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Anesthesia Providers' Knowledge and Attitudes on Fire Risk Assessment During Time-out in the Operating Room

Kathryn D. Coletto
DaPaul University, kcoletto@gmail.com

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Kathryn Coletto

DePaul University

Abstract

Background/Significance: Operating room fire is included in a category of "never-events" which are preventable and often result in poor patient outcomes. However, there is currently no standard policy amongst industry organizations regarding the inclusion of fire risk in the operative time out, though all organizations recognize that the risk exists.

Purpose: The purpose of this descriptive study was to examine the knowledge and attitudes of anesthesia providers on fire risk assessment during time-out in current clinical practice.

Design: A descriptive, cross-sectional design was used.

Methods: Active members of the Illinois Association of Nurse Anesthetists were asked to participate in an online survey. A modified online survey on demographics, knowledge and attitudes on fire risk assessment during operating room time out was sent to the potential participants.

Results: A total of 140 participants completed the survey in this study. The participants reported that they had positive attitudes and higher rates of knowledges on fire risk assessment during time-out. In the knowledge subscale, the dissemination of information related to fire risk assessment during time out has the lowest mean score among all other variables.

Conclusion: The overall knowledge and attitudes reported by CRNAs and SRNAs related to fire risk assessment during time out was found to be largely positive amongst the participants. However, they still need more education on how to disseminate key information related fire risk assessment during operating room time out to improve fire safety practices for health care professionals in the operating room.

Keywords: Operating room, Fire, Safety, Anesthesia Providers, Time-outs

Introduction

Background and Significance

Patient safety is an important component of health care in the United States. The patient safety initiative lies at the heart of providing excellent quality patient care (Hales & Provonost, 2006). The healthcare industry has borrowed from the military and airline industries in the adoption of checklists to improve the quality of patient care and create more standardized patient care. The checklists incorporate important information, such as allergies and correct surgical site (Hales & Provonost, 2006). Fire safety is a small, but real risk in the operating room. Because the consequences of fire in the operating room are dire, it is reasonable to investigate the inclusion of fire risk to the procedural time-out.

According to the Emergency Care Research Institute or ERCI (2015), an estimated 200 to 240 surgical fires occur annually in the United States. It is difficult to estimate the actual number of surgical fires due to lack of reporting. The rate of operating room fires is comparable to other "never-events" such as wrong-side surgery and retained surgical instruments (ECRI, 2015). Case studies of operating room fires show the consequences can be devastating for patients and caregivers with such fires potentially resulting in disfiguring burns and death. The available research demonstrates the causes of operating room fires are largely preventable.

The fire triad consists of three pieces that must be present in order for a fire to occur: an ignition source, an oxidizer, and fuel (ECRI, 2015). In the operating room, three separate people are usually responsible for each part of the fire triad. Typically, the surgeon is responsible for the ignition source, which is often an electrosurgical unit. The anesthesia provider is responsible for the oxidizer, in many cases oxygen. And the nursing staff is responsible for the fuel, which includes drapes and dressings. Addition of fire risk into the surgical time-out opens lines of

communication between members of operating room staff to discuss how fire can be avoided. Regardless of area of responsibility, the entire team in the operating room is responsible for the safety of the patient.

For many years, the military, specifically aviation, has utilized checklists to ensure proper functioning of equipment and preparation of personnel. In the early days of aviation, the act of flying a plane was not a complicated one. However, the mechanics of aviation became increasingly complicated, necessitating a checklist for pilots to ensure they had performed all necessary checks and listed the necessary steps for a safe flight. In 2009, Haynes et al. published research on implementation of a surgical safety checklist. The researchers, through efforts with the World Health Organization designed a 19-item checklist to be applicable to any facility/team performing the surgery and reduce the rate of surgical complications (Haynes et al., 2009). Implementation of the surgical checklist, just as with any change in practice, would require cultural change at each institution in which it was implemented. Haynes et al. (2009) found that the rate of death before the checklist was used was 1.5% and 0.8% (P=0.003) after implementation of the checklist. Further, the rate of inpatient complications declined from 11% to 7% (P=<0.001) after implementation of the checklist (Haynes et al., 2009). The results of this study conclude that the tool helped to reduce surgical complications. Many surgical complications can be attributed to human error and communication error. A checklist, at its least, allows for open communication between providers.

Currently, it is standard practice for health care providers to perform time-outs prior to any procedure. These time-outs occur at the bedside before a bedside procedure and in procedural areas such as the operating room. Typical “checks” in the time-out include, but are not limited to: patient name and birth date, team members and their role, correct procedure,

correct surgical site, allergy information, and prophylactic antibiotics. These checks help to prevent "never-events" such as wrong-sided surgery and retained surgical instruments. Addition of fire risk to the surgical time-out can help to allow surgical staff to reduce fire risk and improve communication.

In 2006, Upton & Upton published a study validating their tool to assess the knowledge and attitudes on evidence-based practice. Evidence based practice is central to current practice today (Upton & Upton, 2006). Prior to instituting change related to evidence based practice, Upton & Upton (2006) realized the importance of quantifying barriers to practice. Prior to their research in 2006 (Upton & Upton), there was no method of quantifying barriers to evidence based practice. This research attempts to describe the knowledge and attitudes of anesthesia providers in relation to fire risk assessment during time-out.

Purpose of the Project

The purpose of this descriptive survey study was to assess the knowledge and attitudes of certified registered nurse anesthetists (CRNAs) and student registered nurse anesthetists (SRNAs) on fire risk assessment during time-out. The target population for this study included CRNAs and SRNAs who belong to the organization of Illinois Association of Nurse Anesthetists (IANA).

Clinical Questions

The following clinical questions were addressed in this project:

- What is the current knowledge level on fire risk during time-out among CRNAs and SRNAs?
- What are the attitudes on fire risk assessment during time-out among CRNAs and SRNAs?

Conceptual Framework

The conceptual frameworks guiding this research include Mezirow's transformative learning theory (Mezirow, 1997) and Solberg's medical practice change theory (Solberg, 2007). Mezirow (1997) believes that adult learning differs from childhood learning. Adults learn to strengthen their foundation while learning new subject matter (Mezirow, 1997). The adult learning takes new information and incorporates it into their existing knowledge base to transform thinking (Mezirow, 1997). This theory involves presenting new information to a learner and then letting him apply it to his current life (Mezirow, 1997).

Knowledge components are important rather than "courses" or topics. Learning occurs when knowledge components are acquired and applied in relation to other knowledge components that the learner already has. Knowledge is acquired through learning events. The learning can then be evaluated with assessments. However, the success of learning depends on the learner's ability to recall and apply the knowledge in the long-term (Koedinger, 2012).

A conceptual framework was also developed by Solberg (2007) pertaining to the improvement of medical practice. He proposes that practice change must include: priority, change process capability, and care process content in order to improve quality. In order to achieve change, there must be leadership who are involved and engaged and a commonly understood framework (Solberg, 2007).

One of the first steps to effecting change is the acquisition and sharing of knowledge. The information must be presented in a manner, which engages the learner, but also is simple enough to produce knowledge recall. Once the knowledge is acquired, practice change can effectively begin. The learners, armed with knowledge, can choose to make this knowledge and thus process change and priority. The implementation of change will fail if stakeholders do not

have sufficient "buy-in". The knowledge can also help to provide a common understanding between all members involved in the improvement or practice change. When there is sufficient knowledge sharing, priority, capability to change, and care process content, improvements can be made in delivery of care. Educational modules should be created with the adult learner in mind. For instance, new information regarding the risk of fire in the operating room could be presented to the learner. He or she will then have to apply this knowledge to their current practice.

Literature Review

This section reviewed current literature related to patient safety, fire safety in the operating room, and reported fire events in the operating room.

Operating Room's Culture of Safety

The culture of safety in the operating room and current reports of fire safety in the operating room are central to this study. In order to reduce the risk of wrong-sided surgery, the surgeon will frequently sign the side of surgery and verify with the patient and other staff and will verify surgical side on the consent forms. During the procedure, it is common practice for operating room staff to count surgical instruments and dressings twice to ensure that what was placed on the sterile field was placed back on the sterile field after use to reduce risk of retained instruments. Retained surgical instruments are defined as a "never event" and the counting of surgical instruments twice aims to reduce its incidence. Operating room fire is also considered a "never event", but there is currently no standard practice to address the risk amongst members of the health-care team.

The ERCI (2015) has discovered that 74% of operating room fires occur in the presence of an oxygen rich atmosphere. The American Society of Anesthesiologists (ASA) states that the

fire triad, which consists of an oxidizer, an ignition source, and a fuel, must be present for fire to occur in the operating room (2015). In the operating room, oxidizers include oxygen and nitrous oxide. Fuel includes surgical drapes, gauze, dressings, and hair. Ignition sources include electrosurgical units (i.e. cautery) and lasers. These three elements are commonly found in the operating room.

The aviation industry has been using checklists for many years to reduce the risk of human error (Hales & Pronovost, 2006). The medical community has been slower to adopt checklists as a means to reduce the risk of human error. Checklists make users aware of essential criteria that are involved in a particular task. Checklists are commonly used in hospitals when inserting central lines, weaning mechanically ventilated patients, and discussing daily goals of patient care. In operating rooms, a time-out is performed prior to initiation of surgical procedures. In surgical time-outs, patient name, date of birth, allergies, procedure to be performed, and administration of pre-operative antibiotics are discussed, among other items that are often institution specific. In the critical care arena, use of checklists has been shown to reduce ICU length of stay, infection rates, and ventilator-days (Hales & Pronovost, 2006).

Reported Fire Accidents in the Operating Room

In 2009, Moskowitz discussed a case report of an operating room fire during open-heart surgery. The patient involved in this operating room fire had a history of pulmonary blebs (Moskowitz, 2009). After intubation, the anesthesia provider encountered difficulty attaining adequate tidal volumes and increased gas flow to achieve necessary tidal volumes. This information was not communicated to the surgeon. The surgeon notified the team when he noted that the patients' pulmonary blebs were leaking and attempted to fix the issue by covering them with saline soaked gauze. When the gauze dried, a surgical fire occurred in the field, ignited by

electrocautery, which was extinguished by the surgical team (Moskowitz, 2009). In this case, there was no harm to the patient. Further review of the incident revealed that a lack of communication between providers might have been involved in the development of the fire. The reviewer determined that more effective team communication might have prevented the fire (Moskowitz, 2009). This case report highlights the importance of communication between the surgical team in reducing fire risk in the operating room.

Batra & Gupta (2008) wrote a case report of operating room fire attributed to alcohol based surgical prep that had not been allowed to dry completely. The vapors from an alcohol based prep solution were ignited with activation of an electrocautery unit (Batra & Gupta, 2008). The flames were noticed immediately and the patient suffered minor burns to the neck and chest. The event discussed in the case report prompted a practice change at this institution and strict adherence to drying times is now practiced (Batra & Gupta, 2008).

Because operating room fires are relatively rare, little research other than case reports exist in the literature. Aspects of operating room fire have been studied, however. Van Cleave et al. (2014), conducted research related to use of intraoral suction as a means to reduce risk of fire in the operating room related to dental surgery. The study found that without intraoral suction a “pop” and “flash” were more likely to appear (VanCleave et al., 2014). Further, in cases where a flame was observed, the duration of the flame was reduced when intraoral suction occurred (VanCleave et al., 2014). Culp, Kimbrough and Luna (2013) performed a study of fuel sources for operating room fires in varying oxygen concentrations. This study found that a statistically significant decrease in time to ignition exists as oxygen concentration increases. They also point out that surgical gowns are required to meet textile flammability standards and surgical drapes are not; however, surgical drapes are implicated in 81% of operating room fires

(Culp, Kimbrough, & Luna, 2013).

Mehta, Bhananker, Posner, and Domino (2013) performed a closed claims analysis using the ASA Closed Claims Project database, related to operating room fires. The closed claim analysis illustrated the situations in which operating room fires occur, and demonstrated that most operating room fires occurred during monitored anesthesia care (MAC), where the oxygen source, often an nasal cannula, is typically open to the environment (Mehta et al., 2013). Oxygen was the most common oxidizer, found to be in use in 95% of the cases reported in the Closed Claim Analysis database. Cautery was determined to be the most frequent ignition source of operating room fires. Operating room fires were also found to be more common in outpatient procedures (Mehta et al., 2013). The Closed Claim Analysis database is limited in that the total number of operating room fires is likely not the number of fires that actually occurred, as these are not mandatorily reported. The number of anesthetics delivered is also not reported. Nonetheless, this closed claim analysis does provide valuable information related to factors that increase the risk of operating room fires.

In 2003, two operating room fires occurred at Christiana Care Health System (CCHS) in Newark, Delaware (Carlson & Rice, 2014). This prompted CCHS to create their own fire risk assessment, do extensive training of operating room staff, conduct operating room fire drills, and incorporate fire risk into their operative time-out (Carlson & Rice, 2013). CCHS has made their materials publicly available for use. Between 2009 and 2010, the Cleveland Clinic reportedly had 6 operating room fires occur (Suchetka, 2010). CEO, Toby Cosgrove, reported that the fires came to light during a visit from the Centers for Medicare & Medicaid Services (Suchetka, 2010). Upon recommendations from the Centers for Medicare & Medicaid services, alcohol based preps, believed to be the cause of the fires, were removed from the operating rooms and

staff was required to complete a 30 minute training prior to return to the operating room (Suchetka, 2010).

In 2004, Jane Flowers published her experience with OR fire drills. Based on the 2003 recommendations of the Joint Commission, they created a plan for a fire drill during a scheduled staff meeting. Staff was educated with an hour-long educational component. Staff discussed the fire drill at another staff meeting the following week (Flowers, 2004). Flowers (2004) reported that staff members felt more competent in handling fires and it emphasized the importance of communication in emergencies.

Appendix E includes a summary table of current operating room related research on fire assessment; currently most of the data are case studies and information on flammability of materials in the OR.

Operating Room Fire Safety Guidelines and Recommendations

The ASA published a practice advisory related to operating room fires. The ASA was unable to publish a guideline or standards due to the lack of controlled studies related to fire in the operating room. The ASA does delineate high-risk procedures as the following: one in which an ignition source comes into close proximity to an oxidizer (ASA, 2015). The practice advisory delineates steps for dealing with fires in the operating room. The ASA also recommends that the entire team should discuss each case and if a risk for fire exists. A common theme in the practice advisory is effective communication between members of the operating room team (ASA, 2015).

The Association of periOperative Registered Nurses (AORN) has also published a guidance statement with respect to fire in the operating room. The AORN (2005) suggests performing operating room fire drills to allow staff to practice the roles they would perform if an operating room fire occurred. The AORN, in their guidance statement, emphasizes the

importance and need for education for all members of the operating room team with respect to fire in the operating room (AORN, 2005).

In summary, the existence of fire triad in the OR is well recognized in the literature. Based on case reports and information from insurance claims, there seem to be clear situations in which OR fires occur. The US Food and Drug Administration (2015) recommends fire safety practices for health care professionals in the OR. There is not, however, a standard of care for dealing with the existence of OR fire risk. There is a paucity of literature regarding incorporation of fire risk assessment into the operative time out. Practice standards do not exist for fire risk, though there are recommendations from industry organizations. Health-care has borrowed checklist mentality from the military and aviation industries, in which they can incorporate awareness of fire risk.

Methods

Research Design

This study used a descriptive, cross-sectional survey design to assess the knowledge and attitudes of CRNAs and SRNAs regarding fire risk assessment during time out.

Sample

The participants in the study included CRNAs and SRNAs who are active members of the Illinois Association of Nurse Anesthetists (IANA). Exclusion criteria for the study included participants less than eighteen years of age and anesthesiologists. Inclusion criteria for the study included CRNAs and SRNAs in current clinical practice that consent to participate in the study. There are approximately 1,617 members of the IANA. There are 1,384 CRNA members and 233 SRNA members of the IANA. In a typical online survey, a 30% response rate could be expected, or 485 completed surveys, based on the systematic review by Cook, Heath, Thompson (2000) on web- or Internet-based surveys. In this study, a power analysis estimated that a

sample of 112 subjects (mean difference of .2; SD of .75) have 80% power to detect statistically significant differences between dichotomous groups at 0.05 alpha level (2 tailed test) using independent samples T test statistic. This study recruited a number of participants beyond the accrual goal of 112 subjects with a total sample of N=166.

Setting

The executive director of the Illinois Association of Nurse Anesthetists distributed an email to active members with a link to the online survey using Qualtrics. The survey was reviewed by the IANA student reviewer before it was distributed. Participants completed the survey on any computer or mobile device of their choice.

Instruments

The online survey containing three sections was used: sociodemographic information, assessment of knowledge, and assessment of attitudes related to fire risk assessment during time-out. Sociodemographic information included gender, age, ethnicity, education, and years of work experience. Demographic information was be collected for sub-group analyses and to determine if there are correlations between a discrete sociodemographic variable and the level of knowledge or attitudes on fire risk assessment during OR time-out. The second part of the online questionnaire is essentially a needs assessment to inquire about the current clinical practice of incorporating fire risk assessment in the procedural OR time-out (**Appendix A**).

Overall, the online survey had 23 questions that included five demographic information, five attitudinal questions and thirteen knowledge of fire safety questions, and on average, it took less than fifteen minutes to complete. The knowledge and attitude questions used in this study were modified from the original questionnaire developed by Upton and Upton (2006) and modified to fit the context of the current study. The original questionnaire has been validated

and found to be highly reliable (Upton & Upton, 2006). Cronbach's α was 0.87 for the questionnaire when tested among a population of 500 nurses from the United Kingdom (Upton & Upton, 2006). Minor modifications of the questionnaire's items have been performed to fit the context of the current study. The modifications of the questionnaire were reviewed by three nursing faculty members for its clarification and content validity.

Recruitment Procedures

The target population of CRNAs and SRNAs was approached via recruitment email distributed by the IANA. An email was sent to members of the IANA containing an information sheet that includes: the purpose of the study, information about privacy, rights of study participants, ability to cease participation in the study without penalty, and information regarding how to reach the investigators (Appendix C). Consent to participate in the study was implied by completing the Qualtrics online study. Participation was anonymous and voluntary.

Data Collection Procedures

The executive director of the IANA was contacted via email for permission to disseminate survey. The survey was also reviewed by the student reviewer of the IANA. Once approval from the IANA was obtained, an email was distributed by the IANA and included a link to the online survey. 1,617 CRNAs and SRNAs were included on the recruitment email distributed by the IANA. Data was collected through the online survey using Qualtrics. After meeting the goal of study subjects' accrual, data was downloaded automatically from Qualtrics as an SPSS format file. A master file was made and was retained on a password-protected computer. All data are expected to be de-identified given that the Qualtrics survey is set up as an anonymous survey with no IP address collected during the online survey.

Follow-up Procedures

Following the initial assessment of the current knowledge and attitudes regarding fire risk assessment during OR time-out, a research-based educational module incorporating fire risk into the procedural OR time-out may be developed if a need is determined to be present. The educational program will be online and will include information regarding fire risk in the operating room and the addition of fire risk to the standard OR time-out. The current OR time-out includes a checklist with items (e.g., surgical site, etc.) that OR staff must discuss prior to initiation of a surgical procedure.

Analytic Procedure

Using SPSS version 23 (SPSS Inc., 2015), descriptive statistics using means, standard deviation, frequencies, and percentages were used to analyze the data on knowledge and attitudes of the respondents on OR fire risk. The underlying hypothesis of this study states that there is no difference in the knowledge level and attitudes means between dichotomous categories of socio-demographic variables. ANOVA was used to examine the statistical difference in the knowledge and attitudes mean scores of three or more groups.

Human Subject Protections

This study received Institutional Review Board approval from DePaul University. The questionnaires did not contain any personal identifiable information. Data was collected online. Any printed records were kept in a locked cabinet located in a locked and secured room of the principal investigator. Any electronic records were kept on a computer that is password-protected at all times. There were no direct benefits for the study participants for their participation on this research project.

Results

Sample Characteristics

Of the 1,617 CRNAs and SRNAs who were included on the recruitment email distributed by the IANA, 166 participants chose to take the survey with an overall response rate of 10.3%. Twenty-six survey responses were discarded due to being less than 50% completed. A total of 140 participants completed surveys were used for analysis. Despite the low survey response rate, the number of responses required 112 sample size to test the hypotheses was reached.

The socio-demographic data of the samples are described in frequencies and cumulative frequencies as shown in Table 1. Sixty-five percent of the respondents (n=91) were female and the remaining thirty-percent (n=48) were male. 50.7% of respondents (n=71) were over the age of 50 with the remaining 69 respondents between 20 and 49. The study sample population was homogenous with regard to ethnicity, 93.6% (n=131) identified themselves as "white." Forty five percent (n=63) of respondents indicated that they had greater than twenty years of experience, 23.6% (n=33) of respondents have practiced 11-20 years, 16.4% (n=23) have practiced 6-10 years, and 15% (n=21) have practiced 0-5 years. Among respondents, 17.1% (n=24) have an associate's or baccalaureate degree, 69.3% (n=97) have a master's degree, and 13.6% (n=19) have a doctoral degree.

Table 1. Sociodemographic Characteristics of Study Participants (N=140)

Variables	Frequencies	Percentage
Gender		
Female	91	65%
Male	48	35%
Age		
60 years old and above	29	20.7%
50-59 years old	42	30%
40-49 years old	25	27.9%
30-39 years old	25	17.8%
20-29 years old	5	3.6%
Ethnicity		
Mixed Race	1	0.7%
Asian/Pacific Islander	3	2.2%

Black/African American	2	1.4%
Hispanic/Latino	2	1.5%
White	131	94.2%
Years of Experience		
> 20 years	63	45%
11-20 years	33	23.6%
6-10 years	23	16.4%
0-5 years	21	15%
Level of Education		
Associate and Baccalaureate	24	17.1%
Masters Degree	97	69.3%
Doctorate – DNP, PhD	19	13.6%

Knowledge and Attitudes on Fire Risk Assessment

Overall, the knowledge and attitudes of the respondents were largely positive. Table 2 shows the mean scores of each item on the knowledge and attitude scale. The first five questions assessed the respondents' attitude toward fire risk assessment during time out. For the attitude based questions, a Likert-type scale was used for the responses to the questions as follows: (1) Strongly Agree, (2) Agree, (3) Neutral, (4) Disagree, and (5) Strongly Disagree. The item with the highest mean score (4.39), indicating a positive attitude was the following: "Fire risk assessment during time out is a waste of my time." The attitude item with the lowest mean score (3.91) was "I stick to tried and trusted methods on fire risk assessment but not during time-out."

The participants were asked to answer the questions assessing the knowledge related to fire risk assessment during time out (Table 3). For these knowledge assessment items the following two Likert-type scales used: (1) Poor, (2) Below Average, (3) Average, (4) Above Average, and (5) Excellent and (1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree, and (5) Strongly Agree. For the knowledge-based questions, a higher mean is associated with more knowledge regarding fire risk assessment during time out. The item with the highest mean score

(4.11) was, “I am able to determine how useful fire risk assessment during time out is to clinical practice.” The item with the lowest mean score (2.99) was, “I disseminate new ideas related to fire risk assessment during time out with my colleagues.”

Table 2. Mean Score of Each Item on the Attitude Scale

Questionnaire Items	Mean	Std. Deviation
-My workload is too heavy so I don't have time for fire risk assessment during time-out.	4.36	.743
-I don't believe fire risk assessment is necessary during time-out for nurse anesthesia practice.	4.30	.996
-I resent having a continuing education on fire risk assessment in relation to time-out.	4.18	.898
-Fire risk assessment during time-out is a waste of my time.	4.39	.826
-I stick to tried and trusted methods on fire risk assessment but not during time-out.	3.91	1.108

Table 3. Mean Score of Each Item on the Knowledge Scale

Questionnaire Items	Mean	Std. Deviation
-My research skills in obtaining information on fire risk assessment during time out is:	3.55	.911
-My information technology (IT) skills related to fire risk assessment during time out is:	3.42	.883
-I monitor and review the current standards on fire risk assessment during time out.	3.49	1.281
-I know how to meet my information needs on fire risk assessment during time out.	3.91	.920
-I am aware of major information types and sources related to fire risk assessment during time out.	3.76	.974
-I am able to identify gaps in my professional practice pertaining to fire risk assessment during time out.	3.80	.824
-I am knowledgeable on how to retrieve information on fire risk assessment during time out.	3.98	.766

-I am able to critically analyze the set standards fire risk assessment during time out.	3.92	.816
-I am able to determine how valid (close to the truth) are the data related to fire risk assessment during time out.	3.88	.742
-I am able to determine how useful fire risk assessment during time out to clinical practice:	4.11	.691
-I share ideas and information on fire risk assessment during time out with my colleagues.	3.48	1.245
-I disseminate new ideas related to fire risk assessment during time out with my colleagues.	2.99	1.299

Sociodemographic Variables Effect on Knowledge and Attitudes

The ages of the respondents were divided into two groups, those who were between the ages of 20 and 49 and those who were 50 years of age and older (Table 3). The mean scores of their attitude toward fire risk assessment during time out were analyzed using independent sample T-tests. It was found that there was no statistically significant difference in the attitudes regarding fire risk assessment during time out between the two age groups. Regarding the mean scores on knowledge related to fire risk assessment during time out, it also was determined that there was no statistically significant difference in the respondents' knowledge of fire risk assessment during time out according to age groups (Table 4).

Table 4. Gender and Age Differences in Knowledge and Attitudes (T Test)

	T test values	df	P value
Attitude Male (mean = 4.09) Female (mean= 4.23)	-.961	137	.338
Attitude Mean Score 20-49 years old. (mean = 4.13) 50 years old and older (mean = 4.24)	-.738	138	.462
Knowledge Mean Score	1.093	137	.276

Male (mean = 3.77) Female (mean = 3.64)			
Knowledge Mean Score 20-49 years old (mean = 3.65) 50 years old and older (mean = 3.74)	-.711	138	.478

The knowledge and attitude mean scores were also analyzed using independent sample T-tests with respect to the gender of the respondents. There was no statistically significant difference in attitude or knowledge scores between male and female study participants.

An analysis of variance (ANOVA) was completed to compare the responses of the study participants with regard to educational level and years of experience (Table 5). The ANOVA revealed that there was no statistically significant difference in knowledge or attitude regarding fire risk assessment during time out among study participants with varying levels of experience or different levels of education. The study sample was homogenous with respect to ethnicity, so no tests were performed for this variable. The Cronbach's alpha for the online survey tool was 0.896 indicating good reliability of the modified instrument used for this current study.

Table 5. Analysis of Variance Comparing Means of Education Levels and Clinical Experience,

ANOVA			
Attitude Mean Score By Years of Clinical Experience			
	df	F	P value
Between Groups	3	1.221	.304
Within Groups	136		
Attitude Mean Score by Educational Levels			
Between Groups	2	.369	.692
Within Groups	137		
Knowledge Mean Score by Years of Clinical Experience			
Between Groups	3	.177	.912
Within Groups	136		

Knowledge Mean Score by Educational Levels			
Between Groups	2	2.032	.135
Within Groups	137		

Discussion

This study assessed the knowledge and attitude of CRNAs and SRNAs with regard to fire risk assessment during time out. The participants of the study included CRNAs and SRNAs who are members of the IANA. The attitudes across all participants were positive with mean score of 4.23 out of 5. The knowledge across all sociodemographic groups was also higher. No studies regarding the knowledge and attitude of CRNAs and SRNAs were found during the literature review for comparison to this study. There is no current standard procedure implemented regarding the assessment of fire risk in the operating room, though several industry groups have published best practice recommendations. While most facilities currently include a time out into procedures, they do not include fire risk in this assessment. The results of the study suggest that CRNAs and SRNAs would incorporate fire risk assessment into their current time out procedures.

The results of the study suggest that CRNAs and SRNAs are already considering fire risk while in the operating room. Further, the results suggest that CRNAs and SRNAs would be open to formally including the fire risk assessment into current time out practices. This study also revealed that including dissemination of fire risk assessment during time out is needed to improve patient safety and to create a safe working environment for health care providers. In order for to affect successful change in clinical practice, there must be buy-in from key players. The results of this survey suggest that CRNAs and SRNAs would be supportive of the inclusion of fire risk assessment during time out. The inclusion of fire risk during a time out aims to improve patient safety. To our knowledge, this is the first study that examined the knowledge

and attitudes of CRNA and SRNA on fire risk assessment, which precludes any comparison from previous studies.

Limitations

The study participants included only CRNAs and SRNAs in the state of Illinois, so the results may not be generalizable across other geographic locations. The survey also only assessed the knowledge and attitudes of CRNAs and SRNAs and did not include other anesthesia providers such as anesthesiologists and anesthesiology assistants. Because of differences in the education process between the different types of anesthesia providers, there may be differences in the knowledge and attitudes between types of providers. Because the sample is composed primarily of Caucasian descent, the effect of ethnicity on knowledge and attitude can't be ascertained. Finally, single-information self-report methodology is another limitation of this study.

Future Direction for Research

Future research can be directed towards the feasibility of including fire risk assessment in the operative time out. Currently, no standard practice exists for addressing fire risk in the operating room. Future research could aim to standardize the fire risk assessment in the operating room all across the entire United States. Future studies aimed at examining potential barriers to fire risk assessment during time out is warranted prior to full implementation.

Implication for Practice

The results of this survey indicate that CRNAs and SRNAs have a positive attitude toward the inclusion of fire risk assessment during time out. Furthermore, the survey results also indicate that CRNAs and SRNAs have a self-reported good knowledge base related to fire risk assessment during time out. This suggests that there should be no major barrier from these

anesthesia providers to inclusion of this risk assessment during time out. However, there is no current standard procedure implemented regarding the assessment of fire risk in the operating room. Going forward, a standard of practice should be developed to ensure that fire risk is assessed for surgical procedures.

Conclusion

Fire risk is a rare, but real, risk in the operating room. Operating room fires occur at the same rate as other "never events", but may be underreported. One of the ways to raise awareness would be to discuss fire risk during the standard operating room time out. This study assessed the knowledge and attitudes of CRNAs and SRNAs related to fire risk assessment during time out. This study found that those CRNAS and SRNAs were very knowledgeable and have positive attitudes, indicating they were aware of the importance of fire risk in the operating room. To improve fire safety practices for health care professionals in the operating room, there is a need to develop a standard to include fire risk to the procedural time-out with dissemination of new information related fire risk.

References

American Association of Nurse Anesthetists. (2015). *Who we are.* Retrieved October 23, 2015, from http://www.aana.com/aboutus/Pages/Who-We-Are.aspx

American Society of Anesthesiologists. (2015). *Operating room fires.* Retrieved October 23, 2015, from https://www.asahq.org/Lifeline/Anesthesia%20Topics/Operating%20Room%20Fires.aspx

Arefiev, K. (2012). Flammability of topical preparations and surgical dressings in cutaneous and laser surgery : A controlled simulation study. *Journal of the American Academy of Dermatology, 67*(4), 700-705.

Association of periOperative Registered Nurses. (2005). AORN guidance statement fire prevention in the operating room. *AORN Journal, 81*(5), 1067-1075.

Batra, S., & Gupta, R. (2008). Alcohol based surgical prep solution and the risk of fire in the operating room: A case report. *Patient Safety in Surgery, 2*(10). doi: 10.1186/1754-9493-2-10.

Carlson, J., & Rice, S. (2014, June 14). *Patient-safety advocates issue call for regulation*. Retrieved from http://www.modernhealthcare.com/article/20140614/MAGAZINE/306149779

Cook, C., Heath, F., Thompson, R.L. (2000). A meta-analysis of response rates in web- or internet-based surveys. *Educational and Psychological Measurements, 60*(6), 821-836.

Culp, W. C. Jr., Kimbrough, B. A., & Luna, S. (2013). Flammability of surgical drapes and materials in varying concentrations of oxygen. *Anesthesiology, 119*(4), 770-776. doi: 10.1097/ALN.0b013e3182a35303

Emergency Care Research Institute. (2015). *Surgical fire prevention.* Retrieved October 23, 2015, from https://www.ecri.org/Accident_Investigation/Pages/Surgical-Fire-Prevention.aspx

Flowers, J. (2004). Code red in the OR – implementing an OR fire drill. *Association of Operating Room Nurses Journal.* 79(4), 797-805.

Hales, B. M., & Pronovost, P. J. (2006). The checklist - a tool for error management and performance improvement. *Journal of Critical Care, 21*(3), 231-235.

Haynes, A. B., Weiser, T. G., Berry, W. R., Lipsitz, S. R., Breizat, A. S., Dellinger, E. P., ... Gawande, A. A. (2009). A surgical safety checklist to reduce morbidity and mortality in a global population. *The New England Journal of Medicine, 360*(5), 491-499.

Koedinger, K. R., Corbett, A.T., & Perfetti, C. (2012). The Knowledge-Learning-Instruction (KLI) framework: Toward bridging the science-practice chasm to enhance robust student learning. *Cognitive Science,* 36(5), 757-798.

Mehta, S. P., Bhananker, S.M., Posner, K.L., & Domino, K.B. (2013). Operating room fires: A closed claims analysis. *Anesthesiology, 118*(5), 1133-1139. doi: 10.1097/ALN.0b013e3182afa7b

Mezirow, J. (1997). Transformative learning: Theory to practice. *New Directions for Adult and Continuing Education, 1997*(74), 5-12.

Moskowitz, M. (2009). Fire in the operating room during open heart surgery: A case report. *American Association of Nurse Anesthetists Journal, 77*(4), 261-264.

Smith, L.P. & Roy, S. (2011). Operating room fires in otolaryngology: Risk factors and prevention. *American Journal of Otolaryngology, 32*(2), 109-114.

Solberg, L. I. (2007). Improving medical practice: A conceptual framework. *Annals of Family Medicine, 5(3),* 251-256.

SPSS Inc. (2015). *Predictive analytic software (PASW) statistics 23*. Chicago, IL: SPSS Inc.

Stouffer, D.J. (1992). Fires during surgery: Two fatal incidents in Los Angeles. *Journal of Burn Care and Rehabilitation, 13*(1), 114-117.

Suchetka, D. (2010). *Cleveland Clinic reports six operating room fires in past year, three patients injured.* Retrieved October 25, 2015, from http://blog.cleveland.com/metro/2010/05/clinic_reports_six_operating_r.html

Upton, D., & Upton, P. (2006). Development of an evidence-based practice questionnaire for nurses. *Journal of Advanced Nursing*, *53*(4), 454-458.

US Food and Drug Administration. (2015). *Recommendations for healthcare professionals on preventing surgical fires.* Retrieved October 23, 2015, from http://www.fda.gov/Drugs/DrugSafety/SafeUseInitiative/PreventingSurgicalFires/ucm270636.htm

VanCleave, A. M., Jones, J. E., McGlothlin, J. D., Saxen, M. A., Sanders, B. J., & Vinson, L. A. (2014). The effect of intraoral suction on oxygen-enriched surgical environments: A mechanism for reducing the risk of surgical fires. *Anesthesia Progress, 61*(4), 155-161.

Appendix A. Knowledge and Attitudes Survey on Fire Risk Assessment During Time-out Among Anesthesia Providers

1. My workload is too heavy so I don't have time for fire risk assessment during time-out.

    1 - strongly agree 2 - agree 3 - neutral 4 - disagree 5 - strongly disagree

2. I don't believe fire risk assessment is necessary during time-out for nurse anesthesia practice.

    1 - strongly agree 2 - agree 3 - neutral 4 - disagree 5 - strongly disagree

3. I resent having a continuing education on fire risk assessment in relation to time-out.

    1 - strongly agree 2 - agree 3 - neutral 4 - disagree 5 - strongly disagree

4. Fire risk assessment during time-out is a waste of my time.

    1 - strongly agree 2 - agree 3 - neutral 4 - disagree 5 - strongly disagree

5. I stick to tried and trusted methods on fire risk assessment but not during time-out.

    1 - strongly agree 2 - agree 3 - neutral 4 - disagree 5 - strongly disagree

6. My research skills in obtaining information on fire risk assessment during time out is:

    1 - poor 2 - below average 3 - average 4 - above average 5 - excellent

7. My information technology (IT) skills related to fire risk assessment during time out is:

    1- poor 2 - below average 3 - average 4 - above average 5 - excellent

8. I monitor and review the current standards on fire risk assessment during time out.

    1 - never 2 - rarely 3 - every once in a while 4 - sometimes 5 - almost always

9. I know how to meet my information needs on fire risk assessment during time out

    1-strongly disagree 2 - disagree 3 - neutral 4 - agree 5 - strongly agree

10. I am aware of major information types and sources related to fire risk assessment during time out.

1 - strongly disagree 2 - disagree 3 - neutral 4 - agree 5 - strongly agree

11. I am able to identify gaps in my professional practice pertaining to fire risk assessment during time out.

1 - strongly disagree 2 - disagree 3 - neutral 4 - agree 5 - strongly agree

12. I am knowledgeable on how to retrieve information on fire risk assessment during time out.

1 - strongly disagree 2 - disagree 3 - neutral 4 - agree 5 - strongly agree

13. I am able to critically analyze the set standards fire risk assessment during time out.

1- strongly disagree 2- disagree 3- neutral 4- agree 5- strongly agree

14. I am able to determine how valid (close to the truth) are the data related to fire risk assessment during time out.

1 - strongly disagree 2 - disagree 3 - neutral 4 - agree 5 - strongly agree

15. I am able to determine how useful fire risk assessment during time out to clinical practice:

1 - strongly disagree 2 - disagree 3 - neutral 4 - agree 5 - strongly agree

16. I share ideas and information on fire risk assessment during time out with my colleagues.

1 - never 2 - rarely 3 - every once in a while 4 - sometimes 5 - almost always

17. I disseminate new ideas related to fire risk assessment during time out with my colleagues.

1 - never 2 - rarely 3 - every once in a while 4 - sometimes 5 - almost always

Appendix B. Demographic Information Questionnaire

1. What is your gender?

( ) Male

( ) Female

2. What is your age group?

( ) 20-29

( ) 30-39

( ) 40-49

( ) 50-59

( ) 60 and above

3. What is your ethnic origin?

( ) White

( ) Hispanic/Latino

( ) Black/African American

( ) Native American/American Indian

( ) Asian/Pacific Islander

( ) Mixed Race

4. How many years of clinical nursing experience did you have?

( ) <1 year

( ) 1-5 years

( ) 6-10 years

( ) 11-20 years

( ) >20 years

5. What is your education level?

( ) Associate degree

( ) Baccalaureate

( ) Masters

( ) Doctorate - DNP, PhD

Appendix C:

Dear IANA Member,

My name is Katie Coletto, and I am a student at NorthShore University HealthSystem School of Nurse Anesthesia. I am conducting research toward a Doctor of Nursing Practice degree at DePaul University. You are receiving this letter as a member of the IANA.

The goal of this survey is to identify knowledge and attitudes related to fire risk assessment during time-out. This survey will benefit anesthesia providers by assessing attitudes and knowledge of fire risk assessment during time-out.

Your participation in this study is completely voluntary and you may withdraw at any time. There will be no compensation for your participation. If you do not wish to participate, please disregard this e-mail.

The nature of this survey design assumes that completion of the survey implies agreement to participate. The link provided below will take you to the survey. I have used a third party survey website, which will ensure that anonymity is maintained.

Please see attached Information Sheet for additional information regarding this study.

Thank you,

Katie Coletto, MS, RN
NorthShore University HealthSystem
School of Nurse Anesthesia
DePaul University
Nurse Anesthesia Trainee- 3

Appendix D:

INFORMATION SHEET FOR PARTICIPATION IN RESEARCH STUDY

Anesthesia Providers Knowledge and Attitudes on Fire Risk Assessment in the Operating Room

Principal Investigator: Katie Coletto, Graduate Student, DePaul University School of Nursing

Institution: DePaul University, USA

Faculty Advisor: Joseph Tariman, PhD, ANP-BC, School of Nursing

Research Team: Karen Kapanke, CRNA, MS and Young-Me Lee, PhD, RN

We are conducting a research study because we are trying to learn more about fire risk assessment in the operating room. We are asking you to be in the research because you are an anesthesia provider. If you agree to be in this study, you will be asked to complete an online survey. The survey will include questions about fire risk assessment in your anesthesia practice. We will also collect some personal information about you such as education completed, primary practice location. "If there is a question you do not want to answer, you may skip it.

This study will take about 10 minutes of your time. Research data collected from you 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 the study.
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

If you have questions, concerns, or complaints about this study or you want to get additional information or provide input about this research, please contact: Katie Coletto, kcoletto@gmail.com or 847-420-0916.

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.