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Certified Registered Nurse Anesthetist's Awareness and Knowledge of Herbal Supplements and Perioperative Interactions

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Abstract

Previous studies have asserted that anesthesia providers are deficient in their knowledge of herbal supplements and their perioperative interactions. The purpose of this project was to examine the impact of an educational handout on Certified Registered Nurse Anesthetists' (CRNAs) knowledge and attitudes of herbal supplements and their perioperative interactions utilizing a pre-posttest project design. The survey components were sent to approximately 1,600 members of the Illinois Association of Nurse Anesthetists (IANA) with a response of 140 surveys.

Data was analyzed using descriptive Cohen's d and nonparametric statistical tests. Reliability of the instruments used were assessed using Cronbach's α coefficients. The posttest Cronbach's α coefficient for attitudes subscale was 0.817, and for the knowledge subscale was 0.915, both of which indicate a high reliability of the consistency of the items in the attitude and knowledge subscale. The Cohen's *d* values for attitudes and knowledge were -0.89 and -0.11 respectively. Thus, the tool had a large effect on attitudes and a small effect on knowledge. The p values for attitudes ($p = 0.000$) and knowledge ($p = 0.043$) were both statistically significant. There were no statistically significant differences found in the mean scores for attitude or knowledge based on categorical groupings by gender, level of education, years of practice, or age.

Keywords: Certified Registered Nurse Anesthetist, complementary alternative medicine, herbal supplements, educational tool

Introduction

Complementary and alternative medicine (CAM) increases in popularity every year, with one of the most common practices being the consumption of dietary herbal supplements. A dietary herbal supplement was defined by the 1994 Dietary Supplement Health and Education Act (DSHEA) as an adjunctive therapy designed "to supplement the diet; and contains one or more dietary ingredients including vitamins, minerals, herbs or other botanicals, amino acids, and other substances or their constituents".[1] Fifty million Americans report taking herbal supplements; however, it is estimated that as many as 70% of this population fail to report their use of supplements in the perioperative setting.[2] Levy et al[3] discovered that 56% of surgical patients who consumed herbal supplements did not report their use to their anesthesiologist. Likewise, 50% of these patients did not stop taking the supplement prior to the day of surgery, despite the fact that the American Society of Anesthesiologists suggests discontinuing herbal supplements 2-3 weeks before surgery.[4] This failure of communication between patient and provider poses a risk to patient safety due to the many adverse reactions that can occur with the concomitant consumption of herbal supplements and perioperative medications.

Physicians and advanced practice nurses alike recognize the importance of assessing patients for herbal supplement use; yet, this realization often fails to transfer into practice. Many anesthesia providers neglect to inquire about herbal supplements during the patient interview, despite the fact that nearly half of surgical patients in the U.S. consume herbal supplements.[3,5] The combination of herbal supplement use amongst surgical patients and lack of provider awareness can lead to adverse events while under anesthesia, including increased bleeding times, interference with metabolism of drugs, increased sedation levels, hemodynamic instability, and even death.[2] To prevent poor outcomes and to maintain patient safety, it is paramount anesthesia providers are aware of the adverse reactions associated with herbal supplements.

Another factor that supports the necessity of incorporating herbal supplement assessment into the preoperative interview is the under regulation of herbal supplements by the federal government. Since the passing of the DSHEA, herbal supplements have remained exempt from any sort of regulation by the US Food and Drug Administration (FDA).[6] Consequently, the creation and manufacturing of these supplements are not overseen, nor are they tested for quality or potency. Thus, poor quality or even extremely potent herbal supplements enter the US consumer market.[7] These potent herbal remedies are a danger to consumers, increasing their risk of adverse events under anesthesia. The combination of absent regulation, deficient provider and patient knowledge, and failure to inquire or report the consumption of herbal supplements creates a communication and knowledge gap between anesthesia providers and patients. This gap calls for the need to educate anesthesia providers in order to provide safer, better quality care.

This project created an anonymous online survey and educational tool were created with the intent to: (1) Identify CRNAs' current level of herbal supplement attitudes and knowledge (2) Assess if CRNAs' current practice includes the preoperative assessment of herbal supplements (3) Examine the impact of an online learning module on CRNAs' knowledge of herbal supplements and their perioperative interactions with other anesthetic agents.

Conceptual Framework

Icek Ajzen's[8] *theory of planned behavior* serves as the theoretical framework for this project. Central to this theory is having an intention to carry out a certain behavior. Simply stated, an individual will feel more compelled to change their current behavior if a strong intention is the driving force behind the change.

Ajzen[8] states there are three different types of beliefs - behavioral, normative, and control - all of which influence the three determining factors of intention - attitude, subjective norm, and

perceived behavioral control. These three factors are readily applicable to this project. In regards to *attitude*, if the nurse anesthetist does not believe herbal supplements are important, then he/she will not be inclined to interview patients about their use. *Subjective norm* can be very influential on an individual's change in behavior. If a nurse anesthetist realizes that his/her peers are incorporating herbal supplement use into their preoperative interview, then he/she will also feel inclined to do so. Likewise, if an individual's peers do not adopt this behavior change, then the individual will also not change their behavior. Additionally, if an institution has a protocol in place regarding herbal supplement assessment, then the nurse anesthetist will again feel more compelled to change their behavior. The nurse anesthetists' *perceived behavioral control* should not be hindered by any obstacles because it is not difficult to ask patients about their use of herbal supplements. However, if the nurse anesthetist thinks adding this assessment into their preoperative interview is unnecessary or will be too time consuming, then he/she will not change their current behavior.

Literature Review

Previous Studies Regarding CRNAs' Knowledge of Herbal Supplements. Since the early 2000s, only two major studies were published, Temple et al[6] and Deel[9], that surveyed CRNA's knowledge, beliefs, and assessment of herbal supplements. Temple et al[6] surveyed 1,000 CRNAs from the American Association of Nurse Anesthetists (AANA), with a response rate of 19% (191 responses). Results of the survey revealed 80% of respondents do not have a designated place on the anesthesia record or preoperative anesthesia assessment to document herbal supplements.[6] 92% of CRNAs believed preoperative evaluation of herbal supplements should occur, though only 30% of CRNAs reported actually evaluating for supplement use.[6] Confidence levels of herbal supplements and their anesthetic interactions were low with only 17% of CRNAs feeling

confident in their knowledge; however, 93% desired more education on the topic.[6] Temple et al[6] concluded their study with the suggestion to survey CRNAs again in the future to determine if the rise in popularity of herbal supplements would lead to more education and therefore an increase in knowledge.

A later study by Deel[9] surveyed 300 CRNAs from the AANA with a 28.3% response rate (85 responses). 30% of respondents were confident in their herbal supplement knowledge while only 16% were knowledgeable about their interactions with other anesthetic agents. 26% of CRNAs reported personally assessing for herbal supplement use, which was lower than the 30% of Temple et al's[6] survey sample. Similarly to Temple et al[6], the majority (58.1%) of CRNAs believed that herbal supplements were medically active and may have an impact on surgical outcomes.[9] Deel's[9] results were similar to Temple et al's[6], confirming that a knowledge gap still exists and that CRNAs both desire and require education regarding herbal supplements.

Mikail, Hearney and Nemesure[10] conducted a study with anesthesia residents that assessed for physician awareness of herbal supplements and their contraindications. The study consisted of a pretest, tutorial and posttest. The pretest assessed the residents' herbal supplement knowledge and consisted of board style true/false, multiple choice, and matching questions. Current practice and desire to learn about supplements were also assessed before the tutorial. The mean pretest score was a low 32%, demonstrating a large knowledge deficit. Additionally, the researchers found only 17% of residents asked their patients about herbal supplement use.[10] Following the tutorial, the mean posttest score increased to 61%, with the in-person tutorial group yielding the highest scores.[10] Mikail et al[10] demonstrated that an educational tutorial about herbal supplements is not only useful, but also desired by anesthesia providers.

Perioperative Importance. While there is a deficiency in the number of studies assessing CRNA knowledge of herbal supplements, there is no shortage of studies regarding patient consumption and underreporting of herbal supplements. Tsen, Segal and Bader[5] discovered that most patients failed to disclose taking herbal supplements to anesthesia providers unless specifically asked. Tsen et al[5] implemented a questionnaire into a preoperative interview with the goal to discover the prevalence of herbal supplement use, demographics of these patients, and to discover the most common herbal supplements used. Of the 3,106 patients questioned, 22% reported taking herbal supplements, the majority being female. The most popular supplements identified were echinacea, ginkgo biloba, St. John's wort, garlic, and ginseng.[5] This study identified a communication gap between patient and provider regarding herbal supplements, and CAM as a whole, due to either patient embarrassment, misunderstanding or fear of physician dismissal of the unconventional therapy.[5]

At Texas Tech University Health Sciences Center, Kaye et al[4] incorporated an herbal supplement questionnaire into the preoperative interview. The authors discovered that of the 755 valid questionnaires, 482 reported taking dietary supplements and of 70% of the 482 failed to disclose their supplement use to their physicians.[4] Garlic, ginkgo, St. John's wort, ephedra, echinacea, and aloe were among the most popular herbal supplements consumed.[4] These findings support the conclusion of Tsen et al's[5] that a lack of communication exists between provider and patient regarding the importance of reporting herbal supplement use.

The reports from the early 2000s are validated in more recent studies performed by Gardiner et al[1] (2015) and Levy et al[3] (2017). Gardiner et al[1] performed interviews and reviewed the charts of 558 inpatients at Boston Medical Center. The goals of this study were to identify if inpatients were reporting dietary supplements, asked about taking dietary supplements upon

admission, and to determine if there were certain demographics of those who consume dietary supplements. The researchers discovered that 60% self-reported taking dietary supplements but only 20% of those patients reported being asked by a physician about their consumption.[1] Of the 20% who were asked by a physician, only 21 of those patients had this information documented in their chart.[1] This study demonstrated that the assessment of herbal supplements is inconsistent. Not only must healthcare providers ask about herbal supplements when interviewing patients, but they must also document this use in their medical record to ensure continuity of communication and care.

Levy et al[3] interviewed surgical patients at an academic medical center in Israel between 2009 and 2014 regarding their use of dietary supplements and then used this information to explore the risks associated with herbal supplements in the perioperative setting. Of the 526 patients interviewed, 230 reported taking dietary supplements, yet only 26 patients had this information documented in their chart.[3] Levy et al[3] concluded that one in fourteen surgical patients were at risk for interactions between herbal supplements and anesthetics and that one in twenty-two patients were at risk of perioperative hemorrhage due to interactions with blood thinners. After this study, the recommendation was that anesthesiologists and medical residents should undergo educational training regarding the risks that herbal supplements pose in the surgical setting.

Herbal Supplements. The study researchers conducted a thorough review of literature to find the most frequently used herbal supplements, their adverse effects, and their interactions. The educational handout (Figure 1) is a review of the seven commonly used supplements garlic, ginger, ginkgo, ginseng, St. John's wort, kava kava, and ephedra.

Methods

Project Design. This project utilized a pre and posttest, quasi-experimental design aimed at describing the CRNAs' attitudes, beliefs and knowledge of herbal supplements and their perioperative interactions. The project also assessed the effect of an investigator-developed online educational handout through an online survey. The educational handout was made available for review to study participants between taking the pre and posttests.

Sample. The population surveyed were current or retired CRNAs who are members of the IANA. The IANA is the official professional organization for CRNAs in the state of Illinois. There are approximately 1,600 members in the IANA.

Setting. Illinois is a large state that includes both small rural towns and large metropolitan cities. Due to the diverse demographics of the state, the IANA network provided us with participants who had a variety of anesthesia experience in multiple different practice settings. This entire project was conducted online, thus allowing the project participants to complete the project wherever they had access to the Internet.

Instruments. The pre and posttests were adapted from a previous survey titled "Questionnaire on herbal supplement knowledge and beliefs" by Temple et al.[6] Permission to adapt this survey was granted by the author. The original survey had been found to have good internal validity and adequate reliability, which ensures that the items and questionnaires have adequate internal consistency in measuring knowledge and beliefs. [6] The original survey was designed as a multiple choice descriptive survey of 53 items, which consisted of demographic information, provider attitudes and current practice, and questions about the use and adverse effects of the following herbal supplements: ephedra, ginseng, ginkgo biloba, valerian root, kava kava, garlic, echinacea, and St. John's wort.

This project's pretest was adapted to included 3 sections: (1) demographic information (8 items), (2) current attitudes and knowledge regarding herbal supplements and anesthesia (6 items), and (3) herbal supplement quiz (10 items). The posttest included 2 sections: (1) attitudes and knowledge regarding herbal supplements and anesthesia (7 items) and (2) herbal supplements quiz (7 items). Both sections of the pre and posttest asking about specific herbal supplements were identical. A Likert scale was used to assess responses in the pre and posttests for attitudes, and the knowledge section consisted of questions with one correct answer.

The educational handout used in this project consisted of a document intended to be a quick reference of the seven most frequently taken herbal supplements: garlic, ginger, gingko, ginseng, St. John's wort, kava kava, and ephedra. The contents of the handout and the pre and posttest items were reviewed and validated by an expert panel comprised of four doctorally prepared NorthShore University HealthSystem educators with an expertise in nurse anesthesia.

Recruitment and Data Collection Procedures. Participants were recruited from the IANA via email. Participation was voluntary. The email contained a description of the project, information about how to participate, and a secure Qualtrics link to the informed consent, survey and educational handout. Qualtrics is a survey platform that allows surveys to be distributed anonymously via an email link. The recruitment email and informed consent text both explained to participants the voluntary and anonymous nature of the survey.

Data Analytic Procedure. Data analysis was completed using statistical package for the social sciences (SPSS) software.[11] Prior to running any statistical tests, data was reviewed and surveys with less than 50% completion were removed. Descriptive statistics including means, standard deviation, frequencies, and percentages were used to evaluate the perceived beliefs, attitudes and knowledge of herbal supplements and their perioperative interactions. Nonparametric tests,

including the Wilcoxon signed rank, the Mann-Whitney U, and the Kruskal Wallis H tests were used to explore any significant differences in the median scores for knowledge and attitudes subscales based on categorical groupings of two or more independent groups using the sociodemographic data of study participants. Items regarding beliefs and attitudes were scored on a Likert scale and produced interval type data, while the items relating to perceived knowledge produced a ratio and binary type data with the correct answer coded as 1 and the wrong answer coded as 0. The reliability of the educational handout was assessed using Cronbach's α coefficients for the Likert-type items and Kuder-Richardson (KR-20) coefficient was calculated for the knowledge questions.

Human Subject Protection. This project received approval from DePaul University's Institutional Review Board. The data collected did not contain any personal identifiers. To ensure anonymity, the pre and posttests were sent via an email that contained a secure link to Qualtrics. No questions asked contained personal identifiable information. Data collected from this project was kept in a secure document on a password protected computer. Participants in this project gained no direct monetary benefits from completing the survey.

Results

Survey Participants. A total of 140 participants responded to the survey resulting in an overall response rate of 8.8%. Of the 140 responses, 111 surveys has at least 50% completion rate and were considered valid for analysis. The sociodemographic characteristics of the respondents and their frequencies are described in Table 1. Of the participants, the majority were female (n = 63) and almost half of the participants were between the ages of 30-39 years (n = 27) or 50-59 years (n = 26). The majority of the CRNAs, 55.3% (n = 63), had 10 or more years of practice

experience and achieved a graduate degree, with 51.1% (n = 48) holding a master's degree and 36.2% (n = 34) with a doctorate.

Attitudes and Beliefs on Herbal Supplements. CRNA attitudes and beliefs towards herbal supplements improved from the pre to posttest. The means and standard deviations for the pre and posttest are shown in Table 2 and Table 3. The questions in this section assessed the participant's attitudes and beliefs towards herbal supplements in their personal practice. Items were scored using a Likert scale as follows: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree.

The largest improvement in mean scores in this section was the item "I (will) assess my patient's use of herbal supplements preoperatively" (pretest M= 3.26; posttest M= 4.10). The lowest scoring mean attitude question was the item "I (now) feel confident in my knowledge of the effects of herbal supplements' interactions with anesthesia" (pretest M= 3.23; posttest M= 3.87). The highest scoring pretest question mean (M= 3.99) was "I would like more educational opportunities to learn about herbal supplements and anesthetic interactions."

The Cronbach's α coefficients were obtained for the pre and posttests. The pretest Cronbach's α for the 4-item attitudes and beliefs subscale was 0.33, indicating poor reliability which is most likely due to participant lack of awareness and knowledge of the subject matter causing too much variability in their responses. The Cronbach's α improved to 0.81 at the posttest, illustrating adequate reliability of the adapted instrument. The significant improvement of the pre and post scores improved the variability of responses to the adapted instrument and subsequently led to the improved Cronbach's α value at posttest. The pretest showed a high variance (SD=0.13) that improved in the posttest (SD=0.87). The Cohen's d value test comparing

the pre and posttest means was -0.89 which showed a large effect. The Wilcoxon signed ranks test for the pre and posttest mean scores was p= 0.000 which is statistically significant.

Knowledge on Herbal Supplements. CRNA knowledge of herbal supplements did not have as dramatic of an improvement between the pre and posttests as did their attitudes and beliefs. The questions asked regarding knowledge on herbal supplements produced binary data with only one correct answer coded as 1 while the incorrect answer was coded as 0. The means and standard deviations for each questionnaire item can be found in Table 4. The majority of the posttest means improved. The overall mean pretest score was 0.56 and the overall posttest mean score was 0.59. The herbal supplement with the highest and lowest posttest means were ephedra (M=0.72) and kava kava (M=0.45) respectively. The herbal supplement with the greatest improvement between pre and posttest means was ginseng (M=0.24 to M=0.46). Three herbal supplements had posttest means that were lower than their pretest means, the most drastic change being between ephedra's pre and post means (M=0.81 to M=0.72).

The 7-item pretest and posttest knowledge subscale have KR-20 coefficient values of 0.79 and 0.91 respectively. The high posttest KR-20 coefficient value reaching above .90 not only supports the validity of the content of educational handout, but the increase in KR-20 value also indicates that the survey participants were gaining mastery of the contents in the herbal supplement handout. The Cohen's d value test when comparing the pre and posttest means was -0.11 which showed a very small effect.[12] The Wilcoxon signed ranks test for the pre and posttest mean scores resulted in a p value of 0.043 which is statistically significant.

Association of Sociodemographic Variables. The Mann-Whitney U test was used to test the null hypothesis for the pre and posttest mean distributions in correlation with gender, level of education (masters or doctorate), and years of practice. The Kruskal-Wallis test was used to test

the null hypothesis for the pre and posttest mean distribution as they relate to participant age. There were no statistically significant differences found in the mean scores (Table 5) for attitudes and beliefs nor for knowledge as they pertain to participant gender, level of education, years of practice, or age. It is worth noting that 71.3% (n = 63) of survey participants reported having no specific place to document herbal supplements on the preoperative evaluation.

Discussion

The pretest Cronbach's α coefficient for attitudes and beliefs (0.332) did not show internal consistency due to a lack of awareness of herbal supplements. After the study participants' review of the educational handout, scores improved and the Cronbach's α coefficients increased from 0.332 to 0.817, which indicates adequate reliability.[13]

The question with the highest pretest mean (*M*=3.99) was the item relating to CRNAs wanting more educational opportunities regarding herbal supplements. This is consistent with similar results from studies published by Temple et al[6] and Deel.[9] Since these studies were conducted more than 10 years ago, one could deduce that anesthesia providers would now have a stronger foundation of herbal supplements. However, this pretest mean of 3.99 suggests that anesthesia providers' confidence has not improved and instead they still seek education pertaining to herbal supplements.

The question with the largest increase in posttest mean scores pertained to the assessment of herbal supplements preoperatively. After the educational handout was reviewed, mean scores improved from 3.16 to 4.10. This finding, in conjunction with the Cohen's *d* value result for attitudes and beliefs (-0.89), support the hypothesis that educational handouts are an effective means to create awareness of herbal supplements, and they have the ability to create changes in

current practice as evidence by a statistically significant difference in the mean scores in knowledge from the pre to posttest period (Z=-2.02; p=.04).

While the reliability of the educational handout as it pertains to improving CRNA knowledge was supported by a posttest KR-20 coefficient of 0.915, the Cohen's *d* value was only -0.114 implying that the tool had a small effect. The potential reasons for this are multifold. The overall mean test score for knowledge only improved to 0.59 from 0.56, thus implying that the educational handout marginally improved CRNA knowledge of herbal supplements. Perhaps the tool was too brief or arranged in a manner that made it difficult for participants to retain information. Another explanation could be that an online tool may not be the ideal platform for an educational tool on herbal supplements. Our project supports the finding by Mikail et al[10] that an in person tutorial may be the preferred method when teaching anesthesia providers about herbal supplements.

The posttest mean scores for the questions regarding gingko, ephedra and ginger all decreased. This could be a result of a poorly constructed or confusing educational handout. Another explanation could be that the length of the entire survey was too long and participants lost interest. This claim is supported by the fact that a noticeable amount of participants failed to complete the posttest, thus skewing the posttest means. Participants did not have access to the handout when taking the posttest. If they had been able to reference the handout, the posttest means may have been higher.

Limitations. This project has numerous limitations. This project had a small valid sample size (n=111) that only consisted of CRNAs from the state of Illinois. Since the project was restricted to one state, results may not be able to be applied to CRNAs nationwide. This project's small sample size could be attributed to many factors, including the fact that there was no incentive for

completing the survey other than personal gain. Another reason for the low response rate is survey length. Initially, 140 participants began the survey, but only 111 completed more than 50%. A cumbersome survey could attribute to this fact. Personal learning style is another limitation to this survey. This project's educational handout was only presented to participants in an online format. While this style does benefit visual learners, it is not ideal for auditory or kinesthetic learners. Another major limitation is the time constraint placed on developing a valid and reliable educational tool for a DNP project. If more time had been available, as in the time allotted to researching and writing PhD dissertations, more educational platforms could have been explored and utilized for use in this project.

Future Direction for Research and Implications for Practice. This project's educational handout was efficacious in changing CRNA beliefs and attitudes regarding herbal supplements, however the handout was lacking in its effectiveness to improve knowledge of each specific herbal supplement. This suggests that future studies aimed at improving knowledge of herbal supplements should occur. When creating an educational tool, future studies should explore other avenues that would be beneficial to multiple learning styles, such as an in-person lecture or an online video.

The survey results indicate that anesthesia providers understand the importance of assessing for herbal supplements during their preoperative interview. However, this importance must be transferred into a change in practice. Future studies could explore the implementation of a new preoperative assessment that included a place to specifically document herbal supplements.

Unfortunately, provider awareness of herbal supplements is not enough to prevent intraoperative events. Patients must also be educated and they must be compliant when they are

advised to stop taking herbal supplements two weeks prior to surgery.[4] According to Ajzen[8] and his theory of planned behavior, an individual is more compelled to make a change in behavior when a strong intention is the driving force. If proper education is given to anesthesia providers and patients alike, less intraoperative adverse events will occur, thus improving the safety to all.

Conclusion

Results from this project are consistent with those concluded over a decade ago in that there remains a need for more education opportunities regarding herbal supplements. This project suggests that once CRNAs are made aware of the perioperative indications of herbal supplements, they are more inclined to change their standard of care and assess for these agents preoperatively. While this project was proficient in altering CRNAs' beliefs and attitudes regarding the importance of herbal supplement assessment, it remained deficient in improving knowledge of particular supplements. Future studies should be conducted in order to achieve provider mastery of this subject matter. Continuing education among CRNAs is needed to maintain adequate and current evidence-based knowledge on herbal supplements and foster positive attitudes towards assessment, documentation, and monitoring of these supplements during the perioperative period.

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Table and Figures

Table 1. Sociodemographic Characteristics of Survey Participants (N = 111)

Knowledge Variable	Frequency	Percentage of Respondents
Gender		
Male	31	33.0
Female	63	67.0
Age		
70+	1	1.1
60-69	16	17.0
50-59	26	27.7
40-49	17	18.1
30-39	27	28.7
20-29	7	7.4
Level of Education		
Anesthesia Certificate	5	5.3
Master's Degree	48	51.1
Doctorate Degree	34	36.2
Years Practicing as CRNA		
1-2	23	24.5
3-5	11	11.7
6-10	8	8.5
10+	52	55.3

Table 2. Attitudes and Beliefs Pretest

Questionnaire Item	Mean	SD

I assess my patient's use of herbal supplements preoperatively.	3.26	0.922
I feel confident in my knowledge of the effects of herbal supplements' interactions with anesthesia.	3.23[b]	0.873
I believe that herbal supplements can have a negative impact on anesthetic outcomes.	3.75	0.756
I would like more educational opportunities to learn about herbal supplements and anesthetic interactions.	3.99 [a]	0.681

[a]Highest mean score.
[b]Lowest mean score.

Table 3. Attitudes and Beliefs Posttest

Questionnaire Item	Mean	SD
I will assess my patient's use of herbal supplements preoperatively.	4.10[a]	0.602
I now feel more confident in my knowledge base of herbal supplements' interactions with anesthesia.	3.87[b]	0.620
I believe that herbal supplements can have a negative impact on anesthetic outcomes.	4.07	0.657
I found this educational module helpful and will use the information learned here in my daily practice.	4.06	0.737

[a]Highest mean score.
[b]Lowest mean score.

Table 4. Knowledge Pretest/Posttest

Knowledge Variable	Answer	Pretest Mean (SD)	Posttest Mean (SD)
May cause inhibition of platelet aggregation and possibly decrease cholesterol levels?	Garlic	.60 (.49)	.66 (.48)
May inhibit platelet activating factors and is used in cognitive disorders?	Gingko	.63 (.49)	.60 (.49)
May precipitate a benzodiazepine-like withdrawal syndrome if suddenly discontinued?	Kava kava	.40 (.49)	.45[b] (.50)
May be used to improve energy and immunity and decreases the effect of opioids?	Ginseng	.24[b] (.44)	.46 (.50)
May cause a serotonin syndrome if taken with SSRIs or tricyclic antidepressants?	St. John's Wort	.54 (.50)	.59 (.50)
May increase sympathetic stimulation, heart rate, blood pressure and dysrhythmias with anesthesia?	Ephedra	.81[a] (.39)	.72[a] (.45)
May be used as an antiemetic and may increase bleeding risk?	Ginger	.70 (.46)	.68 (.47)

[a]Highest mean score.
[b]Lowest mean score.

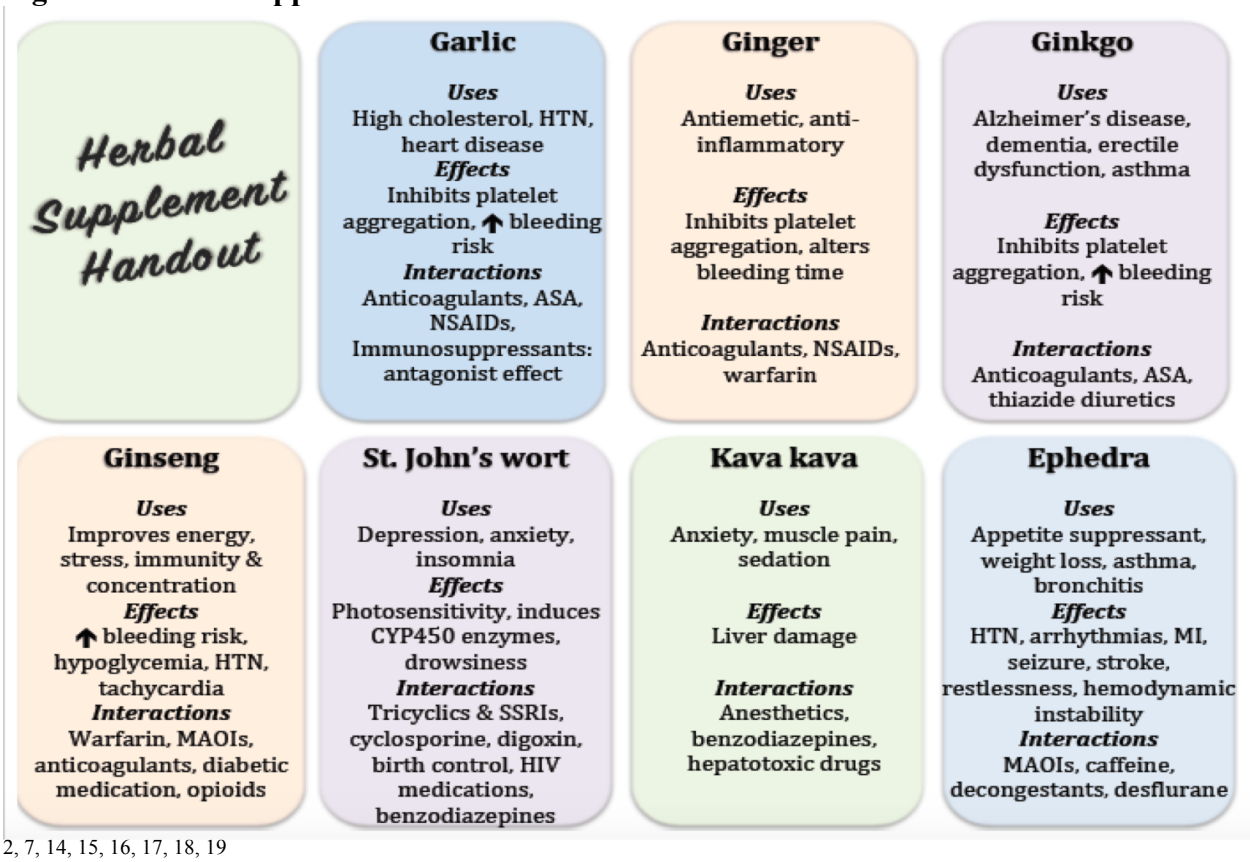
Table 5. Correlation of Posttest Mean Scores with Sociodemographic Variables

	Attitudes and Beliefs	
Demographic	**Test**	**Significance**
Age	Kruskal-Wallis	.855
Gender	Mann-Whitney U	.355

Level of education	Mann-Whitney U	.597
Years practicing	Kruskal-Wallis	.117
Demographic	**Knowledge Test**	**Significance**
Age	Kruskal-Wallis	.586
Gender	Mann-Whitney U	.053
Level of Education	Mann-Whitney U	.430
Years practicing	Kruskal-Wallis	.213

$P < 0.05$ is statistically significant

Figure 1. Herbal Supplement Educational Handout



2, 7, 14, 15, 16, 17, 18, 19

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