthesia practitioners are familiar with AWR as a phenomenon, research has shown it is inadequately assessed, evaluated, and treated in patients receiving GA.

SLIDE 5

For the purpose of this educational program anytime AWR is referred to, its only inclusive of surgical cases in the operating room under general anesthesia and does not include sedation, monitored anesthesia cases, or the time before induction or emergence of GA, when awareness is acceptable for patient to return to a state of consciousness.

SCRIPT: For the purpose of this educational program anytime AWR is referred to, its only inclusive of surgical cases in the operating room under general anesthesia and does not include sedation, monitored anesthesia cases, or the time before induction or emergence of GA, when awareness is acceptable for patient to return to a state of consciousness.

SLIDE 6

Definitions of AWR: An unintended intra-operative awareness occurring under GA.
The patient becomes cognizant of some or all events during surgery or a procedure, and has direct recall of those events. Because of the routine use of neuromuscular blocking agents… the patient is often unable to communicate with the surgical team if this occurs.
Explicit re-call of sensory perceptions that occurs during GA, with specific reference to explicit recall as a determining factor for anesthesia awareness.

SCRIPT: The JC defines AWR as “an unintended intra-operative awareness” occurring under GA. “The patient becomes cognizant of some or all events during surgery or a procedure, and has direct recall of those events. Because of the routine use of neuromuscular blocking agents… the patient is often unable to communicate with the surgical team if this occurs.” The AANA defines AWR as “explicit re-call of sensory perceptions that occurs during general anesthesia. With specific reference to explicit recall as a determining factor for anesthesia awareness…”.

SLIDE 7

Timeline of AWR: 1937- AWR is first identified by Gibbs, Gibbs and Lennox

1960- AWR incidence of 0.8%-1.2% with no sequelae appreciated
1990- Acceptance of AWR sequelae and EEG monitoring technology
2004- JC deems AWR a sentinel event
AWR incidence of 0.1-0.9% of all patients receiving GA
2005- AANA, ASA and AAAA published a joint brochure educating patients on AWR.
These professional organizations continue to revise their recommendations and resources for patients and providers regarding AWR with continued stress on the importance and reality of this anesthetic complication.

SCRIPT: AWR was first identified in 1937 by Gibbs, Gibbs, and Lennox. Then, in 1960- AWR incidence of 0.8%-1.2% with no sequelae appreciated 1990. Acceptance of AWR sequelae and EEG monitoring technology became available. In 2004, the JC issued a sentinel event warning in response to surfacing research, citing that AWR incidence was 0.1%-0.9% of all patients receiving GA. Although the AANA and the ASA published guidelines in 2000 to prevent AWR, the alert prompted the groups to revisit the subject. In 2005, the AANA, ASA and AAAA published a joint brochure educating patients on AWR. These professional organizations continue to revise their recommendations and resources for patients and practitioners regarding AWR with continued stress on the importance and reality of this anesthetic complication.

SLIDE 8

AWR, an Uncomfortable Topic: Anesthetists describe AWR as being a complication they wish to avoid, only second to death. Often times, providers feel that through questioning, a platform of suggestion is created. One way that may assist in preventing suggestion…."While falling asleep before surgery and/or waking up after surgery, you may remember hearing me say things like 'take a deep breath or squeeze my hand' know that your surgery is done. However, awareness during anesthesia is a risk though it is very unlikely and we have monitors to assess for it."

SCRIPT: When research conducted regarding anesthesia practitioners perceived knowledge, familiarity, and comfort in assessment, evaluation and treatment of AWR, no studies or literature was found. In practice, no discussions of potential for awareness has been witnessed. Anesthetists describe AWR as being a complication they wish to avoid, only second to death. Most practitioners assume that through questioning, a platform of suggestion is created. One way that may assist in preventing suggestion while discussing risk is stating…."While falling asleep before surgery and/or waking up after surgery, you may remember hearing me say things like 'take a deep breath or squeeze my hand' know that your surgery is done. However, awareness during anesthesia is a risk though it is very unlikely and we have monitors to assess for it."

SLIDE 9

"Thirty five percent of patients who said they had experienced AWR never told their anesthesiologist because they were frightened and didn't want to be deemed as crazy." "It's never happened to you because you haven't looked for it."

SCRIPT: Thirty five percent of patients who said they had experienced AWR never told their anesthesiologist because they were frightened and didn't want to be deemed as crazy.

Unfortunately this mentality has seemed to be unchanged 12 years later with limited assessment and an extreme lack of knowledge related to evaluation and treatment. Multiple researchers have stated AWR is generally underestimated. He attributes this to several factors, some anesthetists aren't concerned about awareness because it's never happened to them before and he responds to this by saying "It's never happened to you because you haven't looked for it"

SLIDE 10

Areas for Practice Improvement: Assessment, Evaluation, Treatment

SCRIPT: Areas identified where practice can change to close this gap between knowledge and practice are assessment, evaluation, and treatment

SLIDE 11

Assessment: High Risk Populations: Who is at highest risk? ASA III and IV, Emergencies, Multi-trauma, Cardiac, Obstetrics, Pediatrics, Women

SCRIPT: Who is at highest risk? ASA III and IV, Emergencies, Multi-trauma, Cardiac, Obstetrics, Young, Women

SLIDE 12

Assessment: Methods of monitoring: Intra-operative- BIS and ETAC of volatile gases, Post-operative- Brice questionnaire

SCRIPT: Two most used methods of monitoring are bispectral index monitoring (BIS) and end tidal anesthetic concentration (ETAC): monitoring of volatile gases. These are widely accepted and utilized. While those methods are used in the operating room, an available tool to assess post operatively is the Brice questionnaire which consists of a series of questions. Based on the answers to the Brice questionnaire it is identified if awareness occurred during GA.

SLIDE 13

AWR Tools: BIS: The BIS is a monitor that assesses adequate depth of anesthesia based on EEG analysis of burst suppression, spectral power of the beta bandwidth, and bispectral coherence. Incidence: Similarly, AWR incidence was shown to be 0.04% where the BIS was used, compared with 0.18% when BIS was not used. In the B-aware trial, BIS-guided anesthesia was found to reduce the risk of awareness by 82%. BIS monitors cost $1,000 or less. Single use sensor strip can be purchased for $13.

SCIRPT: The BIS is a monitor that assesses depth of anesthesia based on EEG analysis of burst suppression, spectral power of the beta bandwidth, and bispectral coherence. According to Ekman et al. the incidence of AWR in cases where the BIS was used was 0.04% compared with 0.18% in historical control group of 7826 patients from a previous study of awareness in which no cerebral function monitoring was used. In the B-aware trial, BIS-guided anesthesia was found to reduce the risk of awareness by 82%. BIS monitors cost $1,000 or less and a single use sensor strip can be purchased for $13, these costs would seem insignificant when compared to the

benefit of preventing AWR. When considering cost of prevention of AWR, if the technology is available, why not use it? Consider having the technology available, opting not to use it, and then having a patient who experienced AWR.

SLIDE 14

AWR Tools: ETAC: ETAC monitoring is a measure of expired anesthetic gas which helps assess the level of anesthesia. ETAC values are compared to the associated MACs of specific gases (i.e. Sevoflurane, 2%). ETAC monitoring and alarm limits allow anesthesia providers to determine if the patient is receiving a gas concentration that is associated with non-awareness. Incidence: One study reported AWR to be as low as 0.07% when ETAC was used.

SCRIPT: ETAC monitoring is a measure of expiratory levels of anesthetic gas to help assess the level of anesthesia based on the percentage of gas exhaled. ETAC values are compared to the associated MACs of specific gases (i.e. Sevoflurane, 2%) ETAC monitoring and alarm limits allow anesthesia providers to determine if the patient is receiving a gas concentration that is associated with non-awareness. One study reported AWR to be as low as 0.07% when ETAC was used.

Slide 15

AWR Tools: Brice Questionnaire: The Brice questionnaire is a validated tool, used to structure a post-operative AWR assessment. The AANA and ASA recommend the use of the Brice when interviewing patients about AWR post-operatively.

SCRIPT: While those methods are used in the operating room, an available tool to assess post operatively is the Brice questionnaire which consists of a series of questions. The Brice questionnaire is a validated tool, used to structure a post-operative AWR assessment. The AANA and ASA recommend the use of the Brice when interviewing patients about AWR post-operatively.

SLIDE 16

AWR Tools: Brice Questionnaire: A structured questionnaire is available when assessing patients postoperatively, the questions consist of:

1. What was the last thing you remember before going to sleep?
2. What was the first thing you remember after waking up?
3. Do you remember anything between going to sleep and waking up?
4. Did you dream during your procedure?
5. What was the worst thing about your operation?

SCRIPT: The Brice questionnaire includes the following questions 1. What was the last thing you remember before going to sleep? 2. What was the first thing you remember after waking up? 3. Do you remember anything between going to sleep and waking up? 4. Did you dream during your procedure? 5. What was the worst thing about your operation? (Mashour, Tremper & Avidan 2009). Based on the answers to the Brice questionnaire it is identified if awareness occurred during GA.

SLIDE 17

Evaluation: AWR memories and/or sequela may arise 7-243 days post-operatively due to the latency of memories. The Brice Questionnaire is to be used to interview patients immediately post-operatively and 1-2 additional times after the operation. PACU, 1-3 days post-operatively, 7-30 days after surgery.

SCRIPT: Anesthesia practitioners should be aware onset of psychological symptoms vary widely from 7-243 days after surgery, with median being from 4.4-5.6 years. Multiple randomized control trials have shown AWR occurs in 1:1,000 or 0.1% and up to 0.9% of all adults undergoing GA. One hypothesis for the variation in results is due to the times post-operatively at which a patient is interviewed about AWR. Brice questionnaires were developed to be used to interview patients immediately post-operatively and 1-2 additional times after the operation.

SLIDE 18

Evaluation: AWR incidence when evaluated at multiple intervals. Interviewed in PACU, 1-3 and 14 days post-operatively; 0.16%. Interviewed in PACU and 1-2 weeks post-operatively; 0.13%. Interviewed in PACU, 7 and 30 days post-operatively; 1.0% One alternate study showed when interviews were only conducted at 48 hours post-operatively, incidence was 0.007%

SCRIPT: Sandin et al. interviewed patients in the post-anesthesia care unit (PACU), 1-3 days post-operatively and 7-14 days after surgery. They reported an incidence of 19/11,785 patients or 0.16% in a prospective study of AWR. Sebel et al., interviewed patients in the PACU and 1-2 weeks post-operatively and corroborated findings in their prospective multicenter study in the United States showing an incidence of 25/19,575 patients or 0.13%. In 2008, Errando and colleagues conducted a prospective observational study interviewing patients in the PACU and at 7 and 30 days post-operatively. They found AWR incidence was 39/3921, or 1.0% and that incidence decreased to 0.8% when high risk patients were excluded. Pandit cited the outlying study of AWR, conducted by Pollard in 2007, that showed AWR incidence occurring in only 1: 14,500 or 0.007%. However, these studies were limited to interviewing patients at 48 hours post-operatively, possibly missing one third of AWR reports.

SLIDE 19

AWR Sequelae: Nightmares, Anxiety, Depression, PTSD, Avoidance of future surgical/medical intervention

SCRIPT: AWR sequelae includes: Nightmares, Anxiety, Depression, PTSD which we will discuss more in depth and Avoidance of future surgical/medical intervention

SLIDE 20

PTSD: Characteristics of PTSD: Re-experiencing, avoidance, physiological hyper-arousal. PTSD is correlated with poor health choices and physical health symptoms. Sleep disturbances, irritable bowel syndrome, chronic pain, multiple cancers, negative health behaviors such as smoking, substance abuse and poor eating habits. PTSD has a significant incidence in patients who

experienced AWR and can have long term health consequences. Therefore, recognition, acknowledgement and treatment are imperative.

SCRIPT: PTSD develops following traumatic events and experiences, possibly permanently disabling the victims. PTSD is characterized by 1) re-experiencing, 2) avoidance, and 3) physiological hyperarousal. PTSD has been noted to correlate with poor health choices and physical health symptoms. Prevalent sequelae sleep disturbances, irritable bowel syndrome, chronic pain complaints and multiple cancers as well as negative health behaviors such as smoking, substance abuse and poor eating habits have been found. PTSD has a significant incidence in patients who experienced AWR and can have long term health consequences. Therefore, recognition, acknowledgement and treatment are imperative.

SLIDE 21

AWR Treatment: Know your institution's resources for referral when AWR is detected. Immediate psychology referrals, Therapeutic communication, Chaplin. Discussing AWR as a risk of anesthesia, opens line of communication post-operatively. AANA brochure "Patient Awareness under General Anesthesia-What is it?", can be utilized as a tool to help start a discussion. http://www.aana.com/resources2/bookstore/Documents/awarenessbrochure0110.pdf Anesthesia Awareness Registry http://depts.washington.edu/awaredb/home

SCRIPT: When this devastating event occurs, as anesthesia practitioners, it is important to be aware of resources available. In a majority of cases patients are looking for an understanding and acknowledgment that what they recall did occur and they are not crazy. As a provider, this can be very devastating to admit and deal with on a professional level as well. Resources and helpful tools are available to deal with recovery and acknowledgment of these events for the patient and the practitioner. One year after The JC deemed AWR a sentinel event, the AANA published a brochure "Patient Awareness under General Anesthesia-What Is It?". This brochure was then revised in 2009 with a groundbreaking collaboration of the AAAA, AAC, ASA, and AANA because substantial new data and understandings in the area of patient awareness had arisen since its publication. This brochure is a tool to help start a discussion with a patient about the possibility of AWR. It also provides information and resources needed to seek help and provide a safe forum to express experiences in the event that AWR occurs. Anesthesia Awareness Registry is a community of patients who have experienced AWR and offers support for others when it occurs.

SLIDE 22

AWR Treatment: The second victim, the anesthesia practitioner, may also suffer sequelae when their patient experiences AWR. Institutional specific employee assistance programs. Peer debriefing. Professional organization support

SCRIPT: The second victim, the anesthesia practitioner, may also suffer sequelae when their patient experiences AWR. Practitioners have available institutional specific employee assistance programs, peer debriefing, and professional organization support from AANA, ASA, and AAAA.

SLIDE 23

Dollars and Sense: Litigation related to AWR ranges from $18,000-$300,000. When AWR is not treated and PTSD occurs, it is considered a severe disability and may face increased monetary claims. This does not include the patient's emotional cost. If the risk is communicated pre-operatively, patients are less likely to explore litigation following AWR.

SCRIPT: In addition to physical and psychological sequela practitioners may face litigation. Litigation related to AWR can range from $18,000-$300,000. When AWR is not treated and PTSD occurs, it is considered a severe disability and may face increased monetary claims. This does not include the patient's emotional cost. If the risk is communicated pre-operatively, patients are less likely to explore litigation following AWR.

SLIDE 24

Questions: Please proceed to the post-survey questionnaire included in the email. If you have any questions or concerns after completing the post-survey please feel free to email…. kellylannert@gmail.com or dulcieschippa@msn.com Thank you for participating in this survey.

SCRIPT: Now please proceed to the post-survey questionnaire included in the email. If you have any questions or concerns after completing the post-survey please feel free to email…. kellylannert@gmail.com or dulcieschippa@msn.com Thank you for participating in this survey.

SLIDE 25

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SLIDE 26

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APPENDIX G

Permission for use of survey

Dr. E. Adams,

My co-author Kelly Lannert and I, Dulcie Schippa, are student nurse anesthetists at the NorthShore University School of Nurse Anesthesia. We are developing a quality improvement project to assess current practice, knowledge, and comfort levels of anesthesia providers when assessing for, evaluation of, and treatment of sequelae where awareness with anesthesia is concerned.

We have reviewed your survey in the British Journal of Cancer (2013) 108, 1602–1615 | doi: 10.1038/bjc.2013.139 and feel it would be a reliable and fitting survey for us to adapt and collect our statistical data on the effectiveness of our program.

We are writing to ask your permission to use your survey as a reliable established survey tool for our project. Please let us know at your earliest convenience as we are looking to move forward with our project dissemination in January of 2017.

Thank you for your time and look forward to hearing back from you soon.

Sincerely,
Dulcie Schippa RN, BSN, CCRN, NAT
Kelly Lannert RN, BSN, CCRN, NAT
dulcieschippa@msn.com
3124467804

From: Eike Adams <eike.adams@gmail.com>
Sent: Friday, December 9, 2016 4:15:25 AM
To: Dulcie Schippa
Subject: Re: permission for adaptation of survey

Dear Dulcie,

It's nice to hear from you and I'm delighted my survey might be of use to you. Of course, I'm happy for you to adapt it with acknowledgement. Do you have the original article or do you need me to send you a copy?

Good luck with your project,
best wishes
Eike

APPENDIX H

Abbreviation definitions:
AAAA- American Academy of Anesthesia Assistants
AANA- American Association of Nurse Anesthetists
ASA- American Society of Anesthesiologists
AWR - Awareness with Recall (anytime AWR is in power point will refer to Awareness with Recall under GA)
BIS – Bispectral Index Monitoring
ETAC- End tidal anesthetic concentration
GA – General Anesthesia
JC- Joint Commission
MAC – Minimal Alveolar Concentration
NMB – Neuromuscular Blocker
PACU- Post anesthesia care unit
PTSD – Post Traumatic Stress Disorder

APPENDIX I

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** kelly lennert (ID: 5543426)
- **Email:** kellylennert@gmail.com
- **Institution Affiliation:** DePaul University (ID: 1435)
- **Phone:** 773-593-0595

- **Curriculum Group:** Students
- **Course Learner Group:** Students - Class projects
- **Stage:** Stage 1 - Basic Course

- **Report ID:** 19475678
- **Completion Date:** 05/16/2016
- **Expiration Date:** 05/16/2019
- **Minimum Passing:** 80
- **Reported Score*:** 85

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
History and Ethical Principles - SBE (ID: 490)	05/16/16	4/5 (80%)
Defining Research with Human Subjects - SBE (ID: 491)	05/16/16	5/5 (100%)
The Federal Regulations - SBE (ID: 502)	05/16/16	4/5 (80%)
Assessing Risk - SBE (ID: 503)	05/16/16	4/5 (80%)
Informed Consent - SBE (ID: 504)	05/16/16	4/5 (80%)
Privacy and Confidentiality - SBE (ID: 505)	05/16/16	5/5 (100%)
Students in Research (ID: 1321)	05/16/16	4/5 (80%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/16/16	4/5 (80%)
DePaul University (ID: 12952)	05/16/16	No Quiz

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

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COURSEWORK TRANSCRIPT REPORT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

- **Name:** kelly lennert (ID: 5543426)
- **Email:** kellylennert@gmail.com
- **Institution Affiliation:** DePaul University (ID: 1435)
- **Phone:** 773-593-0595

- **Curriculum Group:** Students
- **Course Learner Group:** Students - Class projects
- **Stage:** Stage 1 - Basic Course

- **Report ID:** 19475676
- **Report Date:** 05/16/2016
- **Current Score**:** 85

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT	SCORE
Students in Research (ID: 1321)	05/16/16	4/5 (80%)
History and Ethical Principles - SBE (ID: 490)	05/16/16	4/5 (80%)
Defining Research with Human Subjects - SBE (ID: 491)	05/16/16	5/5 (100%)
The Federal Regulations - SBE (ID: 502)	05/16/16	4/5 (80%)
Assessing Risk - SBE (ID: 503)	05/16/16	4/5 (80%)
Informed Consent - SBE (ID: 504)	05/16/16	4/5 (80%)
Privacy and Confidentiality - SBE (ID: 505)	05/16/16	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/16/16	4/5 (80%)
DePaul University (ID: 12952)	05/16/16	No Quiz

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

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COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Dulcie Robinson (ID: 5538017)
- **Email:** dulcieschippa@msn.com
- **Institution Affiliation:** DePaul University (ID: 1435)
- **Phone:** 3124467804

- **Curriculum Group:** Students
- **Course Learner Group:** Students - Class projects
- **Stage:** Stage 1 - Basic Course

- **Report ID:** 19445050
- **Completion Date:** 05/04/2016
- **Expiration Date:** 05/04/2019
- **Minimum Passing:** 80
- **Reported Score*:** 100

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
History and Ethical Principles - SBE (ID: 490)	05/03/16	5/5 (100%)
Defining Research with Human Subjects - SBE (ID: 491)	05/04/16	5/5 (100%)
The Federal Regulations - SBE (ID: 502)	05/03/16	5/5 (100%)
Assessing Risk - SBE (ID: 503)	05/04/16	5/5 (100%)
Informed Consent - SBE (ID: 504)	05/03/16	5/5 (100%)
Privacy and Confidentiality - SBE (ID: 505)	05/03/16	5/5 (100%)
Students in Research (ID: 1321)	05/03/16	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/04/16	5/5 (100%)
DePaul University (ID: 12952)	05/04/16	No Quiz

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COURSEWORK TRANSCRIPT REPORT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

- **Name:** Dulcie Robinson (ID: 5538017)
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- **Phone:** 3124467804

- **Curriculum Group:** Students
- **Course Learner Group:** Students - Class projects
- **Stage:** Stage 1 - Basic Course

- **Report ID:** 19445050
- **Report Date:** 05/04/2016
- **Current Score**:** 100

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT	SCORE
Students in Research (ID: 1321)	05/03/16	5/5 (100%)
History and Ethical Principles - SBE (ID: 490)	05/03/16	5/5 (100%)
Defining Research with Human Subjects - SBE (ID: 491)	05/04/16	5/5 (100%)
The Federal Regulations - SBE (ID: 502)	05/03/16	5/5 (100%)
Assessing Risk - SBE (ID: 503)	05/04/16	5/5 (100%)
Informed Consent - SBE (ID: 504)	05/03/16	5/5 (100%)
Privacy and Confidentiality - SBE (ID: 505)	05/03/16	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	05/04/16	5/5 (100%)
DePaul University (ID: 12952)	05/04/16	No Quiz

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

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