RECYCLING IN THE OPERATING ROOM: ASSESSING UNDERSTANDING THROUGH
THE PERSPECTIVE OF THE ANESTHESIA PROVIDER

By

James Reilly and Jeffrey Tinen

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DNP Capstone Project Approval Form

This is to certify that James Reilly

(Name of Student)

successfully defended his/her Capstone project entitled:

Recycling in the Operating Room: Assessing Understanding through the Perspective of the Anesthesia Provider

on November 29, 2018.

(Date)

Capstone Faculty Advisor
Loralee Sessanna, DNS, CNS, AHN-BC

(Typed Name)

(Signature)

Committee Member 1*

(Typed Name)

(Signature)

Committee Member 2*

(Typed Name)

(Signature)

Committee Member 3*

(Typed Name)

(Signature)

*If applicable
DNP Capstone Project Approval Form

This is to certify that Jeffrey Tiné
(Name of Student)

successfully defended his/her Capstone project entitled:
Recycling in the Operating Room: Assessing Understanding through the Perspective of the Anesthesia Provider

on November 29, 2018 (Date)

Capstone Faculty Advisor
Loralee Sessanna, DNS, CNS, AHN-BC
(Required)

(Required)

Committee Member 1*

Committee Member 2*

Committee Member 3*

*If applicable
# TABLE OF CONTENTS

Abstract.................................................................5  
Acknowledgements....................................................6  
Background...............................................................7  
Significance...............................................................7  
Purpose.................................................................9  
Theoretical Framework..................................................10  
Literature Review.......................................................13  
Methods.................................................................22  
Results.................................................................30  
Discussion and Recommendations....................................47  
Strengths and Limitations.............................................48  
Ethical Considerations..................................................49  
References...............................................................51  

# APPENDICES

Appendix A Recruitment Email......................................56  
Appendix B Recruitment Poster....................................58  
Appendix C Survey Monkey Standardized Introduction...........60  
Appendix D Survey Monkey Survey................................62  
Appendix E Semi-Structured Interview Questionnaire..............65  
Appendix F Educational Intervention Guideline..................69  
Appendix G Proposed Policy Recommendation......................71  
Appendix H Focus Group Themes.................................74
| Appendix I Figure 1. Thematic Map | .............................................................................. 77 |
|-----------------------------------|------------------------------------------------------------------------------------------------|---|
| Appendix J IRB Approval           | .............................................................................. 79 |
| Appendix K Poster                | .............................................................................. 82 |
Abstract

Operating rooms (ORs) are high contributors to toxic waste that pollutes the environment. Alarming trends show increased incidence of chronic diseases resulting from human exposure to toxins and industrial pollutants. Anesthesia providers can help optimize waste management strategies including recycling in the OR. However, little is known about anesthesia providers’ knowledge and attitudes regarding recycling in the OR. The objective of this project was to identify barriers and facilitators to recycling in the OR as perceived by anesthesia providers. The purpose of this project was to address the question, would creating a waste management and recycling program protocol and educational guideline promote acceptance and increased knowledge and understanding regarding the benefit of recycling in the OR compared to the current waste management and recycling practice. Lewin’s three-step model of planned change was utilized as the theoretical framework. This mixed-methods study incorporated an anonymous online survey and two focus group interviews. Eighty-nine percent of survey respondents indicated that sustainability should be a key focus for the hospital, yet only 11% indicated that environmental sustainability was included in their formal educational training. A convenience sample of 16 providers attended one of two focus group interviews. Braun and Clark’s (2006) thematic analysis (TA) method was utilized. Themes of Barriers, Awareness, and Championing Best Practice were identified. Findings from the survey and focus group interviews were used to develop policy recommendations and educational guidelines. Further investigation into recycling in the OR is warranted in order to reduce waste and promote public health.
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I would like to extend my appreciation to those involved with this project. Thank you to the anesthesia providers who took time from their busy schedules to offer their insight into this important topic. It is my hope that this project has helped inspire a meaningful step toward environmental sustainability in the OR.

I would like to acknowledge my project partner and colleague, Jeffrey Tinen. Thank you for all of your hard work and for elucidating recycling in the OR as a necessary component of proper waste stream management. It was a pleasure working with you.

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Thank you to all of my friends, family, and University at Buffalo School of Nursing faculty who offered their ideas and encouragement on this project. Finally, I would like to express my deep appreciation for my wife, Kristie. Your love and support carried me through this endeavor.
In the United States (U.S.), the health care sector is the second leading contributor of waste, producing 112 billion kilograms of waste annually, with an estimated yearly disposal cost of approximately $10 billion (Martin, Yanez, & Treggiari, 2017). Waste resulting from anesthesia services contributes to an estimated 25% of total U.S. operating room waste (Mcgain, Jarosz, Nguyen, Bates, & O’Shea, 2015; American Society of Anesthesiologists [ASA], 2017). ORs are high contributors to waste streams, or “discarded materials and fluids that eventually return to the land, water system, or air through sewer, landfill, or incineration” (Association of periOperative Registered Nurses [AORN], 2014, p.3). Public health data in the past 10 years show alarming trends in increased incidence of chronic diseases affecting human neurologic, reproductive, and endocrine systems resulting from waste stream exposure to toxic chemicals and industrial pollutants (AORN, 2014, p.2). According to the AORN (2014) position statement on environmental responsibility, perioperative health care providers have an ethical and professional responsibility to advocate for and protect the environment since population health and well-being are directly affected by one’s surrounding environment. The AORN (2014) strongly maintained that perioperative teams need to serve as environmental stewards to conserve natural resources by adopting environmentally sound policies and practices that reduce waste and hazardous material exposure.

**Project Significance**

As a matter of public and global concern, the “greening” of U.S. industry has grown increasingly important (Kogama, Stall, Rubinstein, & Naudie, 2012; Wormer et al., 2013, p.1). A survey conducted by Ard, Tobin, Huncke, Kline, Ryan and Bell (2016) revealed that only 27.7% of ORs in the U.S. actively recycle. The U.S. healthcare sector contributes to nearly 10% of the nation’s greenhouse gas emissions that are a direct result of improper medical waste
RECYCLING IN THE OPERATING ROOM

disposal (Sherman & McGain, 2016). It is estimated that 150,000 patients die each year from climate change related disease around the world including cardiovascular disease, asthma and respiratory disease, infectious disease, compromised food and water security, increased weather disturbances, and threats to blood supply through changing vectors for blood borne illness (Sherman & McGain, 2016). Disturbingly, the rate of death from negative climate change is expected to reach 500,000 by the year 2050 if climate change is left unchecked (Sherman & McGain, 2016). Implementing robust recycling practices as part of a responsible waste management initiative reflects both sound business practice, as well as much needed environmental stewardship.

An abbreviated needs assessment was conducted to explore the necessity for a recycling program and educational guideline from the perspective of anesthesia providers working in an OR in a local University affiliated tertiary care hospital in Buffalo, New York (NY). The abbreviated needs assessment was conducted during three separate stakeholder meetings held on site with the Director of Environmental Services, the Assistant Operating Room Manager, and the Chief of Anesthesiology. These meetings offered invaluable opportunity for information exchange and provided needed insight into the facility’s current waste management and recycling practice throughout all hospital departments including the OR. It was noted that the current hospital waste management and recycling protocol only endorses hospital-wide recycling of paper products and that no specific recycling protocol is in existence for the OR. Currently, all waste produced in the OR is regarded as Regulated Medical Waste (RWM) and disposed of accordingly. This non-differentiation represented an identified gap in clinical practice that this project aimed to address. Furthermore, the preliminary meetings and discussions with the above stakeholders additionally revealed vested interest in assessing the current level of understanding
of and need for recycling in the OR from the perspective of the anesthesia provider. The lack of a current existing recycling program in the University affiliated Hospital’s OR coupled with voiced hospital stakeholder interest in exploring recycling perceptions and needs from the perspective of anesthesia providers, justified the necessity of exploring this area of interest as a means for developing an OR recycling and waste management program protocol and educational guideline for anesthesia providers in the OR.

**Expanded Project Purpose**

The purpose of this Doctor of Nursing Practice (DNP) project was to address the question, among anesthesia providers directly involved in patient care at a local University affiliated tertiary care hospital in Buffalo, NY, would creating a waste management and recycling program protocol and educational guideline promote acceptance and increased knowledge and understanding regarding the benefit of recycling in the OR compared to the current waste management and recycling practice? Project goals were as follows: 1) to explore the meaning of recycling in the OR and what constitutes recycling in the OR from the perspective of anesthesia providers; 2) to explore and identify existing recycling barriers as they are perceived by anesthesia providers in the OR; 3) to explore and identify existing recycling facilitators as they are perceived by anesthesia providers in the OR; 4) to explore and identify what is needed to develop and implement a waste management and recycling program from the perspective of the anesthesia providers in the OR; and 5) to develop an OR recycling and waste management program protocol and educational guideline for anesthesia providers in the OR.

The American Association of Colleges of Nursing (AACN) doctorate of nursing practice (DNP) curriculum prepares the graduate to develop, evaluate, and provide leadership for health care policy that shapes health care financing, regulation, and delivery (AACN, 2006). The
significance of this project to the DNP prepared certified registered nurse anesthetist (CRNA) is demonstrated by the unique position afforded to the graduate CRNA. Being able to provide direct patient care while evaluating and changing health care policy is in direct alignment with the AACN’s DNP Essentials, and encompasses the leadership, regulatory, delivery, and financial roles and responsibilities of the DNP prepared CRNA.

**Theoretical Framework**

The purpose of this DNP project was to assess and explore current knowledge and level of understanding regarding the need for and importance of recycling in the OR as well as benefits and facilitators to recycling in the OR from the perspective of anesthesia providers. Kurt Lewin’s (1942) seminal work on field theory and planned change was utilized as the theoretical framework for the purpose of this DNP project. Understanding motivation for recycling as well as the dynamic interrelationship between human behavior and the environment from the perspective of the anesthesia provider in the OR setting is central to the topic of interest under exploration for this capstone project.

**Field Theory**

Lewin’s concept of planned change was created within the field of social psychology. Planned change utilizes field theory as its foundational framework which was developed to further insight into the study of group dynamics. Field theory is used to describe human behavior as a function of opposing environmental forces; those that are seen as driving or helping forces, and those that are considered restraining or hindering forces (Shirey, 2013). According to Lewin, if one could understand this interplay of forces, then one could potentially be able to understand and even change individual and group behaviors (Burnes & Cooke, 2013).
Lewin’s Three Step Model of Change

Lewin’s three-step model of change builds on his understanding of human behavior and identifies unfreezing, transitioning, and refreezing as three stages or phases that must be passed through in order to effect lasting change (Rotondo, 2017). The scope of this DNP project falls primarily within the first stage of change, unfreezing. The first stage of unfreezing undesirable extant behaviors begins with recognizing either a problem or need for change (Rotondo, 2017). Organizational change is facilitated by a change agent who inspires a sense of urgency in challenging the status quo (Shirey, 2013). An abbreviated needs assessment exploring recycling needs in the hospital OR with hospital stakeholders was conducted at a local University affiliated tertiary hospital in Buffalo, NY after recognition by two Student Registered Nurse Anesthetists (SRNAs) that a robust recycling program in the OR was non-existent but could prove to be beneficial for the hospital, patients at the hospital, and the environment. The needs assessment brought attention regarding the student’s recycling concerns to hospital stakeholders who then voiced vested interest in exploring the need for recycling in the OR from the perspective of anesthesia providers. The needs assessment further supported the need to understand the environment in which anesthesia providers work and the need to explore the dynamic interplay of environmental influence on anesthesia providers’ knowledge and beliefs about recycling in the OR.

Burnes and Cooke (2012) maintained that, according to Lewin, the status quo is maintained by a dynamic balance of opposing forces. The dynamic forces identified for the purpose of this DNP project are the barriers and facilitators to anesthesia provider recycling in the OR setting which contribute to a lack of recycling knowledge and understanding. Anesthesia provider perception of recycling barriers and facilitators was ascertained utilizing a mixed
methods approach through use on an anonymous online survey and two focus group interview sessions. The anonymous online survey granted the anesthesia providers an initial opportunity to evaluate their knowledge and understanding regarding recycling in the OR. Raising the topic of recycling in an anonymous format allowed the anesthesia provider respondents to identify barriers and facilitators to recycling in the OR setting freely and without feeling the need to conform to social pressures or undue influence from their colleagues. This initial assessment step in the unfreezing phase supports a grassroots approach that, according to Lewin, increases acceptance and implementation of change (Parkman, 2013).

The two focus group interviews provided an arena in which the anesthesia providers could voice concerns and express their views about waste management and recycling that is unique to their cohort. Open-ended and probing interview questions encouraged discussion to identify barriers and facilitators to anesthesia providers recycling in the OR. In this setting, engaging stakeholders in open dialogue is fundamental to understanding and unfreezing the status quo (Parkman, 2013). Furthermore, it was hoped that the focus group interview sessions would provide insight into group dynamics that were at play within the anesthesia cohort and would help define the culture and environment in which the needed change might occur.

The second stage in Lewin’s three-step model of change is known as the transitioning phase (Rotondo, 2017). This phase consists of an active change process and involves implementing and trialing aspects of the desired change (Batras, 2014). Learning, training, and up-skilling are integral features of the transitioning phase and are cultivated in order overcome barriers, and maximize facilitators in order to ultimately disrupt the status quo (Batras, 2014). This stage of change is often filled with uncertainty and requires open communication to allay fears and facilitate buy-in by stakeholders (Shirey, 2013). For the purpose of this DNP project,
the transition phase was represented by elevating anesthesia providers’ knowledge and understanding of recycling in the OR from their perspective.

Refreezing is the final stage in Lewin’s three-step model of change and occurs as the organizational norms and culture realign to incorporate and sustain the desired change (Batras, 2014). Though beyond the scope of this DNP project, it is the hope of the DNP project authors that the recommended recycling program protocol and educational guideline resulting from this project for anesthesia providers in the OR setting at the participating hospital will be implemented and evaluated in the future to promote lasting change in the waste management and recycling operations efforts.

In summary, Lewin’s field theory and the three-step model of change was utilized to guide this DNP project. The unfreezing stage corresponded to identifying barriers (financial, physical, psychological, knowledge-based) as well as facilitators to anesthesia provider recycling in the OR in order to cultivate a sense of needed change to current policy. Lewin’s second stage of change, the transition phase, was represented by elevating anesthesia providers’ knowledge and understanding of recycling in the OR based on their personal perception. The final phase of Lewin’s change theory, refreezing, was marked by future implementation of a recommended recycling program with evaluation to support anesthesia providers’ internalizing recycling as a positive and needed change to the current waste management policy.

**Literature Review**

A review of literature was conducted to explore waste management and recycling knowledge and understanding among anesthesia providers working in hospital OR settings. Databases searched were limited to English language and the years 2008 through 2018. The search was limited from the years 2008 to 2018 to ensure inclusion of early studies due to current
research gaps with regard to the project topic of interest. Databases searched included CINAHL, Cochrane Database of Systematic Reviews, EMBASE, MEDLINE, PubMed, Web of Science Core Collection, as well as Google Scholar. The search was performed using the following terms and keywords both singularly and in various combinations: recycling, waste management, protocols, programs, standards, practices, guidelines, operating room, OR, anesthesia, anesthesia providers, green, environment, attitudes, perceptions, sustainability, education, adult learner(s).

The literature review revealed a paucity of available evidence regarding waste management and recycling knowledge and understanding among anesthesia providers working in hospital OR settings. The review additionally revealed that a gap in knowledge exists regarding anesthesia provider perception and understanding of waste management and recycling facilitators and barriers in OR settings. Many available studies focused primarily on the acts of recycling and proper waste stream segregation (Azouz et al., 2018; Kogama, Stall, Rubinstein, & Naudie, 2012; Lui, Rudmik, & Randall, 2014), while notably few studies explored anesthesia provider recycling and waste management motivation and understanding (Ard et al., 2016; McGain, White, Mossenson, Kayak, & Story, 2012; Sherman & McGain, 2016). Following is a summary of the literature review conducted for the purpose of this DNP project.

**Doctor of Nursing Practice Essentials**

The AACN (2006) lists the ability to influence healthcare policy on all levels as one of five essential characteristics of a DNP graduate (2006). While recycling practice in health care is not specifically outlined in the DNP essentials or nursing curriculum, the AACN DNP curriculum prepares the graduate to develop, evaluate, and provide leadership for health care policy that shapes health care financing, regulation, and delivery (AACN, 2006). Regarding the topic of recycling in the OR, recommending and advocating for policy change as well as
educational interventions aligns with the AACN DNP essential of demonstrating leadership in hospital policy as well as the AACN DNP essential of educating others, including policy makers at all levels, and delivering cost effective care.

**Examining Provider Opinion**

Azouz et al. (2018) created a 23-question survey to examine the attitudes of OR personnel towards recycling in the OR. The mixed methods study was conducted across four campuses of the Mayo Clinic in the U.S. Eligible participants were surgical staff members described as surgical scrub technicians, OR nurses, physicians' assistants, residents, fellows, anesthesiologists, or attending surgeons. Of the 1,082 participants recruited for the survey, 524 (48%) responded identifying that the greatest barriers to recycling were the lack of knowledge of recyclable materials (47.7%) and handling of contaminated materials (16.8%). Surveyed respondents also stated that proper training and labeling of recyclable materials would be most effective in improving OR waste management (Azouz et al., 2018). Following the survey, a recycling improvement program was implemented in a separate facility along with an educational program. The educational program consisted of addressing cost-effective OR waste management as well as sharps disposal. Signage was also posted on receptacles in the ORs. The recycling improvement program showed that a 10.3% cost savings was observed while only examining the sharps disposal (Azouz et al., 2018).

Ard et al., (2016) conducted a survey of the American Society of Anesthesiologists (ASA) to understand environmental practice attitudes among American Anesthesiologists. The 24 question survey, emailed to a random sample of 5,200 members (out of 48,000 possible ASA members), attained a 42% response rate. Of those who responded, 80.1% (confidence interval, 78.2%-81.9%) were interested in recycling; while 67% (confidence interval, 64%-69%)
indicated that there was insufficient information on how to recycle in the OR. The survey revealed that the greatest perceived barrier among ASA anesthesiologists to recycling in the OR was inadequate information about recycling in their respective organizations.

A web-based survey of anesthesiologists’ views of OR recycling was conducted by McGain et al. (2012). This web-based survey of 11 questions was administered to anesthesiologists working in Australia, New Zealand, and England. Of the 780 respondents, most (93% with a confidence interval of 91% - 95%) indicated that they would like to increase recycling of OR waste and that they were willing to commit their time, but not their money toward those efforts. Respondents also cited inadequate recycling facilities (49%), negative staff attitudes (17%), and inadequate information (16%) as the greatest barriers to recycling waste in the OR (McGain et al., 2012).

**Environmental Impact**

A literature review of 65 articles conducted by Kogama et al. (2012) revealed that robust waste management programs can satisfy the “triple bottom line” (people, planet, and profits) by providing high-quality patient care that is neither detrimental to the environment nor to a hospital’s financial standing (p. 1905). Kogama et al. (2012) identified recycling and waste stream optimization as part of the “5 R’s” (reduce, reuse, recycle, rethink, and research) that are fundamental to ensuring long-term environmental sustainability (p. 1950). Hospitals possess significant purchasing power and are in a position to effect change with environmentally conscious purchasing and practices.

**Successful Waste Management Studies**

The results of a prospective study conducted by Wyssusek, Foong, Steel, and Gillespie (2016) supported the implementation of recycling and waste management programs in the OR.
Prior to study implementation, 100% of OR waste was disposed of as clinical waste which resulted in a much higher disposal costs than general waste. After basic waste stream segregation was introduced with the study, only 33% of OR waste was identified as clinical waste, while 66% was seen as general waste. Of this general waste, it was estimated that 70% could be recycled. The cost difference in processing the two distinct waste streams was significant and represented an institutional savings of approximately $5,790 per month.

Wyssusek et al. (2016) incorporated evaluation into their work by utilizing the Plan-Do-Study-Act method for quality improvement initiatives. Wyssusek et al. (2016) identified staff attitude (though not anesthesia personnel, specifically) as the “foremost barrier” to implementing the waste management QI project (p. 316).

Martin, Yanez, and Treggiari (2017) developed a recycling in the OR (RECOR) project to optimize waste streams in the ORs of Harborview Medical Center in Seattle, Washington. They utilized Lean Six Sigma as a framework for quality improvement. The RECOR project consisted of a preliminary audit of waste streams, an education campaign, and situating appropriate waste receptacles in areas easily accessible by anesthesia staff. The results of the project showed that the weight of recyclable waste increased from a mean (± SD) of 0.89 ± 0.50 kg to 1.06 ± 0.55 kg per OR per day (P < .01), which represented an increase of 19% from baseline to the intervention period. Moreover, the number of bags of recyclable waste increased from 0.64 ± 0.34 to 0.93 ± 0.56 (P < .01), an increase of 45% from baseline to intervention period. Similarly, staff knowledge about recycling and proper waste triage improved following the RECOR project.

A prospective study conducted by Lui, Rudmik, and Randall (2014) evaluated the effectiveness of preoperative waste diversion in 97 otolaryngology procedures performed in
three university-affiliated tertiary level hospitals. The preoperative period was defined in the study as “the opening of the surgical supply cart for operating room preparation until procedure initiation” (Lui et al., 2014, p. 805). The authors reported significant success in their program’s effectiveness at reducing preoperative waste. Approximately 23.1% of total operative waste mass (36.7% by volume) was derived from preoperative set-up (of which, 87% was recyclable). This study identified preoperative waste as a clean source of recyclable materials that could divert approximately 21% of total OR waste from the landfill.

A multicenter quality improvement study conducted by Southorn, Norrish, Gardner, and Baxandall (2012) examined waste produced from orthopedic procedures taking place in two hospitals in England. The purpose of analyzing the waste from these procedures was to determine which waste could be disposed of in domestic bags versus clinical waste bags in order to reduce the carbon footprint. The results from the study identified that a simple change in practice can result in a significant positive impact on the environment as well as cost savings for the facility. The findings showed that there were no instances of clinical waste contamination in the domestic bags. The process of segregating waste involved no additional staff and only necessitated an educational intervention to highlight the environmental and economic advantages, as well as accessibility of the correct receptacles to simplify waste segregation and recycling.

Wormer et al. (2013) conducted a prospective mixed methods study by forming a Green OR Committee consisting of members of the surgical team. The team included surgical staff, fellows, residents, research personnel, nursing, environmental services, and administration. The goals of the committee were to reduce the amount of waste coming from the ORs, to save money, and measure committee success, thereby creating a sustainable and environmentally
friendly workplace. The Green OR Committee was formed at the Carolinas Medical Center in Charlotte, North Carolina in 2008. The committee established four campaigns for a green OR including Solid Waste Reduction, OR Recyclables and Reusables, Energy and Water Reduction, and Charitable Donations. Quarterly meetings were held to analyze and discuss the environmental impact along with cost analysis. Among the results, red bags designated for biohazardous materials were identified as costing 10 times that of general waste. The Green OR Committee was able to reduce the number of red bags by educating staff on which materials were appropriate and inappropriate for disposal in the red bags. The reduction in red bag waste was observed to be 75% following the educational intervention, saving the facility $60,000 per year (Wormer et al., 2013).

**Needs of the Adult Learner**

Fast et al. (2018) designed a short training program in Benin, Canada to address the knowledge gap of how education and training of sterile processing (SP) staff impacted sterile processing standards in the hospital setting. Using a mixed-methods research design incorporating qualitative and quantitative research approaches, the researchers aimed to evaluate participant’s knowledge, skills, and practices following education sessions in sterile processing. The researchers also aimed to identify changes in sterile processing processes and practices at work places. Pre and post training hospital assessments and training tests were used as well as participant interviews. Participants identified that they changed their practices following the intervention. Participants also identified that they changed their perception of SP work. Surgical site infections also decreased following the intervention. Barriers to implementing recommended practices, such as lack of funding, were also identified. This study provided
useful information regarding implementing an educational intervention in the perioperative setting which can be applied to recycling in the OR.

A mixed methods study by Eid and Quinn (2017) aimed to identify predictors between healthcare professionals and quality improvement training transfer. Quality improvement (QI) training transfer is defined as, “maintenance of newly acquired knowledge and skills and application of newly acquired knowledge and skills to new areas” (p. 1). The study took place at large health care facility in the south-central U.S. from 2005 to 2014. The study examined healthcare professionals that participated in a QI training program over this time period. A survey was sent out to the participants via email examining critical applications of the QI project and how the trainees applied the skills learned in the training to their everyday practices. The answers to the survey were used as indicators of training transfer. Sociodemographic variables with potential impact on training transfer including age, gender, profession, academic role, length of work experience, and training cohort were also examined. The respondents with scores in the highest and lowest ranges were selected for semi-structured interviews. Survey data was analyzed using SPSS (Statistical Package for the Social Sciences) and descriptive statistics were used to determine the distribution of the sociodemographic variables. Thematic analysis was conducted on the interview data to identify themes. 142 trainees completed the survey and 86 survey respondents participated in the follow up interviews. Mixed methods data analysis showed three categories of factors predicting QI training transfer including trainee characteristics, training course, and work environment. Training course design that predicted successful training transfer were identified as being team-based learning. Work environments that predicted successful training transfer were identified as dependent on change-driven culture and low stress work environments.
A prospective quantitative study by Mangold, Kunze, Quinonez, Taylor, and Tenison (2018) examined the preferred learning styles of practicing nurses through a survey titled the Index of Learning styles (ILS). The ILS was developed to describe the differences in styles of learning among engineering students however, it has been adopted in the health care sector. The ILS classifies learners along a four-dimension continuum including sensing-intuitive, visual-verbal, active-reflective, and sequential-global (Mangold et al., 2018). The survey was administered to 2,071 members of the nursing staff at a tertiary medical center in the U.S. The response rate was 67.55% resulting in a sample size of 1,399 participants. Findings from the survey indicated that sensing and visual learning were the preferred styles regardless of gender, age, or experience. Sensing was described as being a concrete thinker, being practical, and being oriented to facts and procedures. Visual learning was described as preferring visual representations such as pictures, charts, and diagrams. Findings also showed that delivering education in multiple formats allowed learners to choose which method is most conducive to them (Mangold, et al., 2018).

A study by Safabakhsh, Irajpour, and Yamani (2018) utilized a three-stage method to design an interprofessional continuing education model. First, a systematic review of the literature was conducted to identify the common models of continuing education and to determine the elements of each model. A qualitative analysis was performed on the relevant articles to determine the elements. Following the literature review, experts in interprofessional continuing education were interviewed based on the findings of the literature. The semi-structured interviews were set up to have the components of the relevant articles explained. Descriptive themes were identified from the semi-structured interviews. Five constructs were extracted from the interviews including subject, objectives, content, learning strategies,
evaluation strategies. Based on the five constructs, an interprofessional continuing education model was developed in three stages: design, implementation, and evaluation. In the design stage, a needs assessment is conducted in order to select the subject of the program. In the implementation stage, professionals from each profession involved are introduced and common learning objectives, content, methods, and assessment of the learners are identified. Finally, in the evaluation stage, questionnaires are administered followed by an analysis and debriefing phase with feedback given to the groups involved.

**Methods**

**Design, Sample, and Setting**

The DNP project team consisted of two UB Student Registered Nurse Anesthetist (SRNA) students. The project employed a mixed-methods approach to assess and explore anesthesia provider waste management and recycling facilitators, barriers, and needs in a hospital OR setting. Data were collected through an anonymous online survey and two focus group interview sessions. Project student one was responsible for developing the online survey questions, creating the online survey, analyzing survey data with the assistance of an appointed UB School of Nursing statistical consultant, and writing and reporting survey findings.

Project student two was responsible for developing the semi-structured interview questionnaire for the two focus group interview sessions and for transcribing, analyzing the data using Braun and Clark’s (2006) thematic analysis method with assistance from qualitative methods expert on faculty at UB School of Nursing, and writing and reporting findings. The project was conducted at a large, academic, tertiary care hospital located in downtown Buffalo, NY. The sample was drawn from individuals employed by the anesthesia group providing service to the hospital.
Project inclusion criteria included anesthesia providers who were 18 years and older, anesthesia providers who could read and understand English, anesthesia providers who could use a computer, and anesthesia providers who volunteered to participate in the project. Invited anesthesia providers included CRNAs, medical residents, medical fellows, and attending anesthesiologists. A total of 88 anesthesia providers were invited to participate in the online survey. The focus groups were based on a convenience sample of anesthesia providers who were willing and able to attend interview sessions within set project designated times.

**Recruitment**

Following UB Institutional Review Board (IRB) study approval, a recruitment email designed by both DNP SRNA students conducting this project was sent out to the hospital’s anesthesia providers via an anesthesia department listserv (Appendix A). Recruitment for the project took place through email correspondence and a recruitment poster placed in the anesthesia break room inviting anesthesia providers to take part in the project (Appendix B). Both students conducting the project were present on site during clinical rotations to encourage voluntary participation in the project and to answer any questions about the project.

**Data Collection Methods**

**Online survey.**

Survey data was collected using a survey format designed as an anonymous online survey (Appendix D) using Survey Monkey®, a secure web-based online questionnaire tool that allows for participant anonymity through blocking identification of IP addresses/URLs/email addresses. Survey Monkey® meets Federal guidelines for website accessibility and is 508 and WCAG2 compliant. The survey window was open for two weeks following the listserv recruitment email and was available to be taken from any public, private, or personal computer.
Anesthesia providers wishing to participate in the project were asked to access a Survey Monkey® website link included in the recruitment email that took them directly to the online survey. Instructions for completing the online survey were provided for the participants using a written standardized introduction attached to the survey (Appendix C). Analytics from Survey Monkey® indicated that the survey on average took approximately two minutes to complete. Having both DNP SRNA students conducting this project totally blind to anesthesia provider participation removed any real or perceived influence regarding project participation. A standardized Consent to participate was obtained by participant agreement to complete the online survey with the following statement included on the survey information sheet:

   By completing and submitting this anonymous online survey, you give your consent to voluntarily participate in the study and acknowledge that you have fully read and understand the above information regarding your rights as a study participant.

   In SurveyMonkey®, the data collected is kept private and confidential. Data is stored on secure servers and is accessed using a username and password. Only the two DNP SRNA students who conducted this project had access to the username and password. For data analysis purposes, survey results were exported using Excel file format which is offered in Survey Monkey® as an export file type. The exported data file was kept on a password protected computer owned by project student one. Only project student one had access to the data on the password protected computer. Data was additionally stored on a thumb drive stored in a locked file cabinet drawer located in project student one’s personal home office. All data files will be kept for three years and then will be destroyed. After completion of the project, data stored on the SurveyMonkey® server was purged and deleted.
To capture current OR anesthesia provider waste management and recycling knowledge and level of understanding, the survey consisted of 15 questions created and guided by current literature review findings and findings resulting from a previously published study exploring the environmental practice attitudes of American anesthesiologists (Ard et al., 2016). Content questions used a 5-point frequency scale (always, often, sometimes, rarely, or never), or a 5-point agreement scale (strongly agree, agree, neutral, disagree, strongly disagree). Demographic information was collected including age, gender, current position, and years of experience in current position.

**Focus group interviews.**

Findings resulting from the online survey were utilized to guide developing the semi-structured interview questions created for the two focus group interview sessions (Appendix E). Interested participants were directed to participate in only one of the two focus group interview sessions. Participants who completed the online survey were encouraged to participate in one of the two focus group interview sessions as a means to further explore recycling barriers, facilitators, and needs from the perspective of anesthesia providers working in the hospital OR setting. Convenience sampling was utilized to recruit anesthesia provider focus group interview participants. According to Etikan, Musa, and Alkassim (2016), “the main objective of convenience sampling is to collect information from participants who are easily accessible to the researcher” with the main assumption that “the members of the target population are homogeneous” (p. 2). A homogeneous sample focuses on participants who share similar traits or characteristics such as jobs or life experiences (Etikan et al., 2016, p. 2).

A standardized introduction was read to all participants and all participant questions were answered regarding project participation prior to beginning the focus group interview sessions.
Providers were reminded that their participation in the focus group was entirely voluntary and that taking part was regarded as expressed verbal consent to participate in the project. Providers were free to participate in the discussion to the extent that they felt comfortable, were able to leave the discussion group at anytime, and could refuse to participate entirely without fear of reprisal. There was no cost associated with participating in the focus group discussion. There was also no direct benefit to participating in the focus group discussion with the exception that participants were adding to what is known about recycling in the OR.

The two focus group interview sessions lasted an average of 30 minutes each and were conducted two weeks apart in the hospital anesthesia breakroom. The semi-structured interview questionnaire consisted of open-ended questions with use of probing questions to elicit further understanding of waste management and recycling needs from the perspective of the anesthesia providers working in a hospital based OR (Appendix E). To accommodate variability in anesthesia provider hospital schedules, both focus group interview sessions took place during two separate Thursday morning meetings held from 07:00 to 08:00 in the anesthesia breakroom. The Thursday morning meetings are regularly scheduled departmental meetings held on a weekly basis. The focus group sessions were audio recorded using a TASCAM DR-40 4-track handheld recorder. Project student one took field notes concurrently.

**Data Analysis Methods**

**Online survey.**

The anesthesia community at the facility, totaling 88 employees, were invited to participate in the online survey. Demographic data was collected via a set of forced-choice questions addressing age, sex, time in field, and job title. Demographic data was used to
characterize the set of survey respondents and to compare them to the focus group participants and the larger anesthesia hospital community.

Content questions used 5-point frequency scale (always, often, sometimes, rarely, or never), or a 5-point agreement scale (strongly agree, agree, neutral, disagree, strongly disagree). For each question the number of responses to each category was tallied, then the positive and negative ends of each scale was collapsed, yielding a condensed 3-point scale. Finally, a percentage was calculated for each collapsed category.

**Focus groups.**

A UB School of Nursing qualitative methods expert assisted with data analysis. Braun and Clark’s (2006) thematic analysis (TA) method was utilized to analyze the data. Braun and Clark’s (2006) TA method is comprised of the following six phases: 1) becoming familiar with the data; 2) generating initial codes; 3) searching for themes; 4) reviewing themes; 5) defining and naming themes; and 6) writing-up (Braun & Clarke, 2006).

The process of analyzing the focus group interview data begins with Phase one of Braun and Clark’s (2006) TA method, becoming familiar with the data. During Phase one, both audio recorded focus group interview sessions were transcribed verbatim by a professional transcriptionist with no participant identifiers. Data immersion took place through the reading and re-reading of both transcripts by project student two while listening to the audio recordings to ensure accuracy of the transcribed data. Reading and rereading the transcribed interviews allowed time for researcher two to gain better understanding of the data as well as make notes and observations about the data (Braun & Clarke, 2013).

Generating initial codes, or Phase two of Braun and Clark’s (2006) TA method, began following the reading and re-reading of the transcripts with recorded notes and observations.
Initial codes were generated to simplify the data, develop structured ideas about the data, and to identify and label interesting data as relating to a theme or issue important to the overarching research question (Nowell et al., 2017). Direct quotes from participants were then extracted to match and demonstrate codes. Concluding Phase two, the entire data set from both focus group interviews were assigned codes and collated for code relationship building and patterning (Braun & Clarke, 2013).

Searching for themes constitutes Phase three of Braun and Clark’s (2006) TA method. A theme is defined as “a coherent and meaningful pattern in the data relevant to the research question” (Braun & Clark, 2013, p.121). According to Nowell et al. (2017), a theme is “an abstract entity that brings meaning and identity to a recurrent experience and its variant manifestations. As such, a theme captures and unifies the nature or basis of the experience into a meaningful whole” (p. 8). During Phase three, generated codes were sorted into potential main themes and subthemes with supporting participant direct quotes.

Phase four of Braun and Clark’s (2006) TA method entails reviewing themes. The entire data set was read and re-read to “ascertain whether the themes ‘work’ in relation to the data set (Braun & Clark, 2006, p. 21). Themes were reworked, assessed, expanded or divided, or removed entirely (Braun & Clarke, 2006). This refining process is recursive and lasts until satisfaction is reached that themes and subthemes reflect the “overall story they tell about the data” (Braun & Clark, 2006, p. 21).

Defining and naming themes is the fifth phase of Braun and Clark’s (2006) TA method. In this phase of analysis, themes were further refined and developed to capture the “essence of what each theme is about” (Braun & Clarke, 2006, p.22). Main themes and subthemes were organized, named and finalized for final analysis.
Finally, Phase six of Braun and Clark’s (2006) TA method entails writing and producing a report. Findings were reported in a concise and compelling manner and in a logical and methodical way such that the critical reader will find them credible (Nowell et al., 2017). Direct participant quotes were incorporated into the final report to show “sufficient evidence of the themes within the data” (Braun & Clarke, 2006, p. 23). The final report extends beyond merely describing findings, and situated the critical analysis within the context of relevant literature in order to advance the research question as interesting and authentic.

Both focus group interviews were field recorded using a TASCAM DR-40 4-track handheld recorder. Field notes were taken concurrently by DNP project student one. Immediately following each interview session, audio recordings were downloaded to DNP project student two’s password protected computer and subsequently transcribed verbatim by a professional transcript service without participant identifiers. Transcripts were then read and reread by DNP project student two while listening to the audio recording of each focus group interview to ensure transcription accuracy. To ensure interrater reliability, transcripts were first independently reviewed and thematically analyzed by both DNP project students and their DNP Project Faculty Advisor, a UB School of Nursing qualitative methods expert. Thematic analysis findings were then discussed and agreed upon by both DNP project students and their DNP project advisor during a meeting.

According to Nowell, Norris, White, and Moules (2017), establishing trustworthiness in qualitative research is important in conveying to readers that research findings are “worthy of attention” (p.3). Trustworthiness is established through creating an audit trail and through meeting credibility, transferability, dependability and confirmability criteria. Nowell et al. (2017) maintained that “An audit trail provides readers with evidence of the decisions and
choices made by the researcher” … so that “another researcher can clearly follow the decision trail” (p. 3). An audit trail was established through use of field notes and transcripts and through the reporting of detailed data collection and analyzation methods. With regard to credibility, or the fit between participant views and the researcher’s representation of them, data triangulation was utilized by means of developing the semi-structured interview questions based on participant survey results (Nowell et al., 2017). In addition, credibility was established through member checking, or going back to the participants to review focus group findings and interpretations to ensure that findings accurately reflected participant thoughts, views, and feelings (Nowell et al., 2017). Transferability, or transferring findings, was established through use of thick descriptions (Nowell et al., 2017). Dependability was established through creating a logical, traceable, and clearly documented audit trail (Nowell et al., 2017). Finally, confirmability was established by use of direct participant quotes to support themes and subthemes that emerged from the data (Nowell et al., 2017).

**Validity and Reliability**

Both the survey and the semi-structured interview questionnaire were trialed and reviewed by the DNP project advisor. To improve statistical reliability and significance, a UB School of Nursing statistical consultant oversaw the online survey data analysis. Findings resulting from both the survey and focus group interview sessions were utilized to develop an OR recycling and waste management program protocol and educational guideline for anesthesia providers in the OR.

**Results**

**Survey**

The anesthesia community at the hospital was invited to participate in the online survey.
A link to the survey was sent out to 88 anesthesia providers via the anesthesia department secretary through the anesthesia providers work group email server. Twenty-seven of the 88 providers completed the survey between 9/10/2018 and 9/28/2018 (31% response rate). Typical respondents were 30-45 years old (63%), were female (56%), had 1-5 years of experience (52%), and were CRNAs (59%). Results of the four demographic questions are shown below in Table 1.

Table 1

Demographic Results

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Sex</th>
<th>Experience</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>1 Male</td>
<td>&lt; 1 year</td>
<td>Fellow</td>
</tr>
<tr>
<td>30-45</td>
<td>17 Female</td>
<td>1-5 year</td>
<td>Resident</td>
</tr>
<tr>
<td>46-60</td>
<td>6</td>
<td>6-10 year</td>
<td>Anesthesiologist</td>
</tr>
<tr>
<td>61-75</td>
<td>3</td>
<td>&gt; 7 year</td>
<td>CRNA</td>
</tr>
<tr>
<td>Total Responses</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
</tbody>
</table>

Question 5 addressed the frequency of home recycling and used a 5-point frequency scale (always, often, sometimes, rarely, or never). Questions 6-14 used a 5-point agreement scale (strongly agree, agree, neutral, disagree, strongly disagree). For each question, the number of responses to each category was tallied, then the positive and negative ends of each scale were collapsed, yielding three totals for each question. Table 3 shows the counts for each reply to questions 5-14 and Table 4 shows the collapsed count totals. Finally, a percentage was calculated for each collapsed category. Table 5, *Collapsed Scale Percents*, shows these percentages.
Table 3

Counts of Each Reply by Question

<table>
<thead>
<tr>
<th>Question</th>
<th>Counts</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Always/ Strongly Agree</td>
<td>Often/ Agree</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
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</tr>
<tr>
<td>9</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>12</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>13</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 4

Counts with the Scale Ends Collapsed, by Question

<table>
<thead>
<tr>
<th>Question</th>
<th>Counts</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Always + Often/ Strongly Agree + Agree</td>
<td>Sometimes/ Neutral</td>
</tr>
<tr>
<td>5</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>5</td>
<td>8</td>
</tr>
</tbody>
</table>
Table 5

Collapsed Scale Percents

<table>
<thead>
<tr>
<th>Question</th>
<th>Percentage</th>
<th>Always + Often/Strongly Agree + Agree</th>
<th>Sometimes/Neutral</th>
<th>Rarely + Never/Disagree + Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>85</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>96</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>89</td>
<td>11</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>67</td>
<td>30</td>
<td>4</td>
<td></td>
</tr>
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<td>9</td>
<td>93</td>
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<td>11</td>
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<td>85</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>85</td>
<td>11</td>
<td>4</td>
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<td>12</td>
<td>70</td>
<td>19</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>7</td>
<td>4</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>19</td>
<td>30</td>
<td>52</td>
<td></td>
</tr>
</tbody>
</table>

The majority of respondents (85%) indicated that they always or often recycled at home and almost all respondents (96%) indicated that they generally considered recycling a positive waste management approach. A full 89% of respondents indicated that sustainability should be a key focus for the hospital. There was some difference of opinion about the cost effectiveness of recycling with only 67% of the respondents indicating it may be so and 34% indicating it may not be. Regardless, 93% of respondents indicated that they were concerned about the amount of waste generated by the OR. Very few respondents (11%) indicated that environmental sustainability was included in their educational training. A majority of respondents (85%) indicated it was not addressed in their training.

Most respondents (85%) agreed that recycling was feasible in the OR but 30% did not agree that there was enough time to recycle while they were there. Only 7% of respondents agreed that they were educated about environmental sustainability or recycling during their hospital orientation with 93% stating they were not educated. Only 19% of respondents
indicated that they knew where to look for and whom to contact in an effort to answer questions about waste disposal in their facility. Finally, question 15, a free text question having only one respondent answer, indicated a concern for infection control with recyclable materials in the OR.

**Focus Group Findings**

A total of 10 anesthesia provider participants participated in the first focus group interview session and a total of 6 anesthesia participants participated in the second focus group interview session for total of 16 participants. Of the 16 participants, 7 were male and 9 were female. Participants ranged in age from 46 to 60 years with 1 to 5 years of practice experience (see Table 6 & Table 7).

Table 6

**Demographic Results Focus Group 1**

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Sex</th>
<th>Experience</th>
<th>Title</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>1</td>
<td>Male</td>
<td>4 &lt; 1 year</td>
<td>Fellow</td>
</tr>
<tr>
<td>30-45</td>
<td>1</td>
<td>Female</td>
<td>6 1-5 year</td>
<td>Resident</td>
</tr>
<tr>
<td>46-60</td>
<td>4</td>
<td></td>
<td>6 6-10 year</td>
<td>Anesthesiologist</td>
</tr>
<tr>
<td>61-75</td>
<td>3</td>
<td></td>
<td>&gt; 7 year</td>
<td>CRNA</td>
</tr>
<tr>
<td>&gt;75</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 7

**Demographic Results Focus Group 2**

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Sex</th>
<th>Experience</th>
<th>Title</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>3</td>
<td>Male</td>
<td>3 &lt; 1 year</td>
<td>Fellow</td>
</tr>
<tr>
<td>30-45</td>
<td>2</td>
<td>Female</td>
<td>3 1-5 year</td>
<td>Resident</td>
</tr>
<tr>
<td>46-60</td>
<td>1</td>
<td></td>
<td>6-10 year</td>
<td>Anesthesiologist 2</td>
</tr>
<tr>
<td>&gt;75</td>
<td>1</td>
<td></td>
<td>&gt; 7 year</td>
<td>CRNA</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>
Throughout both focus group interview sessions, participants voiced eagerness to express their views and understanding of the anesthesia provider’s role in recycling in the OR setting. Three main themes emerged from the data: Barriers, Awareness, and Championing Best Practice. Subthemes supporting each main theme are described in detail in the following (see Table 8 & Figure 1). The following presents the three main themes and supporting subthemes in detail.

**Theme 1. Barriers**

**Knowledge gaps.**

Participants identified the following perceived barriers to anesthesia providers implementing a recycling program in the OR: Knowledge Gaps, Concerns, Habit and Mindset, and Administration. With regard to Knowledge Gaps, participants described not receiving any education in graduate school or medical school regarding environmental responsibility, recycling, and waste management in OR settings. Despite not receiving education, participants strongly felt that recycling in the OR was an important topic to address both as part of formal anesthesia provider educational preparation as well as in employment orientations. One participant commented, “…this is something that is actually really worth looking into.”

Participants also expressed having feelings of unknowing with regard to current OR waste management protocols. One participant responded, “As far as I know, there's no waste management protocol” with another participant agreeing, “If there is, I'm unaware of it.” Feelings of unknowing were again expressed when the group discussed the outcome of hospital waste with one participant stating, “We don't really know downstream where the garbage from the hospital goes… Incineration? Landfill? We have no idea.”

The majority of participants indicated that they had no facility-specific training on recycling practices in the OR including which items could be recycled and under what
circumstances. One participant expressed disbelief when learning that the current hospital waste management and recycling protocol only endorsed hospital-wide recycling of paper products and that no specific recycling protocol is currently in existence for the OR. This participant stated, “I'm amazed actually, why the hospital system doesn't recycle everything.”

**Concerns.**

The anesthesia providers were acutely aware of the amount of waste produced daily in the OR. This was a salient point to which participants devoted special attention. Open-heart and neuro-surgical procedures were identified specifically as cases producing the greatest amount of waste – invariably requiring waste receptacles be emptied intraoperatively. One participant responded, “…those garbage bags are full before the patient even comes in the room – just [from] the set up.”

The environmental impact of hospital waste produced in the US was identified by focus group participants as a global concern. One participant commented, “The earth is finite. People think that it is vast but if you're going to keep crapping, it's just a matter of time before it starts affecting everything.” Group members discussed the effects of plastics in the oceans and on wildlife. On group member commented, “There's whales that are eating all of this…because they scoop up the plankton and plastic comes with it.” Participants also recognized that the environmental implications of improper waste management are far-reaching and are of international concern. One participant described identifying “huge containers of plastic medical waste” while walking the beach of a poor island nation. Another participant acknowledged the socio-economic and public health concerns of waste disposal stating, “…there's actually barges that certain types of waste goes on, and then countries offload it to other, poorer countries.”
Participants were critical of over-consumption and of disposable, single-use products in the US stating, “Our country is... we don't conserve much of anything…” but were quick to identify Canada and Sweden as role models of recycling and waste management asserting that “Sweden is very, very, very into this topic. And they essentially are conserving almost everything… even in a hospital.”

Despite concern regarding the amount of waste produced in the OR, some participants had reservations over the practice of recycling itself as an effective means of waste stream diversion. This concern, perhaps more accurately described as mistrust, was founded on their experiences with recycling practice outside the hospital (in their personal lives) in the municipalities in which they reside. One participant stated, “They don't know what's in those containers…you don't even need, you know, clear bags. You can put anything in it. And then they throw… the glass and plastic and the paper in the same thing.” Another participant added, “Yeah, I know…So again, I think that people do it, but I think there is some mistrust as to what happens after they do do it. You know, I mean.”

**Habit and mindset.**

Participants identified habits and mindsets as potential barriers to implementing a recycling program in the OR. It was noted that providers have developed their practice over time and that asking them to change could prove challenging. “So, there are mindsets that are difficult to change. They don't feel it's important.” This same respondent later pointed to the fact that if there was a recycling protocol in place for the OR, then even those providers resistant to change would still need to abide by the policy.
Administration.

Participants explained that they were not hospital employees and it was their feeling, therefore, that they were not privy to policy development. They described hospital administrators as “…the ones that have the power to change.” Despite this feeling of distance, the anesthesia providers expressed interest in a robust recycling program in the OR and would work to help implement it “…we could comply to anything that's put out there [by the administration].”

Theme 2. Awareness

Awareness was a theme in the focus group discussions that was buttressed by three subthemes; defining recycling, environmental impact, and advocacy.

Defining recycling.

Defining recycling in the OR was accomplished with some hesitation and careful consideration by participants. Ultimately, repurposing items “…using materials in a new way.” and “not throwing away things that are not used” were two agreed-upon definitions. Donating items was also recognized as a form of recycling “We used to recycle to third world countries.” Participants were able to cite potentially recyclable items and materials used daily in the OR with plastics being chief among them. Notable items were Yankauer suction catheters, oral and nasal airways, endotracheal tubes, paper drapes, paper and plastic wrappings of sterile items, plastic coverings for x-ray machines, soda-lime CO2 absorbers, glass bottles and vials, as well as metal items such as scissors, hemostats, needles, suture kits and anesthetic gas containers.

Environmental impact.

Participants unequivocally described the amount of OR waste produced as unacceptable with one participant commenting, “I think this is an excellent topic.” There was agreement
among both focus group participants that a need exists for adopting OR recycling programs to prevent toxic waste streams since not all OR waste is processed as regulated medical waste. Despite belief among participants that recycling should be employed to reduce the environmental impact of providing surgical and anesthesia services for patients, questions and concerns were raised during both focus group sessions as to when and how to best implement recycling during the course of the day in the OR with strong attention on potential biocontamination issues. After some discussion, it was decided that recycling efforts might best be implemented in the morning prior to case initiation. One participant stated, “I think the only logical way to do that [recycle] would be before the patient’s in the room. And then you would have to assume that after the patient's in the room, everything is [contaminated] ...”.

**Advocacy.**

The sub-theme of advocacy was expressed by participants and was described as Voices/Being Heard, Policy, and Process. Advocacy seemed especially important to participants. Being heard and having a voice evoked emotional responses among some of the anesthesia providers with one participant stating, “We're essentially a voice-less workforce.” This statement was revealing in that it expressed a perceived underutilization of a talented and motivated cohort within the perioperative environment. Empowering such providers with a voice is a meaningful step in advocating for best practice. This motivated group overwhelmingly supported recycling in the OR and expressed willingness to help operationalize such a program.

As important members of the perioperative team, the anesthesia providers felt that they had a role to play in Policy development. It was agreed among focus group participants that recycling was an issue that was “… not addressed as much as it should be.” Being keenly aware of the amount of waste generated daily in the OR, as well as the social and environmental
implications of inappropriate or improper waste management practices, the participants stressed that they could offer valuable insight into how a robust recycling policy could best be developed for the OR.

Bringing awareness to the process of effective waste stream diversion and recycling methods was advocated for by members of both focus groups. Participants discussed how awareness of process would require concerted efforts from various stakeholder groups with an acute focus on effective communication. One participant commented, “Well, just make it easy. You know, if you make it easy, more people will do it. And then just educate, educate, educate. What can go in, what can't go in, so when you finally implement it you'll have a picture on the wall of what can go in and what can't. I mean you really will have to be very specific.”

**Theme 3. Championing Best Practice**

The anesthesia providers made it clear that they wished to provide their patients with the best care possible. Participants believed that the desire for best practice did not simply manifest at the bedside. They believed that best practice extended to involve the culture of the facility with the ultimate goal being the provision of healthcare services that are safe, equitable, and sustainable for the environment and community at large. This desire to champion best practice was directly in line with the facility’s mission statement, “…to advance the health of our community”, as well as the facility’s vision, “To provide compassionate, high-value, quality care, improving health in Western New York and beyond, educating the future health care leaders and discovering innovative ways to advance medicine.”

**Education.**

Education and recycling awareness campaigns were described by participants as needed and paramount to implementing a meaningful and successful OR recycling program. One
participant responded, “Awareness, awareness, awareness. If everyone is aware about this, educated, trained, I think this would help us to save some.” Education was identified as an essential need in addressing recycling barriers among the anesthesia providers. Educational barriers identified by participants included Habits and Mindset and Knowledge gaps. Participants voiced concern that education regarding healthcare provider responsibility toward environmental stewardship is lacking from many graduate health and medical programs and that a need exists for hospitals to educate employees and patients regarding the importance of environmentally sustainable healthcare. It was noted that orientation for employees new to the OR should include comprehensive training on recycling methods and materials as well as having recycling references and resources readily available to OR personnel. Results from the online survey indicated that only 7% of respondents received education about environmental sustainability or recycling during their hospital orientation. This represents an area in which gains may be made.

Ongoing in-house training regarding recycling and proper waste stream management was viewed by focus group members as important to cultivating and maintaining hospital employees’ knowledge and compliance to an OR recycling protocol not only for anesthesia providers, but for housekeeping staff as well. One participant stated, “Training of the people that remove the garbage from the operating room. I mean, those are the housekeeping staff. And if they’re not aware of your efforts to recycle then they just put it in the hall and throw it in the bin.” Participants went on to talk about the importance of staffing and ensuring that employees be trained and competent in how to properly manage recyclable materials and empty receptacles with one commenting, “And it's not just us. It is housekeeping that has to ... Maybe the bags should be a different color. They should be green, bright green. Or something. Something that
has to be triggered, so that even if it's the fill in guy that's doing the housekeeping knows that that's [the] recyclable stream. And that's where it's going.”

Though anesthesia providers and housekeepers were cited specifically in the focus group discussions as two services that would benefit from ongoing in-house training, other perioperative services were alluded to that would benefit from proper waste stream management training. One participant, voicing his support of education and training, stated, “More projects like this, awareness, education would be very helpful to us; to everyone.” Another participant suggested that more environmental awareness and education for staff members could have a real effect, “I think it'd generate less waste.”

During both focus group discussions, it was voiced that implementing and sustaining an effective OR recycling program would require strong interdisciplinary collaboration and communication with recycling roles and responsibilities being clearly understood and assigned. One focus group member stated, “You'd have to get administration on board.”, while another offered, “You're obviously going to have to get [housekeeping] services on board.” The formation of an ad hoc recycling committee, or a “green” task force, with representatives from various stakeholder groups (i.e. administration, anesthesia, housekeeping, etc…) was described by participants as a necessary step toward establishing such communication and collaboration.

**Responsible use of resources.**

Responsible use of resources, a sub-theme of Championing Best Practice, is a recycling concern the anesthesia providers felt strongly about. Group members identified the following approaches and strategies that they felt would foster responsible use of resources: Mindful/Judicious use, Careful Planning, Security vs Over-Consumption, and Adopting a Reduction Strategy in One’s Practice. Participants agreed that these approaches were intimately
related to one another and that they could/might help to reduce the amount of waste produced in delivering anesthesia care.

Mindful/judicious use of resources was endorsed as an approach to practice that anesthesia providers could employ at any time and in any setting. In this particular facility, where a robust OR recycling program has yet to be established, this practice could empower anesthesia providers to reduce the amount of waste associated with the provision of anesthesia care. One participant exercised this point commenting, “The only thing you can do is not open things and then see them thrown away. Which I see many people do. They open up a whole set and then it gets discarded. And you see that happen time after time after time.”

Careful planning was described as an important aspect of Responsible Use of Resources. Careful planning, like Mindful/judicious use, makes certain demands on the anesthesia provider. For example, the provider must have a patient-specific plan of care established, with patient and procedure-appropriate equipment, medications, and dosages ready. In this sense, nonessential materials are spared. When acknowledging the problem of wasted materials, one participant added, “I think there's a fear of not being ready for a disaster…” This prompted more discussion, as another participant identified wasteful behaviors as indicative of poor planning stating, “And then you have all the syringes drawn up. And I mean, even the drugs are wasted. There's so much waste that goes on. People open up something that it takes a moment, it's in the drawer, it takes a moment to grab and open up even in an emergency situation. They've got it ripped open and then it's garbage then. It becomes garbage.”

Participants described how anesthesia providers must also be skilled in cultivating meaningful lines of communication with perioperative staff in order to tailor a safe and appropriate anesthetic. Understanding the planned surgical approach (as well as its alternatives),
expected duration of the surgery, specific needs of the surgeon, and intended postoperative course for the patient were discussed as needed in order to make informed decisions regarding equipment, medications, and anesthetic approach. The novice practitioner is arguably still developing careful planning skills, yet when probed a little further, participants explained that it was not only novice providers who demonstrated wasteful behaviors in practice, seasoned practitioners with set habits were also identified as practicing in this manner.

Security vs over-consumption was an important and astute assessment regarding anesthesia provider resource utilization that was brought up during both focus group discussions. One participant believed that there is a “…very fine line between security and over-consumption.” This point, again, is intimately related to Careful planning and Mindful/judicious use of resources. Anesthesia providers play an important role in managing crises and near-crises. In that role, they must be prepared to act quickly and decisively – delivering the right intervention at the right time with the right follow-through. When addressing the fear of not being prepared for anything, one group member mentioned a secondary fear of being rebuked by a colleague or superior stating, “And then having someone say something to you. Like, "Why aren't you ready?" Or "How could you not have a…" It is with these considerations in mind that an anesthesia provider might prepare, and ultimately contaminate, materials that go unused. Focus group participants did not touch upon strategies to help increase feelings of security for anesthesia providers. One participant noted, “… it takes a moment to grab and open up even in an emergency situation.” Perhaps this tenet could remind providers that with careful planning, an organized work space, and situational awareness, it is possible to be ready for anything at a moment’s notice while avoiding over-consumption of resources.
A reduction strategy was suggested by participants as an approach to care that could be adopted by all providers alike, and should be cultivated specifically in novice anesthesia providers during orientation and in-house training exercises (if not before as a topic in formal anesthesia education programs). This method of practice could work in concert with recycling efforts in the OR to yield an even greater impact on reducing waste stream results coming from the OR. As simply stated by one focus group member, “Try to generate less waste in a safe fashion.”

**Implementing recycling.**

Many focus group members offered encouragement and spoke favorably of their experiences with OR recycling programs at various hospitals around the US. One participant stated, “…the [hospital]. Yeah, and I found ... they really had a system in place… It put your mind a little more to ease that you weren't generating all this garbage all the time.” Another participant commented, “Everyone who did start cases, you had so much paper. I don't know how they were able to recycle all that wrapping. To me, that was, like they can't be recycled, but they did. So basically, we just encouraged people first thing in the morning. It was only clean stuff, but it was something and it's a huge amount of stuff.”

Again, participants cited Canada and Sweden as role models of recycling and waste management with one participant noting, “I was interested in the waste gasses. Because I know that for instance, in Canada they recycle the Sodasorb containers and that's another thing that we should be looking at.” Finally, one group member suggested seeking out healthcare facilities in New York State having successful OR recycling programs and to model after them since they would be compliant with state and local regulations regarding waste management with
knowledge regarding legal and logistics implications of implementing an OR recycling program in Buffalo, NY.

**Ease of use.**

Ease of use was cited by focus group members as critical to the successful implementation of a robust recycling protocol in the OR setting. It was agreed that stakeholders (namely, housekeeping and anesthesia personnel) must have a clear, unequivocal understanding of what constitutes recyclable materials as well as which items would be appropriate for various other waste streams. Clear signage replete with images and descriptions of recyclable items, as well as green bags placed inside green recycling receptacles, would help anesthesia providers readily identify recyclable waste stream materials and promote ease of use. Participants stressed, “Make it clear”, “Make it simple”, and “Label, label, label.” Participants believed that visual and physical cues should be augmented with phone numbers and contact information of waste management resource personnel equipped to address any questions stakeholders have regarding OR recycling made readily available. In closing, one participant nodded in agreement to these suggestions and acknowledged past experiences with recycling in the OR reiterating, “I’ve done it before. It's easy.”

**Cost-benefit analysis.**

It was agreed that a cost-benefit analysis would need to be undertaken in order to assess the merits and negative aspects, as well as the feasibility of implementing an enduring recycling program, in the OR. Participants expressed concern that the cost of current waste management services provided to the OR by outside contracted services must be high noting, “They probably charge the hospitals a premium just to take the medical waste away.” There was some discussion as to whether or not it would be in the best interest of the hospital to change the
status quo. One participant expressed unease regarding the potential financial burden of implementing a recycling program in the OR stating, “I mean, would the hospital be willing to take on an extra cost to segregate this product? I don't think so.” There was a certain degree of unknowing and disagreement surrounding this topic; some participants felt that a robust OR recycling program would cost the hospital money, while others felt that it would save the hospital money simply by minimizing the amount of materials billed for and disposed of as regulated medical waste. One participant commented, “I'm not sure there's money to be made on recycling products from the OR… but everything else is maybe just reduction of costs of disposal.” A cost-benefit analysis should also consider the social and environmental effects of recycling as a responsible waste management practice. Endorsing practices that advance the health of the community is in line with the mission statement of the hospital and is a platform for public relations.

**Discussion and Recommendations**

In general, with regard to recycling in the OR, findings resulting from the survey and focus group interview sessions revealed that a lack of waste management education during anesthesia provider training currently exists both in school and on the job despite clear anesthesia provider understanding of its importance to the planet and the practice of medicine. Although project participants voiced willingness to participate in waste stream reduction efforts, they also voiced concern regarding the impact of such reduction efforts on OR workflow that included potential resistance among established anesthesia providers with set routines.

Site specific OR recycling policy recommendations and educational interventions should be developed to meet the needs of anesthesia departments and to help facilitate recycling in OR settings. The educational intervention should be applicable to both the hospital and academic
setting. Based on project findings, a suggested educational intervention guideline (Appendix F) and a proposed hospital recycling policy (Appendix G) were developed by both DNP project students.

Education is lacking in both the hospital setting and educational training programs for CRNAs and medical doctors of anesthesia. Participants in the focus groups generally agreed that education surrounding environmental sustainability was important and identified strategies on how best to recycle and reduce OR waste. The suggested educational guideline created by both DNP project students as a result of project findings may be incorporated into future employee hospital training as well as student anesthesia training in the academic setting. Additionally, because a policy for recycling in the OR does not currently exist at the hospital where this project was conducted, a proposed policy recommendation based on project findings focusing on how to initiate and facilitate recycling in the OR was created by both DNP project students for the hospital stakeholders (Appendix G).

**Strengths and Limitations**

This project helped to address identified gaps in clinical practice and research with regard to anesthesia provider knowledge and understanding of the need to implement recycling programs in hospital OR settings. The mixed methods project design was a strength as it first utilized an anonymous online survey approach that removed any real or perceived influence for project participants as a means to examine existing anesthesia provider knowledge and understanding gaps. Following the online survey, a semi-structured interview questionnaire was developed based on survey results and the identified gaps in anesthesia provider knowledge and understanding of recycling in OR settings. This project approach helped lend legitimacy to the
project findings. Trustworthiness of data was supported through creating an audit trail and establishing credibility, transferability, dependability, and confirmability.

Limitations of this project include a relatively small sample size, findings that may be site-specific, veracity of responses to online survey questions, and potential focus group peer pressure an/or influence of group thinking. Moreover, the findings resulting from this project were derived from a convenience sample of anesthesia providers who had an expressed interest in the topic and who were willing and able to volunteer their time. Finally, the semi-structured focus group interviews were held on-site in a shared-use room that potentially introduced distractions from the conversations.

**Ethical Considerations**

UB Institutional Review Board (IRB) approval was obtained prior to conducting this project. There were no foreseeable risks to participating in this project. Project participants were consenting adults aged 18 and older and project participation was completely voluntary. Participants were under no financial, social, or employment obligations to participate in the project and no financial incentive was offered to participants. Study participants were able to withdraw at any point and time from the project. Implied individual consent was obtained for the online survey with understanding that completing the online survey meant giving consent to participant in the project. Verbal consent was obtained from all participants in both focus group interview sessions. Online survey results were collected anonymously through Survey Monkey® and survey data was stored on a password protected computer owned by DNP project student two. Survey data will be stored in a locked drawer in the home office of DNP project student one. Data will be destroyed after three years as per the UB IRB protocol.
Participants in both focus groups were asked not to reveal any personally identifying information and were asked not to address other participants by name during the audio recording. The audio recordings from both focus groups will be kept in a locked file drawer in the home office of DNP project student two. Audio recordings were transcribed without participant identifiers. Field notes taken during the focus group contained no participant identifying information. Focus group data will be destroyed after three years according to UB IRB policy.
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Appendices
Appendix A

Recruitment Email
Dear Anesthesia Providers;

We invite you to participate in a quick online survey examining your views on recycling in the operating room. Participation is voluntary and all of your responses are completely anonymous. The survey takes about 5 minutes to complete and your participation is vital for our (James Reilly and Jeffrey Tinen) UB capstone project. Please click the link below to take the survey.

Link: (survey monkey link will go here)

Participants who have completed the online survey will be asked to join us on one of two dates to participate in a focus group held during the Thursday morning meeting time slot. Refreshments will be provided.

More about our project:

The purpose of this capstone project is to address the question, among anesthesia providers directly involved in patient care at a local University affiliated tertiary care hospital in Buffalo, NY, would creating a waste management and recycling program protocol and educational guideline promote acceptance and increased knowledge and understanding regarding the benefit of recycling in the OR compared to the current waste management and recycling practice? Capstone project goals are as follows: 1) to explore the meaning of recycling in the OR and what constitutes recycling in the OR from the perspective of anesthesia providers; 2) to explore and identify existing recycling barriers as they are perceived by anesthesia providers in the OR; 3) to explore and identify existing recycling facilitators as they are perceived by anesthesia providers in the OR; 4) to explore and identify what is needed to develop and implement a waste management and recycling program from the perspective of the anesthesia providers in the OR; and 5) to develop an OR recycling and waste management program protocol and educational guideline for anesthesia providers in the OR.
Appendix B

Recruitment Poster
James Reilly and Jeffrey Tinen, two University at Buffalo, School of Nursing, Student Registered Nurse Anesthetists, invite XXXXXXXXXX anesthesia providers to participate in a capstone project that will be conducted for the purpose of exploring knowledge, understanding, barriers, and facilitators to recycling in the hospital operating room setting. Your decision to participate is completely voluntary and will in no way affect your employment at the hospital. The capstone project is designed to prevent any identifying information regarding your participation. If you decide to participate, you will be asked to complete an anonymous online survey administered via Survey Monkey and to participate in one of two focus group interview sessions held on site in a XXXXX conference room. The survey should take approximately 5-10 minutes to complete. An email will be sent out to the hospital anesthesia provider listserv and will include a direct link to the survey. The focus group interview sessions will be held during two of the morning “late start days” meetings and will take approximately one hour. Participants completing the online survey are asked to attend one of the focus group sessions. Breakfast and coffee will be provided during both focus group sessions.

The online survey will be open from 8/27/2018 - 9/3/2018
Focus group interview session 1 will take place on 10/4/2018
Focus group interview session 2 will take place on 10/18/2018

Please contact Jeffrey Tinen at jktinen@buffalo.edu with questions regarding the online survey.
Please contact James Reilly at jbreilly@buffalo.edu with questions regarding the focus group interview sessions.
Appendix C

Survey Monkey Standardized Introduction
We thank you for taking the time to participate in a quick online survey examining your views on recycling in the operating room. Participation is voluntary and all of your responses are completely anonymous. The survey takes about 5-10 minutes to complete and your participation is vital to our (James Reilly and Jeffrey Tinen) UB capstone project.

The purpose of this capstone project is to address the question, among anesthesia providers directly involved in patient care at a local University affiliated tertiary care hospital in Buffalo, NY, would creating a waste management and recycling program protocol and educational guideline promote acceptance and increased knowledge and understanding regarding the benefit of recycling in the OR compared to the current waste management and recycling practice? Capstone project goals are as follows: 1) to explore the meaning of recycling in the OR and what constitutes recycling in the OR from the perspective of anesthesia providers; 2) to explore and identify existing recycling barriers as they are perceived by anesthesia providers in the OR; 3) to explore and identify existing recycling facilitators as they are perceived by anesthesia providers in the OR; 4) to explore and identify what is needed to develop and implement a waste management and recycling program from the perspective of the anesthesia providers in the OR; and 5) to develop an OR recycling and waste management program protocol and educational guideline for anesthesia providers in the OR.
Appendix D

Survey Monkey Survey
Anesthesia Provider Survey on Recycling in the Operating Room

1.) What is your age?
   a. <30 years   b. 30-45 years   c. 46-60 years   d. 61-75 years   e. >75 years

2.) What is your gender?
   a. Male   b. Female   c. Other

3.) Which best describes your current position?
   a. CRNA   b. Resident   c. Fellow   d. Attending Anesthesiologist

4.) How long have you worked in your current position at this facility?
   a. Less than a year   b. 1-5 years   c. 6-10 years   d. More than 10 years

5.) How often do you recycle at home?
   a. Never   b. Rarely   c. Sometimes   d. Often   e. Always

6.) Recycling is a positive approach in waste management in hospital operating room (OR) settings.

7.) Environmental sustainability should be a key focus and/or priority for hospital OR settings.

8.) Improving hospital OR recycling waste policies and protocols would be cost effective.

9.) I am concerned about the amount of waste being generated by anesthesia providers in the OR.

10.) It is feasible to recycle in the hospital operating room.
11.) Anesthesia providers are afforded time to recycle while in the OR.

12.) Environmental sustainability and/or recycling was taught as part of my anesthesia provider college education.
   a. Yes  b. No  c. Can’t recall

12.) Environmental sustainability and/or recycling was part of my hospital employment orientation.
   a. Yes  b. No  c. Can’t recall

14.) I know where to look or who to ask if I have questions regarding OR waste disposal in my facility
   a. Yes  b. No  c. Can’t recall

15.) In your own words, please discuss anything you feel is important regarding anesthesia provider recycling in hospital OR settings that wasn’t asked in this survey.

Thank you for taking time to complete this survey!
Appendix E

Semi-Structured Interview Questionnaire
Anesthesia Provider Waste Management and Recycling Facilitators, Barriers, and Needs

Standardized Focus group Introduction

Welcome: Good morning everyone. My name is James Reilly and this is Jeffrey Tinen. We are nurse anesthesia students at the University at Buffalo. We would like to thank you for joining us this morning, and for participating in our capstone project.

Introduction: The purpose of our focus group discussion this morning is to explore knowledge, understanding, barriers, and facilitators as they relate to anesthesia providers recycling in the operating room. The discussion will take no more than an hour, and we invite you to have breakfast and refreshments while we talk.

Anonymity & Participation: We would like to remind you that your participation in this discussion group is completely voluntary and therefore taking part will be regarded as your verbal consent. If you feel uncomfortable for any reason you are free to excuse yourself without fear of reprisal or penalty. Your comments, for the purposes of data collection and reporting, will be audio recorded, professionally transcribed, and be free of personal identifiers, thereby helping to ensure your anonymity (recordings will be destroyed after three years). Given the nature of focus group discussions, however, we as researchers will be unable to guarantee confidentiality. We implore you as participants to be respectful of one another’s privacy as well as the research process by not repeating what was said here today outside of the focus group.

Ground Rules: In terms of the discussion, we ask that everyone participate to the extent that they feel comfortable. It is important to the study that we obtain the views of as many participants as possible. We ask that we be respectful of one another and allow others to finish speaking without interrupting them. There are no right or wrong answers – we are interested in
hearing your expressed views. Please feel free to disagree with others in the group, but we ask that you do so in a respectful manner. Jeffrey and I are here only to moderate the discussion; we ask that you address one another when expressing your opinions. Thank you. Are there any questions before we begin?

**Interview Questions**

1. Describe for me what recycling in a hospital OR means to you.

2. Describe for me what you know about anesthesia provider responsibility for the environment.

3. Tell me about any education you had in graduate school about recycling and anesthesia provider responsibility.

4. Tell me about any coursework you had in graduate school about anesthesia provider responsibility for recycling hospital OR settings.

5. Discuss your thoughts regarding whether or not recycling should be included in anesthesia provider education.

6. Describe for me any benefits you perceive to implementing a recycling program in the hospital operating room.

7. Describe for me any barriers you perceive to implementing a recycling program in the hospital operating room.

8. Describe for me how recycling efforts can be best implemented without interrupting the OR workflow.

9. Describe for me the role anesthesia providers should take regarding sustainability in OR waste management?
10. Is there anything we did not discuss today about recycling and anesthesia provider responsibility that you feel is important for me to know?
Appendix F

Educational Intervention Guideline
Educational Intervention Guideline

- Hospital Education
  - Utilize team-based learning in a low stress environment
  - Educate providers to employ reductionist strategy
    - When teaching students make expectations known
    - Don’t open multiple endotracheal tubes
    - Have drugs readily available but do not draw up what you are not going to 100% use
  - Educate providers on cost of medical waste versus cost of recycling
    - Demonstrate the cost benefit to recycling
  - If applicable, educate providers on what can be recycled and where to recycle it
    - Use pictures and make recycling bins easy to access and identify

- Anesthesia Training Education (Academia)
  - Discuss the environmental impact of the waste generated in the OR
  - Discuss the cost benefit of recycling versus not
  - Discuss the choice of anesthetic as well as low fresh gas flows and agent choice
  - Teach students about utilizing a reductionist strategy in their practice
Appendix G

Proposed Policy Recommendation
Proposed Policy Recommendation

- Employ multiple departments
  - Anesthesia Department
  - Environmental Services Department
  - Infection Control Department
  - Nursing Department
  - Surgical Department
  - Hospital Administration

- Develop a Green OR committee with key stakeholders from the above services

- Identify items and materials that can be safely recycled

- Conduct in-services and educational activities to promote awareness and compliance with recycling and proper waste management protocols

- Donate clean and unused medical supplies to charity medical groups providing international aid

- Develop a policy for recycling that will:
  - Utilize well-established waste streams
    - Soda lime, paper, plastic
  - Deploy easily identifiable recycling bins, utilizing easy to read signs with pictures as to what can be recycled in the OR
  - Place bins where staff can easily access them
  - Emphasize recycling of “pre-patient” setup items and empty bins before each OR case
  - Ensure open dialogue between Green OR committee, stakeholders, and staff
• Conduct OR waste stream audits
  o Perform cost-benefit analysis
  o Report findings to stakeholders and staff
Appendix H

Focus Group Themes
Table 8 *Focus Group Themes*

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-theme</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barriers</td>
<td>Knowledge Gap</td>
<td>“We don't really know downstream where the garbage from the hospital goes… Incineration? Landfill? We have no idea.”</td>
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<tr>
<td></td>
<td>- Unknowing</td>
<td>“I'm amazed actually, why the hospital system doesn't recycle everything.”</td>
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<td></td>
<td>- Disbelief</td>
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<td></td>
<td>Concern</td>
<td>“Our country is... we don't conserve much of anything…”</td>
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<tr>
<td></td>
<td>- Amount of Waste Produced</td>
<td>“…but I think there is some mistrust as to what happens after…”</td>
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<td></td>
<td>- Mistrust of Recycling Methods</td>
<td>“But the cost that the planet is paying, is priceless.”</td>
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<td></td>
<td>- Harming Nature</td>
<td>“There's only a finite amount of landfill space.”</td>
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<td></td>
<td>- Pollution</td>
<td>“Sweden is very, very, very into this topic. And they essentially are conserving almost everything... even in a hospital.”</td>
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<td></td>
<td>- Biohazard</td>
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<td></td>
<td>- Finite landfill space</td>
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<td></td>
<td>- International Concern</td>
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<tr>
<td></td>
<td>Habit &amp; Mindset</td>
<td>“So, there are mindsets that are difficult to change. They don't feel it's important.”</td>
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<tr>
<td></td>
<td>- Difficult to unfreeze</td>
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<td></td>
<td>- Difficult to change practice</td>
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<td></td>
<td>Administration</td>
<td>“…they're the ones that have the power to change.”</td>
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<td></td>
<td>- Dictates Policy</td>
<td>“But we could comply to anything that's put out there.”</td>
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<td></td>
<td>- Power to effect change</td>
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<tr>
<td>Awareness</td>
<td>Defining Recycling</td>
<td>“…using materials in a new way.”</td>
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<tr>
<td></td>
<td>- Repurposing</td>
<td>“We used to recycle to third world countries.”</td>
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<td></td>
<td>- Donating</td>
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<td></td>
<td>Environmental Impact</td>
<td>“I think the only logical way to do that [recycle] would be before the patient's in the room. And then you would have to assume that after the patient's in the room, everything is [contaminated] ...”</td>
</tr>
<tr>
<td></td>
<td>- Clean vs Contaminated Materials</td>
<td>“I think this is an excellent topic.”</td>
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<td></td>
<td>- Support for Recycling</td>
<td></td>
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<tr>
<td>Awareness</td>
<td>Advocacy</td>
<td>“We're essentially a voice-less workforce.”</td>
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<td></td>
<td>- Voices/Being Heard</td>
<td>“It’s not addressed as much as it should be.”</td>
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<td></td>
<td>- Policy (and Recycling)</td>
<td>“Well, just make it easy. You know, if you make it easy, more people will do it. And then just educate, educate, educate. What can go in, what can't go in, so when you finally</td>
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<tr>
<td></td>
<td>- Process</td>
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<tr>
<td>Championing Best Practice</td>
<td>Education</td>
<td>“More projects like this, awareness, education would be very helpful to us; to everyone.” “You’re obviously going to have to get janitorial services on board.”</td>
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<tr>
<td>Championing Best Practice</td>
<td>Responsible Use of Resources</td>
<td>“I think there's a fear of not being ready for a disaster…” “…very fine line between security and over-consumption.” “Try to generate less waste in a safe fashion.”</td>
</tr>
<tr>
<td>Championing Best Practice</td>
<td>Implementing Recycling</td>
<td>“…the [hospital]. Yeah, and I found ... they really had a system in place… It put your mind a little more to ease that you weren't generating all this garbage all the time.” “I've done it before. It's easy.”</td>
</tr>
<tr>
<td>Championing Best Practice</td>
<td>Cost-Benefit Analysis</td>
<td>“They probably charge the hospitals a premium just to take the medical waste away.”</td>
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</tbody>
</table>

- Championing Best Practice
- Education
  - Orientation
  - In-house training
  - Multidisciplinary
- Responsible Use of Resources
  - Mindful / judicious use
  - Careful planning
  - Security vs over-consumption
  - Reduction strategy
- Implementing Recycling
  - Mentor facilities
  - Ease of Use
Appendix I

Thematic Map
Figure 1. Thematic Map

- **Awareness**
  - Defining Recycling
  - Advocacy
  - Policy
  - Voices Heard
  - Process
  - Repurposing
  - Donating

- **Barriers**
  - Administration
    - Dictates Policy
    - Power to Effect Change
  - Habit & Mindset
    - Difficult to Unfreeze
    - Difficult to Change Practice
  - Knowledge Gap
    - Unknowing
    - Diabolical
  - Concern
    - International
    - Amount of Waste
    - Harming Nature
    - Pollution
    - Biohazard
    - Landfills

- **Championing Best Practice**
  - In-House Training
  - Education
  - Multidisciplinary
  - Cost-Benefit Analysis
  - Mentor
  - Implementing Recycling
  - Easy
  - Responsible Use of Resources
    - Careful Planning
    - Reduction Strategy
    - Mindful Judicial Use
    - Security vs Overconsumption
Appendix J

IRB Approval Form
September 12, 2018

Dear James Reilly,

On 9/12/2018, the University at Buffalo IRB reviewed the following submission:

<table>
<thead>
<tr>
<th>Type of Review:</th>
<th>Initial Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title of Study:</td>
<td>Recycling in the Operating Room: Assessing Understanding Through the Perspective of the Anesthesia Provider</td>
</tr>
<tr>
<td>Investigator:</td>
<td>James Reilly</td>
</tr>
<tr>
<td>IRB ID:</td>
<td>STUDY00002788</td>
</tr>
<tr>
<td>Funding:</td>
<td>None</td>
</tr>
<tr>
<td>Grant ID:</td>
<td>None</td>
</tr>
<tr>
<td>IND, IDE, or HDE:</td>
<td>None</td>
</tr>
</tbody>
</table>
| Documents Reviewed: | • Recruitment Email.pdf, Category: Recruitment Materials;  
|                  | • Reilly and Tinen HRP-503-Template Protocol Revised.docx, Category: IRB Protocol;  
|                  | • Recruitment Poster.pdf, Category: Recruitment Materials;  
|                  | • Semi-Structured Interview Questionnaire.docx, Category: Surveys/Questionnaires;  
|                  | • Reilly&Tinen HRP-502_Survey Adult Consent to Participate in a Research Study.pdf, Category: Consent Form;  
|                  | • Letter of Request .docx, Category: Site Permission Letter;  
|                  | • Reilly&Tinen HRP- Focus Group _502 Adult Consent to Participate in a Research Study.pdf, Category: Consent Form;  
|                  | • Online Survey .docx, Category: Surveys/Questionnaires; |

The University at Buffalo Institutional Review Board has considered the submission for the project referenced above on 9/12/2018 and determined it to be Exempt.

In conducting this study, you are required to follow the requirements listed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the Click system.
UBIRB exemption is given with the understanding that the most recently approved procedures will be followed and the most recently approved consenting documents will be used. If modifications are needed that may change the exemption determination, please contact the UB IRB Office. Also, see the Worksheet: Exempt Determination (HRP-312) for information on exemption criteria and categories.

As principal investigator for this study involving human participants, you have responsibilities to the SUNY University at Buffalo IRB (UBIRB) as follows:

1. Ensuring that no subjects are enrolled prior to the IRB approval date.

2. Ensuring that the UBIRB is notified of:
   - All Reportable Information in accordance with the Reportable New Information Smart Form.
   - Project closure/completion by submitting a Continuing Review/Modification/Study Closure Smart Form in Click.

3. Ensuring that the protocol is followed as approved by UBIRB unless minor changes that do not impact the exempt determination are made.

4. Ensuring that the study is conducted in compliance with all UBIRB decisions, conditions, and requirements.

5. Bearing responsibility for all actions of the staff and sub-investigators with regard to the protocol.

6. Bearing responsibility for securing any other required approvals before research begins.

If you have any questions, please contact the UBIRB at 716-888-4888 or ub-irb@buffalo.edu.
Appendix K

Poster
RECYCLING IN THE OPERATING ROOM: ASSESSING UNDERSTANDING THROUGH THE PERSPECTIVE OF THE ANESTHESIA PROVIDER

James Reilly BSN, RN, DNP-c & Jeffrey Tilen BSN, RN, DNP-c

Introduction
- The United States (U.S.) healthcare sector is the second leading contributor of waste, producing 1.1 billion kilograms of waste annually.
- Waste resulting from anesthesia services contributes to an estimated 26% of total U.S. operating room (OR) waste.
- Olives are high contributors to waste streams.
- Perioperative health care providers have an ethical and professional responsibility to serve as environmental stewards.
- Perioperative health care providers need to develop sound policies and technology guide environmental practices.
- Informed hospital stakeholders’ perspectives in exploring perceptions and needs from the perspective of anesthesia providers.

Project Question
- Among anesthesia providers directly involved in patient care at a local University affiliated tertiary care hospital in Buffalo, New York, would be able to reduce the management and recycling program protocols and educational guidelines promote acceptance and increase understanding regarding the importance of recycling in the OR.

Project Objectives
- To explore the following from the perspective of anesthesia providers working in an OR:
  1) The importance of recycling in the OR.
  2) Recycling barriers in the OR.
  3) Recycling facilitators in the OR.
- To develop an anesthesia management program protocol and educational guidelines for anesthesia providers.

Theoretical Framework
- Lewin’s three-step model of change that builds on the understanding of human behavior in three phases of stages:
  1) Unfreezing
  2) Transitioning
  3) Refreezing

Methods
- A mixed methods approach was used to collect data following IRB approval from the University at Buffalo:
  1) Use of a 15 question anonymous online SurveyMonkey® survey with questions guided by ten literature review findings and 5 demographic questions.
  2) Two semi-structured interview sessions were conducted with open-ended interview questions guided by findings resulting from the online survey and probing questions to elicit further understanding of waste management and recycling.
- A total of 16 participants volunteered. Both focus group sessions were audio recorded and transcribed for thematic analysis.

Data Analysis

Anonymous Online Survey
- Demographic data were used to characterize the set of survey respondents and to compare them to the focus group participants and the larger anesthesia hospital community.
- Content questions used a 5-point frequency scale (always, often, sometimes, rarely, or never), or a 5-point agreement scale (strongly agree, agree, neutral, disagree, strongly disagree).
- For each question the number of responses to each category was tallied, then the positive and negative ends of each scale were collapsed, yielding a condensed 3-point scale.

Semi-Structured Focus Group Interviews
- Braun and Clarke’s (2006) thematic analysis (TA) method based on the following 6 phases was utilized to analyze the data: Data Immersion, Generating Initial Codes, Building for Themes, Reviewing Themes, Defining and Naming Themes, and Producing a Report.
- A UB School of Nursing content expert guided qualitative data analysis.

Results

Anonymous Online Survey
- 27 of 88 providers completed the survey (31% response rate).
- A majority of respondents (85%) indicated they always or often recycled at home and almost all (96%) indicated that they generally considered recycling a positive waste management approach.
- A full 95% indicated that sustainability should be a key focus for the hospital.
- Very few (11%) respondents indicated that environmental sustainability was included in the hospital’s financial education training.
- The majority (86%) of respondents agreed that recycling was feasible in the OR, but 30% did not agree that there was enough time to recycle in the OR.

Discussion
- DNP Essentials addresses leadership, regulatory, delivery, and environmental responsibilities.
- Anesthesia providers in the OR currently in Lewin’s Unfreezing and Transitioning stage.
- Based on project results, OR recycling recommendations and guidelines were developed.
- OR recycling educational guidelines developed in the Certified Registered Nurse Anesthetist (CRNA) role courses at the University of Buffalo (UB).
- Limitations of this study include a relatively small sample size, site-specific findings, and the potential influence of peer pressure on the future focus groups.

Future Implications
- DNP essentials based on project recommendations and guidelines conduct a program evaluation that includes a cost-benefit analysis.
- Incorporate and implement educational guidelines into the CRNA curriculum at UB and evaluate the program.