Effects of Lavender Essential Oil on Perceived Stress:

A Quality Improvement Project

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Abstract

Stress-related problems in the RN workplace are described as an occupational hazard estimated at over $300 billion annually in the United States as a result of job accidents, absenteeism, employee turnover, diminished productivity, medical fees, legal fees, insurance costs, and workers' compensation. Aromatherapy can be effective at reducing stress in the workplace environment. High stress levels on a Press-Ganey RN satisfaction survey at a level-1 trauma hospital was the trigger for this quality improvement project. Decreasing nurse perceived stress levels may increase nurse satisfaction. Lavender essential oil aromatherapy was provided to all nurses and medical staff who wanted to volunteer for the quality improvement project. Perceived stress levels among registered nurses were measured before, during, and after the 60-day quality improvement project. Pre-mid-post assessment Perceived Stress Scale scores showed decrease from 21 to 19, then 19 to 18 respectively.

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Stress is a common phenomenon encountered among registered nurses (RNs) in practice. Excessive or chronic stress on RNs can negatively affect patient safety, nursing satisfaction, turnover, and burnout (Canadas-De la Fuente et al., 2015; Khamisa, Oldenburg, Peltzer, & Ilic, 2015; Khamisa, Peltzer, Ilic, & Oldenburg, 2016). Recent evidence has shown that essential oils are a quick, low cost, effective method of lowering stress levels (Bouya, Ahmadidarehsima, Badakhsh, Balouchi, & Koochakzai, 2018; Chen, Fang, & Fang, 2015; Johnson et al., 2017; McCaffrey, Thomas, & Kinzelman, 2009; Park & Lee, 2004; Pemberton & Turpin, 2008; Redstone, 2015; Senturk & Tekinsoy Kartin, 2018; Seo, 2009; Song & Lee, 2018; Steflitsch et al., 2015; Tang & Tse, 2014; Xiao, Li, Xie, Xu, & Liu, 2018). This quality improvement project aims to improve perceived stress levels in RNs through the application of lavender essential oil aromatherapy.

Description of the Problem

Stress-related problems in the RN workplace are described as an occupational hazard estimated at over $300 billion annually in the United States as a result of job accidents, absenteeism, employee turnover, diminished productivity, medical fees, legal fees, insurance costs, and workers' compensation (The American Institute of Stress, 2018). Reported high stress levels on a Press-Ganey RN satisfaction survey at a level-1 trauma hospital was the trigger for this evidence-based quality improvement project. One goal of the hospital is to maintain the American Nurses Credentialing Center's (ANCC) Magnet Recognition award for nursing excellence status. The latest Press-Ganey RN satisfaction survey showed significant room for

improvement regarding nursing satisfaction on this project's nursing unit, which may impact ANCC Magnet Recognition eligibility in the future.

Literature Review and Synthesis

Search Strategy

A literature search was conducted on PubMed Medline and CINAHL using the Boolean search terms: Aromatherapy (MeSH Terms), AND nursing (all fields), NOT breastfeeding (MeSH Terms), AND stress (all fields), NOT massage (all fields). The literature search yielded 55 total results including PubMed Medline and CINAHL. Inclusion criteria were comprised of studies published after 2004 that focused on aromatherapy's effect on one or more components of stress. There were 19 studies (See Appendix A) that met inclusion criteria, and 36 studies that did not, due to year published, animal studies, or focusing on aromatherapy's effect on concepts that did not include stress. Melnyk and Fineout-Overholt's (2015) criteria were used to categorize the studies by levels of evidence as seen in Appendix B.

Literature Review

Since 2004, 13 published studies provided statistically significant data that lavender essential oil aromatherapy was an effective means for improving stress in nurses, patients, and adults (Bouya et al., 2018; Chen et al., 2015; Johnson et al., 2017; McCaffrey et al., 2009; Park & Lee, 2004; Pemberton & Turpin, 2008; Redstone, 2015; Senturk & Tekinsoy Kartin, 2018; Seo, 2009; Song & Lee, 2018; Steflitsch et al., 2015; Tang & Tse, 2014; Xiao et al., 2018). There were 4 studies that provided a positive correlation in the data that essential oil aromatherapy had improved stress, but lacked statistical significance (Hur, Cheong, Yun, Lee, & Song, 2005; Hur, Song, Lee, & Lee, 2014; Hwang, 2006; Seol et al., 2013). There were 2 studies that had evidence that essential oil aromatherapy did not relieve stress (Bikmoradi et al., 2015;

Muzzarelli, Force, & Sebold, 2006). In these studies, there was a wide variety of delivery methods and tools used to measure stress. Delivery methods included a water-based diffuser, bottled essential oil, topical applications, and more. Studies did not use the same tools to measure stress so direct comparison between studies is a limitation.

Aromatherapy's effect on work-place stress was examined in 4 recent studies and all of them found that lavender essential oil aromatherapy was an effective means to reduce stress for RNs (Chen et al., 2015; Johnson et al., 2017; Pemberton & Turpin, 2008; Steflitsch et al., 2015). There were 11 studies that focused on aromatherapy's effect on stress among patients (Bikmoradi et al., 2015; Bouya et al., 2018; Hur et al., 2005; Hwang, 2006; Muzzarelli et al., 2006; Redstone, 2015; Senturk & Tekinsoy Kartin, 2018; Seol et al., 2013; Song & Lee, 2018; Tang & Tse, 2014; Xiao et al., 2018). The remaining 4 studies looked at aromatherapy's effect on stress among other populations including nursing students, adolescents, and healthy adults (Hur et al., 2014; McCaffrey et al., 2009; Park & Lee, 2004; Seo, 2009).

The experiment by Chen et al. (2015) included 110 RNs; there were 53 RNs in the experimental group and 57 RNs in the control group. Bottles of 3% lavender oil were pinned to their clothes at the chest level to decrease workplace-related stress. The study found that there was statistically significant improvement to stress as evidenced by a decrease in the number of stress symptoms from 6.1 to 2.8, and a decrease in the measurement for pain from 5.6 to 2.8 (Chen et al., 2015).

Johnson et al. (2017) conducted a quasi-experimental design study which involved 134 nurse participants on three separate nursing units to assess perceived stress levels before and after lavender essential oil aromatherapy. There was a statistically significant decrease in the response to the survey question, "how often do nurses feel stressed at work in a typical week?"

The pre-survey mean was 2.97 (SD=0.99) and the post-survey mean was 2.70 (SD=0.92) which correlates respectively to "feeling stressed half of time" to "once in a while" (Johnson et al., 2017).

Pemberton and Turpin (2008) conducted a quasi-experimental pilot study on 14 intensive care unit RNs to test the effect of essential oils on stress in the critical care setting. The study found that an essential oil blend consisting of lavender and clary sage decreased perceived stress level in 57.1% of the sample. Sample size is a limitation in this study (Pemberton & Turpin, 2008).

Steflitsch et al. (2015) studied the effect of topical application of essential oils on stress levels in the hospital staff at Otto Wagner Spital in Vienna. There were 88 hospital staff who completed the pre-test enrollment questionnaire and 55 hospital staff who completed the post-test questionnaire. From the time of pre-test to post-test the stress level on average decreased from 6.28 to 5.24. The majority of study participants were able to markedly reduce their work-place stress through the use of essential oils (Steflitsch et al., 2015).

Hur et al. (2014) conducted a systematic review and meta-analysis of randomized controlled trials testing the effect of aromatherapy on stress in healthy adults. Five of the RCTs that met inclusion criteria failed to describe sequence generation and allocation concealment; four of the RCTs had potential high risk of bias in blinding (Hur et al., 2014). Despite the shortcomings of the RCTs that met inclusion criteria, Hur et al. (2014) concluded that an RN's stress cannot be compared directly to the stress of a healthy adult because the stress of a nurse is not similar to an average healthy adult's stress.

Quality/Quantity/Consistency

Quality of evidence can be found in Appendix C. Quantity of evidence on the effectiveness of aromatherapy on reducing stress levels among nurses is limited, however there is a growing interest in the topic. Studies included one systematic review, one meta-analysis of stress reduction in healthy adults, six randomized controlled clinical trials, four non-randomized controlled clinical trials or quasi-experimental design studies, one systematic review of qualitative and descriptive studies, and seven qualitative or descriptive studies. Based on the overall quality, quantity, consistency, and level of evidence obtained from this literature review there is enough data to justify conducting a quality improvement project regarding the application of lavender aromatherapy to registered nurses.

Most of the studies using essential oil in the bedside nurse setting had positive results in the treatment of stress for RNs and patients. Due to the majority of the evidence showing beneficial results in the treatment of stress from essential oils and low liability, the use of essential oils at the bedside should be considered as a quick and effective tool to decrease stress.

Weakness/Gaps/Limitations

The primary limitation and weakness of the studies included were low sample sizes and lack of a consistent validated tool being used to measure stress levels. Not all tools in the studies had an established baseline for reliability or validity. There are also limited descriptions of the quality and strength of essential oil used. Gaps in the literature were formed by the limited number of studies focused on aromatherapy's effect on RN stress in the acute care inpatient setting. No direct correlations, or adverse events, between lavender essential oil and allergies or respiratory sensitivities were mentioned in the studies despite some studies doing testing before implementing their interventions. However, studies did mention that allergies, sensitivities, and respiratory issues were exclusion criteria in their study.

Conceptual Framework

This project proposal followed the Iowa Model of Evidence-Based Practice (2015) framework, designed by a team of nurses to integrate the latest research findings with patient care. The Iowa Model is one of the most relevant framework models to choose from when integrating any nursing related evidence-based practice. The Iowa Model has an easy to use flowsheet style algorithm as seen in Appendix D based on 7 steps: identifying triggering issues or opportunities; stating the question or purpose; forming a team; assembling, appraising and synthesizing a body of evidence; designing and piloting the practice changes; integrating and sustaining the practice change; and disseminating the results. The Iowa model is continually revised to best present the current research and the current framework approved by the hospital where this study took place (Iowa Model Collaborative, 2017).

PICO(T) Question

Will lavender essential oil aromatherapy applied at a medical-surgical unit in an academic level-1 trauma hospital decrease perceived stress levels of RNs after 60 days? The PICO(T) question will guide this DNP Project.

Technique

Purpose Statement and Project Objectives

The purpose of this evidence-based quality improvement project was to decrease stress for medical surgical nurses through the use of certified pure therapeutic-grade lavender essential oil aromatherapy at Queen's Medical Center. The objective is to apply lavender essential oil aromatherapy in a medical-surgical unit within an academic level-1 trauma hospital.

Location

This DNP project was conducted on a medical-surgical unit in a 533-bed academic level-1 trauma hospital in Honolulu, Hawai‘i. The Project took place on a 30-bed semi-private hospitalist medical-surgical unit. The majority of patients present during the project were admitted for the following conditions: mental health disorders, infectious diseases, sepsis, diabetic ketoacidosis, diabetic ulcers, gastrointestinal disorders, end-stage renal disease, end-stage liver disease, and drug overdose.

This DNP project involved making judgements about a program to improve or further develop program effectiveness and inform decisions about future programming within an organization (University of Hawai‘i Human Studies program, August 2, 2018). All these tasks were related to quality improvement, meant for internal use only, and will not produce generalizable knowledge.

Volunteers

RNs were asked to volunteer for this project. There was a chance the volunteer group would not be similar to all the RNs who work on the unit. To be included in this project the RN must have been full-time or part-time and work at least one 8-hour shift every week on the unit. The volunteers included registered nurses providing bedside care and charge nurses on the unit. RNs who were allergic or had a history of complications when exposed to lavender essential oils did not participate. The unit had a total of 42 RNs, 40 RNs were fulltime, and many RNs rotated to the role of charge nurse.

Steps of the Process

Approval from The Queen’s Medical Center. The proposal, as approved by the student’s DNP Committee, was submitted to the Research and Institutional Review Committee (RIRC) for confirmation this project would not require IRB review/approval; and was submitted

to the unit supervisor for confirmation of support and implementation. RIRC and the unit supervisor both consented to allow this quality improvement project to take place.

Determination of stress. The Perceived Stress Scale (PSS) was used to determine the volunteer's self-reported level of stress (See Appendix E). The purpose of the PSS was to measure the degree to which one's life situations were deemed as stressful, unpredictable, uncontrollable, and overloaded during the previous month. According to Cohen, Kamarck, and Mermelstein (1983) the original 14 question PSS had a coefficient alpha reliability of 0.84, 0.85, and 0.86 in three samples showing strong internal consistency. Also the test-retest correlation was 0.85 (Cohen et al., 1983). However, five years later it was shortened to 10 questions using factor analysis based on data from 2,387 participants to improve its psychometric properties (Cohen & Williamson, 1988).

Materials. Certified pure therapeutic grade lavender essential oil was used undiluted onto cotton balls. Cotton balls were 100% cotton from a new sealed bag. Round plastic sealed containers were sterile laboratory specimen cups labeled with names of the volunteers.

Preparation. First the DNP student bought the necessary materials including essential oils, cotton balls, and round plastic sealed containers with screw on plastic lids large enough to hold two cotton balls.

The DNP student educated the nursing staff regarding the purpose of the project, evidence, and rationale of aromatherapy. The education also consisted of when to use the aromatherapy, how to use the aromatherapy, how to store the containers, how to prepare the aromatherapy, and how to dispose of the aromatherapy cotton balls. The outline of the educational content is shown in Appendix F.

Each volunteer was instructed to write their name on their own issued round plastic sealed container roughly the size of a lab specimen container. A permanent marker was used to prevent the volunteer's names from smearing and the potential of containers getting mixed up.

The preparation of the containers occurred in a locked non-clinical area by the RNs whenever they started their shift. The RNs were instructed to place two cotton balls inside their container with three drops of therapeutic-grade lavender essential oil on each cotton ball, then to screw the plastic lids onto the containers.

The disposal of the used cotton balls took place in the same locked non-clinical area as the preparation using disposable resealable plastic bags, then said bags were thrown in the trash.

The Actual Project

By the first month of the project assessment, (a) baseline registered nurse (RN) levels of stress were assessed by using the Perceived Stress Scale (PSS); and (b) RNs were educated on the benefits of aromatherapy in the acute care setting. By the first to second month of the project's assessment, aromatherapy using lavender essential oil infused cotton balls in individual sealed containers started. RNs were instructed to unseal and inhale aromatherapy slowly three times away from patients and colleagues when possible, especially when stressed. By the third month, post-assessment PSS levels were obtained, then compared to pre- and post-assessment PSS levels to assess if the volunteers reported a lower level of perceived stress. Assessment of PSS levels was obtained from volunteer RNs using text-messaging via personal cellphones.

One sealed plastic container with certified pure therapeutic grade lavender essential oil cotton balls was assembled by each RN at the beginning of his or her shift and kept with the RN at all times during that shift. At the end of the shift, the registered nurses discarded the used cotton balls and kept their containers in their lockers. Cotton balls were disposed of in a

resealable plastic bag to prevent exposure to staff. When the nurses returned to work for their next scheduled shift, they reloaded their own containers with the cotton balls and lavender essential oil.

Essential oil diffusing containers were used by RNs over a 60 day period during their working hours. A mid-point PSS level was obtained from the volunteers after 30 days. The DNP student conducted a post-PSS assessment after the 60 day period.

Evaluation of the Findings

After collecting pre-assessment, mid-point-assessment and post-assessment PSS data, the DNP student compared the aggregated data to determine if the quality improvement project was successful. To calculate PSS scores the four positively stated items (items 4, 5, 7, and 8) had their responses reversed (e.g., 0=4, 1=3, 2=2, 3=1, and 4=0). After scoring, the pre-assessment PSS survey, mid-point assessment PSS survey, and post-assessment PSS survey were compared against each other using the one-way analysis of variance.

PSS scores higher than those on the "Norm Table for the PSS 10 item inventory" (see Appendix E) are correlated with "more colds, greater vulnerability to life-event-elicited depressive symptoms, failure to quit smoking, and failure to control blood sugar levels (for diabetics)" (Cohen, Kamarck, & Mermelstein, 1983). The primary risk factors of interest for this project were more colds and depressive symptoms.

The DNP student conducting the quality-improvement project informally "talked story" with the volunteers. Volunteers were asked to share their perceptions about the use of the lavender infused cotton balls for stress reduction, as well as the average number of times they used the aromatherapy per shift. Responses were reported as qualitative data.

Findings

A total of 97 PSS surveys were collected from 44 volunteer RNs during this quality improvement project. During the pre-assessment period of the project 33 PSS surveys were collected over a period of 1 week (Time 1) with a mean PSS score of 21.1 (21.09 rounded to 21.1). During the mid-assessment period of the project 27 PSS surveys were collected over a period of 1 week (Time 2) with a mean PSS score of 19. During the post-assessment period of the project 32 PSS surveys were collected over a period of 1 week (Time 3) with a mean PSS score of 17.7 (17.71 rounded to 17.7).

Pre-assessment (Time 1)		Mid-assessment (Time 2)		Post-assessment (Time 3)	
N	Mean	N	Mean	N	Mean
33	21.1	27	19	32	17.7

Results show an overall improvement in the PSS score for Time 1, Time 2, and Time 3. From Time 1 to Time 2 the mean PSS score decreased 10%. From Time 2 to Time 3 the mean PSS score decreased 10.5%. From Time 1 to Time 3 the mean PSS score decreased 16%.

Qualitative data included informal “talk story” with the volunteers. Volunteers disagreed about the effectiveness of aromatherapy. There were 25 entries of qualitative data from the same eight RNs, four mentioned an improvement in stress and four mentioned that the aromatherapy was ineffective at helping stress. Some volunteers shared that perception of their workplace stress was not significantly improved from the start of the study, while other volunteers stated that they felt an enormous improvement from the start of the essential oil aromatherapy. A word-cloud was made to display some of the most commonly used words to describe the quality improvement project (See Appendix G).

Discussion

General feedback was positive for this quality improvement project with minimal resistance from the organization or nursing unit. The reported PSS survey results showed a clinically significant improvement despite qualitative data saying otherwise. This was possibly due to an inverse relationship between clinical significance and qualitative data in the findings. Although the findings were clinically significant, the qualitative data showed that its subjective clinical significance might not have been significant at all. Regarding clinical significance, the mean PSS scores obtained were higher than all mean values listed in the "Norm Table for the PSS 10 item inventory" (see Appendix E) regardless of gender, age, or race. When using the highest normal mean value (14.7) to compare to the perceived stress of the volunteers, only 3 out of 97 volunteers could be considered equal to or less than the normal mean PSS scores. The PSS tool does not differentiate PSS scores over the normal values so although scores did decrease, it is unclear if this will have any effect on the volunteer RNs. Regarding qualitative data there were equal numbers of those who agreed and those who disagreed that aromatherapy improved perceived stress. Potentially if more volunteers participated with the qualitative data, then the clinical significance might have had similar results. Volunteers frequently were not interested in providing qualitative data by "talking story" and only wanted to answer the survey to save their time and attention for charting in the electronic health record.

Extraneous factors that influenced outcomes measured included stress-relief activities outside of work and the quality of the delivery method for the essential oils. RNs were vulnerable to human drift, novelty effect, honeymoon effect, or placebo effect during the project, which would wear off with time given an established aromatherapy routine. There were also life-related factors, which influenced the project's outcomes, e.g., overall life stress, previous stress

reduction training and experiences, the individual's stress related states and traits, and the individual's core beliefs.

Conclusion and Implications

This quality improvement project suggests the integration of alternative based therapies may decrease RN stress in the acute care setting. No difficulties, adverse reactions, or allergies were encountered during the 60-day period of this project. Aromatherapy may relieve stress for registered nurses in the workplace and be an inexpensive and effective way to improve patient experience scores and nurse retention. Further research in the acute care setting would be valuable to better evaluate essential oil aromatherapy's effect on perceived stress in the workplace.

This quality improvement has the potential to be redesigned as a project for future DNP students. After conducting this quality improvement project it is highly recommended for future iterations of this project to: give volunteers time to learn the routine before collecting the data, explore literature for guidance on optimal timing for the intervention, consider literature review on different types of individuals and their stress management therapies and aromatherapies, have individuals determine the number of drops of essential oil that works for them, improve the tool to include qualitative data questions, use baseline questions to quantify volunteers' personal beliefs on lavender essential oil's effect on stress (i.e. how much do you believe the lavender essential oil will help decrease your work stress?), record the number of times the aromatherapy is used per shift per volunteer, record which shift (i.e. Day or Night shift) is being worked, and record length of shift. Adopting the changes mentioned will improve the chance of success in the future. Long-term sustainability is a possibility if there is regular follow-up.

This quality improvement project met the DNP Essentials of Doctoral Education for Advanced Nursing Practice by designing, implementing, and evaluating a quality improvement project that was inseparable from the nursing practice experience. This quality improvement project is reviewed and evaluated by a committee and outlines the DNP student's educational experiences, knowledge, and expertise (American Association of Colleges of Nursing, 2006; See Appendix H for more information).

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Appendix A

Literature Review Matrix

Year	Author(s) last name, first initial	Title	Research Question(s)/Hypotheses	Methodology/Sample Size	Findings	Conclusions	Implications for Future Research	Implications for Practice
2015	Bikmoradi, A. Seifi, Z. Poorolajal, J. Araghchian, M. Safiaryan, R. Oshvandi, K.	Effect of inhalation aromatherapy with lavender essential oil on stress and vital signs in patients undergoing coronary artery bypass surgery: A single-blinded randomized clinical trial	Can inhaled aromatherapy reduce mental stress and improve the vital signs of patients after coronary artery bypass surgery?	Randomized Controlled Trial/60 patients	No significant difference in the mean mental stress scores and vital signs of the aromatherapy and control groups.	Inhalation aromatherapy had no significant effects on mental stress or vital signs in patients after coronary artery bypass surgery	Consider another treatment modality for mental stress for coronary artery bypass surgery patients other than inhalation aromatherapy	Aromatherapy not an effective treatment for stress relief in coronary artery bypass surgery patients
2015	Bouya, S. Ahmadidarehsima, S. Badakhsh, M. Balouchi, A. Koochakzai, M.	Effect of aromatherapy interventions on hemodialysis complications: A systematic review	Systematically review literature to determine effect of aromatherapy on hemodialysis complications	Systematic Review	n/a	Aromatherapy reduced anxiety, fatigue, pruritus, pain, stress, and headache.	Further research on aromatherapy should include high quality studies with emphasis on designing appropriate control groups.	Aromatherapy is an effective treatment for stress relief for patients with hemodialysis complications.
2015	Chen, M. C. Fang, S. H. Fang, L.	The effects of aromatherapy in relieving symptoms related to job stress among nurses	Can inhaled aromatherapy reduce workplace stress among nurses?	Controlled clinical trial/110 nurses	significant decrease in number of stress symptoms from 6.1 to 2.8	Aromatherapy by inhalation was an effective method to reduce the number of stress symptoms	Future research on aromatherapy's effect on stress should include a validated tool	Aromatherapy is an effective treatment for stress relief for nurses

2005	Hur, M. H. Cheong, N. Yun, H. Lee, M. Song, Y.	Effects of delivery nursing care using essential oils on delivery stress response, anxiety during labor, and postpartum status anxiety	Can aromatherapy help in the care of primiparas to reduce anxiety and stress?	Controlled Clinical Trial/48 primipara women	significantly lower levels of epinephrine in the experimental group. No difference between experimental and control in reduction of anxiety.	Aromatherapy helped lower epinephrine levels but not anxiety levels in primipara women	Consider using a different tool for measuring anxiety and stress to determine if aromatherapy is effective in primipara women	Aromatherapy might be an effective treatment for stress in primipara women
2014	Hur, M. H. Song, J. A. Lee, J. Lee, M. S.	Aromatherapy for stress reduction in healthy adults: a systematic review and meta-analysis of randomized clinical trials	Can aromatherapy reduce stress in healthy adults?	Systematic Review and Meta-Analysis of RCTs/5 RCTs	Few RCTs met strict inclusion criteria, of the RCTs that met inclusion all had high risk of bias per Cochrane Criteria	Aromatherapy may or may not be effective in the treatment of stress in healthy adults	Future research on aromatherapy is necessary to determine aromatherapy's effects on stress in healthy adults.	Aromatherapy might be an effective treatment for stress in healthy adults
2006	Hwang, J.	The effects of the inhalation method using essential oils on blood pressure and stress responses of clients with essential hypertension	Can inhaled aromatherapy improve blood pressure and stress response for essential hypertension patients?	randomized controlled clinical trial/52 patients	Blood pressure, pulse, stress, and anxiety improved. Catecholamine levels did not change.	Results suggest inhaled aromatherapy can be an effective method for reducing stress and hypertension.	Future research should include high quality studies with emphasis on designing appropriate control groups and the use of a validated tool.	Aromatherapy is an effective treatment for stress relief in patients with essential hypertension
2017	Johnson, K. West, T. Diana, S. Todd, J. Haynes, B. Bernhardt, J. Johnson, R.	Use of aromatherapy to provide a therapeutic nurse environment	Can inhaled aromatherapy reduce workplace stress among nurses?	longitudinal study/134 RNs	dependent sample t-test showed a significant decrease in how often RN felt stressed at work.	Aromatherapy to decrease stress at work may improve nurse retention, workplace environment, and nurse satisfaction.	Further research on aromatherapy's effect on stress should include a validated tool	Aromatherapy is an effective treatment for stress relief for nurses

2009	McCaffrey, R. Thomas, D. J. Kinzelman, A. O.	The effects of lavender and rosemary essential oils on test-taking anxiety among graduate nursing students	Can inhaled aromatherapy reduce test-taking anxiety among graduate nursing students?	cross-sectional study	lower scores on test anxiety measure and pulse rates	Aromatherapy might help nursing students with test-taking anxiety	Randomization, use of a validated tool, a control group, and a larger sample size should be strived for in further research.	Aromatherapy is an effective treatment for stress relief in nursing students.
2006	Muzzarelli, L. Force, M. Sebold, M.	Aromatherapy and reducing preprocedural anxiety: A controlled prospective study	Can aromatherapy reduce pre-procedural anxiety?	cross-sectional study/ 118 patients	no statistical difference in anxiety or stress between experimental and control group	Lavender is inexpensive and popular for relaxation and can be offered to patients as an opportunity to reduce stress	Future research should contain high quality studies is necessary to determine aromatherapy's effects on stress	Aromatherapy was not an effective treatment for stress relief
2004	Park, M. K. Lee, E. S.	The effect of aroma inhalation method on stress responses of nursing students	Can inhaled aromatherapy decrease perceived stress by nursing students?	quasi-experimental/77 nursing students	anxiety and perceived stress score were lower in the experimental group vs the control group.	Essential oil can help stress management for nursing students	Future research should include randomization and blinding.	Aromatherapy is an effective treatment for stress relief for nursing students
2008	Pemberton, E. Turpin, P. G.	The effect of essential oils on work-related stress in intensive care unit nurses	Can topical application of essential oils decrease stress in ICU nurses?	cohort study/14 ICU RNs	decrease in perceived stress levels in intervention group	essential oil could help stress management for ICU RNs	Future research should include a much larger sample size and different delivery method for essential oils	Aromatherapy is an effective treatment for stress in ICU RNs
2015	Redstone, L.	Mindfulness meditation and aromatherapy to reduce stress and anxiety	Can adults on a behavior health unit with mood disorders benefit from aromatherapy enhanced meditation to lower stress and anxiety?	pilot study/18 participants	decrease in perceived anxiety and stress levels	findings of the pilot project suggest aromatherapy with meditation may offer stress and anxiety lowering effects	Future research on aromatherapy's effect on adults with mood disorders should include a larger sample size and a valid/reliable tool to compare data against	Aromatherapy is an effective treatment for perceived stress in patients

2018	Senturk, A. Tekinsoy Kartin, P.	The Effect of Lavender Oil Application via Inhalation Pathway on Hemodialysis Patients' Anxiety Level and Sleep Quality	Can inhaled aromatherapy improve sleep and anxiety levels for hemodialysis (HD) patients?	Randomized controlled trial/34 HD patients	Sleep quality of the experimental group was better than the control group however there was no improvement in time taken to fall asleep. Anxiety levels were significantly improved (P<0.001).	Lavender essential oil is a promising sleep and anxiety aid for HD patients.	Future research should include a larger sample size	Aromatherapy is an effective treatment for sleep and stress in HD patients
2009	Seo, J. Y.	The effects of aromatherapy on stress and stress responses in adolescents	Can inhaled aromatherapy using a necklace improve stress and stress responses in adolescents?	Controlled Clinical Trial/36 Female High School students	Stress levels significantly lower in the experimental group	aromatherapy could be an effective stress management method for high school students	Future research should include a larger sample size, and randomization.	Aromatherapy is an effective treatment for stress in adolescents.
2013	Seol, G. H. Lee, Y. H. Kang, P. You, J. H. Park, M. Min, S. S.	Randomized controlled trial for Salvia sclarea or Lavandula angustifolia: differential effects on blood pressure in female patients with urinary incontinence undergoing urodynamic examination	What is inhaled aromatherapy's effect on vital signs for females undergoing urodynamic assessments for urinary incontinence?	RCT/34 Female patients	Clary oil group experienced a significant decrease in systolic blood pressure compared to the control group (P=0.048) and lavender oil group (P=0.026). Inhalation of Clary or Lavender oil lead to significant reduction in respiratory rate compared to the control group (p<0.001).	results suggest that lavender oil may be ineffective in lowering stress during urodynamic examinations, while clary oil may be useful for relaxation in female urinary incontinence patients.	Future research should include high quality studies with emphasis on designing appropriate control groups and the use of a validated tool.	Aromatherapy is an effective treatment for stress in urinary incontinence women patients

2018	Song, E. J. Lee, M. Y.	Effects of Aromatherapy on Stress Responses, Autonomic Nervous System Activity and Blood Pressure in the Patients Undergoing Coronary Angiography: A Non-Randomized Controlled Trial	What is the effect of aromatherapy on stress responses and vital signs for hospitalized patients planned for coronary angiography?	Controlled clinical trial/64 patients	mental stress level measured before and after essential oil with DASS-21 questionnaire. Vital signs also assessed.	No significant difference was found between experimental and control group.	Future research should include randomization and possibly a different modality for the delivery of essential oils.	Aromatherapy was not effective at treating stress in patients hospitalized for coronary angiography.
2015	Steflitsch, W. Steiner, D. Peinhaupt, W. Riedler, B. Smuc, M. Diewald, G.	Health Promotion through Prevention of Stress and Burnout with Essential Oils for All Professionals at the Otto Wagner Spital in Vienna	can aromatherapy reduce occupational stress in hospital members including nurses?	cohort study/88 preintervention and 55 postintervention hospital staff	stress impairment scale showed significantly lower stress impairment (p=0.036)	majority of hospital staff had lower stress associated impairment after the use of essential oils.	Future research should be blinded and randomized with the use of a placebo.	Aromatherapy was an effective treatment for stress in hospital staff
2014	Tang, S. K. Tse, M. Y.	Aromatherapy: does it help to relieve pain, depression, anxiety, and stress in community-dwelling older persons?	can aromatherapy decrease negative emotions (stress, anxiety, and depression)?	cohort study/82 "community dwelling elderly"	A significant reduction in depression, anxiety, and stress was found (p<0.05)	aromatherapy can be an effective tool to reduce stress, anxiety, depression, and pain among community-dwelling elderly	Future research should include the use of reliable validated tools and randomization.	Aromatherapy was an effective treatment for stress in community-dwelling elderly
2018	Xiao, Y. Li, L. Xie, Y. Xu, J. Liu, Y.	Effects of aroma therapy and music intervention on pain and anxious for breast cancer patients in the perioperative period	can aromatherapy and music relieve anxiety and pain for breast cancer patients in the perioperative period?	RCT/100breast cancer patients	The experimental group showed significantly decreased pain and anxiety at post-operation period compared with the control group (P<0.05).	Both aromatherapy and music therapy can decrease stress response and anxiety for breast cancer patients	Future research should focus on one essential oil modality instead of two.	Aromatherapy and music therapy were an effective method for decreasing stress in breast cancer patients.

Appendix B

Levels of Evidence

Melnyk & Fineout-Overholt's Levels of Evidence	
Level I	Evidence from Systematic Review of all relevant randomized controlled trials (RCT's)
Level II	Evidence obtained from at least one well-designed RCT
Level III	Evidence obtained from controlled trial without randomization, quasi-experimental design
Level IV	Evidence from well-designed case-control and cohort studies
Level V	Evidence from systematic reviews of descriptive and qualitative studies
Level VI	Evidence from a single descriptive or qualitative study
Level VII	Evidence from authorities' opinion and/or reports of expert committees

Appendix C

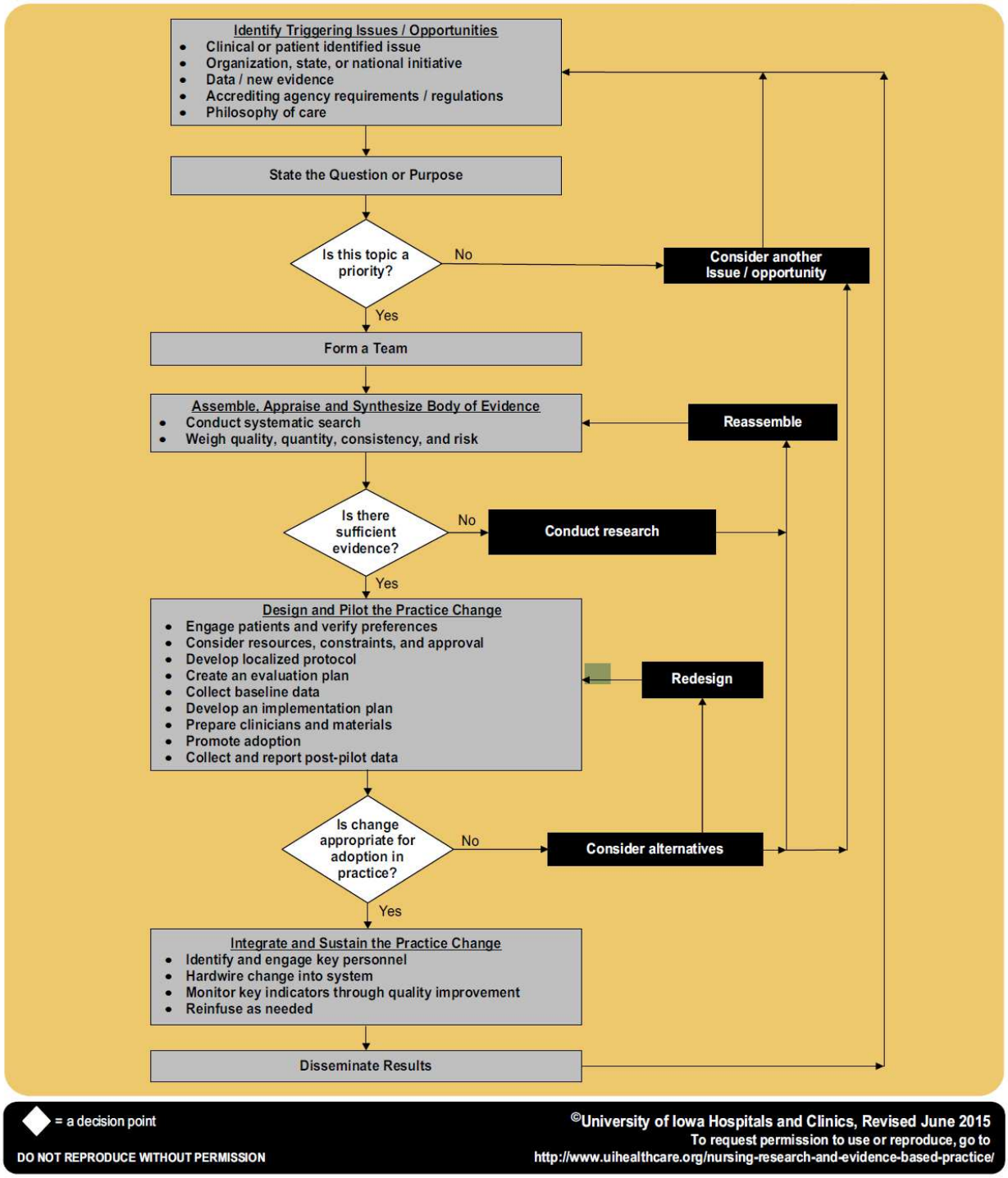
Studies by Level of Evidence

Studies by Melnyk & Fineout-Overholt's Levels of Evidence			
Author	**Date**	**Title**	**Level of Evidence**
Bikmoradi, A. Seifi, Z. Poorolajal, J. Araghchian, M. Safiaryan, R. Oshvandi, K.	2015	Effect of inhalation aromatherapy with lavender essential oil on stress and vital signs in patients undergoing coronary artery bypass surgery: A single-blinded randomized clinical trial	II
Bouya, S. Ahmadidarehsima, S. Badakhsh, M. Balouchi, A. Koochakzai, M.	2018	Effect of aromatherapy interventions on hemodialysis complications: A systematic review	V
Chen, M. C. Fang, S. H. Fang, L.	2015	The effects of aromatherapy in relieving symptoms related to job stress among nurses	VI
Hur, M. H. Cheong, N. Yun, H. Lee, M. Song, Y.	2005	Effects of delivery nursing care using essential oils on delivery stress response, anxiety during labor, and postpartum status anxiety	III
Hur, M. H. Song, J. A. Lee, J. Lee, M. S.	2014	Aromatherapy for stress reduction in healthy adults: a systematic review and meta-analysis of randomized clinical trials	I
Hwang, J. H.	2006	The effects of the inhalation method using essential oils on blood pressure and stress responses of clients with essential hypertension	II
Johnson, K. West, T. Diana, S. Todd, J. Haynes, B. Bernhardt, J. Johnson, R.	2017	Use of aromatherapy to promote a therapeutic nurse environment	VI
McCaffrey, R. Thomas, D. J. Kinzelman, A. O.	2009	The effects of lavender and rosemary essential oils on test-taking anxiety among graduate nursing students	VI
Muzzarelli, L. Force, M. Sebold, M.	2006	Aromatherapy and reducing preprocedural anxiety: A controlled prospective study	II

Park, M. K. Lee, E. S.	2004	The effect of aroma inhalation method on stress responses of nursing students	VI
Pemberton, E. Turpin, P. G.	2008	The effect of essential oils on work-related stress in intensive care unit nurses	VI
Redstone, L.	2015	Mindfulness meditation and aromatherapy to reduce stress and anxiety	VI
Senturk, A. Tekinsoy Kartin, P.	2018	The Effect of Lavender Oil Application via Inhalation Pathway on Hemodialysis Patients' Anxiety Level and Sleep Quality	II
Seo, J. Y.	2009	The effects of aromatherapy on stress and stress responses in adolescents	III
Seol, G. H. Lee, Y. H. Kang, P. You, J. H. Park, M. Min, S. S.	2013	Randomized controlled trial for Salvia sclarea or Lavandula angustifolia: differential effects on blood pressure in female patients with urinary incontinence undergoing urodynamic examination	II
Song, E. J. Lee, M. Y.	2018	Effects of Aromatherapy on Stress Responses, Autonomic Nervous System Activity and Blood Pressure in the Patients Undergoing Coronary Angiography: A Non-Randomized Controlled Trial	III
Steflitsch, W. Steiner, D. Peinhaupt, W. Riedler, B. Smuc, M. Diewald, G.	2015	Health Promotion through Prevention of Stress and Burnout with Essential Oils for All Professionals at the Otto Wagner Spital in Vienna	VI
Tang, S. K. Tse, M. Y.	2014	Aromatherapy: does it help to relieve pain, depression, anxiety, and stress in community-dwelling older persons?	III
Xiao, Y. Li, L. Xie, Y. Xu, J. Liu, Y.	2018	Effects of aroma therapy and music intervention on pain and anxious for breast cancer patients in the perioperative period	II

Appendix D

Conceptual Framework



Appendix E

Measurement Tool

PERCEIVED STRESS SCALE

The questions in this scale ask you about your feelings and thoughts during the last month. **In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.**

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

PERCEIVED STRESS SCALE

by Sheldon Cohen

The *Perceived Stress Scale* (PSS) is the most widely used psychological instrument for measuring the perception of stress. It is a measure of the degree to which situations in one's life are appraised as stressful. Items were designed to tap how unpredictable, uncontrollable, and overloaded respondents find their lives. The scale also includes a number of direct queries about current levels of experienced stress. The PSS was designed for use in community samples with at least a junior high school education. The items are easy to understand, and the response alternatives are simple to grasp. Moreover, the questions are of a general nature and hence are relatively free of content specific to any subpopulation group. The questions in the PSS ask about feelings and thoughts during the last month. In each case, respondents are asked how often they felt a certain way.

Evidence for Validity: Higher PSS scores were associated with (for example):

- failure to quit smoking
- failure among diabetics to control blood sugar levels
- greater vulnerability to stressful life-event-elicited depressive symptoms
- more colds

Health status relationship to PSS: Cohen et al. (1988) show correlations with PSS and: Stress Measures, Self-Reported Health and Health Services Measures, Health Behavior Measures, Smoking Status, Help Seeking Behavior.

Temporal Nature: Because levels of appraised stress should be influenced by daily hassles, major events, and changes in coping resources, predictive validity of the PSS is expected to fall off rapidly after four to eight weeks.

Scoring: PSS scores are obtained by reversing responses (e.g., 0 = 4, 1 = 3, 2 = 2, 3 = 1 & 4 = 0) to the four positively stated items (items 4, 5, 7, & 8) and then summing across all scale items. A short 4 item scale can be made from questions 2, 4, 5 and 10 of the PSS 10 item scale.

Norm Groups: L. Harris Poll gathered information on 2,387 respondents in the U.S.

Norm Table for the PSS 10 item inventory

Category	N	Mean	S.D.
Gender			
Male	**926**	**12.1**	**5.9**
Female	**1406**	**13.7**	**6.6**
Age			
18-29	**645**	**14.2**	**6.2**
30-44	**750**	**13.0**	**6.2**
45-54	**285**	**12.6**	**6.1**
55-64	**282**	**11.9**	**6.9**
65 & older	**296**	**12.0**	**6.3**
Race			
white	**1924**	**12.8**	**6.2**
Hispanic	**98**	**14.0**	**6.9**
black	**176**	**14.7**	**7.2**
other minority	**50**	**14.1**	**5.0**

Appendix F

Educational Content Outline

1. Purpose of the project: Decrease stress for medical surgical nurses through the use of certified pure therapeutic-grade lavender essential oil aromatherapy
2. Background (evidence) and rationale of aromatherapy: Based on the overall quality, quantity, consistency, and level of evidence obtained from this 19 peer reviewed journal articles, there is enough data to justify conducting a quality improvement project regarding the treatment of stress using lavender aromatherapy on registered nurses.
3. Process of using the lavender infused cotton balls
    a. When to use: Encourage to use when feeling stressed. Use aromatherapy when away from those not participating in the quality improvement project.
    b. How to use: Inhale slowly and deeply three times in succession. There is no limit to the number of inhalations per shift.
    c. How to store: Do not store essential oils in direct sunlight. Store plastic containers in personal lockers.
    d. How to dispose: RNs will be given resealable bags to dispose of used cotton balls.
    e. How to reload: RNs will Place two cotton balls inside their container with three drops of therapeutic-grade lavender essential oil on each cotton ball
4. Project's measures: Perceived Stress Scale
5. Project's dates: To be determined

Appendix G

Qualitative Data Word-Cloud

Appendix H

DNP Essentials Criteria

DNP Essential	DNP Student's Activities/Products
Essential I: Scientific Underpinnings for Practice	• Completed required Doctor of Nursing (DNP) program course work including evidence-based practice, leadership, translational science, the DNP project, health informatics, bioethics, health economics, and health policy. • Literature search, literature review, and levels of evidence utilized for DNP project. • This evidence-based quality improvement project used up to date literature and scientific rationale to improve perceived stress among registered nurses that is in line with nursing values and practice.
Essential II: Organizational and Systems Leadership	• Completed required DNP program course work focused on leadership in health systems and health policy (including course work from Essential I). • As the quality improvement project leader, this student engaged nursing leadership and content experts regarding aromatherapy policy, and delivery, that was practical and safe with the organization where the project took place.
Essential III: Clinical Scholarship and Analytical Methods for EBP	• Reviewed and evaluated the literature to determine the significance of the problem and best practice to address it. Project used a tool with proven validity and reliability. • Collected and analyzed data from quality improvement project. • Preparation of DNP project report.
Essential IV: Information Systems/Technology	• Completion of coursework for health technology and informatics (including course work from Essential I). • No medical records were used for this DNP project.
Essential V: Health Care Policy for Advocacy in Health Care	• Completion of coursework for health policy (including course work identified in Essential I). • Actively participated with nurse manager and nursing staff to address perceived stress.
Essential VI: Inter-Professional Collaboration	• Worked actively with nursing manager, nursing staff, and content expert for the completion of the DNP project. Reviewed project with nurse aides, rehabilitation services, and social workers.
Essential VII: Clinical Prevention and Population Health	• Reviewed literature about environmental work stress for registered nurses. DNP project focused on improving the health status of registered nurses. • Designed, implemented, and evaluated a DNP project to improve work stress among registered nurses.
Essential VIII: Advanced Nursing Practice	• Developed and sustained therapeutic relationships with volunteers of the DNP project. Guided and mentored other registered nurses to improve their perceived stress in the hospital.