Aromatherapy and Essential Oils: A Map of the Evidence

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PREFACE

The VA Evidence Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted healthcare topics of importance to clinicians, managers, and policymakers as they work to improve the health and healthcare of Veterans. These reports help:

- Develop clinical policies informed by evidence;
- Implement effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- Set the direction for future research to address gaps in clinical knowledge.

The program is comprised of four ESP Centers across the US and a Coordinating Center located in Portland, Oregon. Center Directors are VA clinicians and recognized leaders in the field of evidence synthesis with close ties to the AHRQ Evidence-based Practice Center Program and Cochrane Collaboration. The Coordinating Center was created to manage program operations, ensure methodological consistency and quality of products, and interface with stakeholders. To ensure responsiveness to the needs of decision-makers, the program is governed by a Steering Committee comprised of health system leadership and researchers. The program solicits nominations for review topics several times a year via the program website.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, Deputy Director, ESP Coordinating Center at Nicole.Floyd@va.gov.

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This report is based on research conducted by the Evidence Synthesis Program (ESP) Center located at the VA Portland Healthcare System, Portland, OR**,** funded by the Department of Veterans Affairs, Veterans Health Administration, Health Services Research and Development. The findings and conclusions in this document are those of the author(s) who are responsible for its contents; the findings and conclusions do not necessarily represent the views of the Department of Veterans Affairs or the United States government. Therefore, no statement in this article should be construed as an official position of the Department of Veterans Affairs. No investigators have any affiliations or financial involvement (*eg*, employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties) that conflict with material presented in the report.

ACKNOWLEDGMENTS

This topic was developed in response to a nomination by the Office of Patient Centered Care and Cultural Transformation (OPCC&CT) to guide the use of aromatherapy and essential oils in the VHA. The scope was further developed with input from the topic nominators (*ie*, Operational Partners), the ESP Coordinating Center, the review team, and the technical expert panel (TEP).

In designing the study questions and methodology at the outset of this report, the ESP consulted several technical and content experts. Broad expertise and perspectives were sought. Divergent and conflicting opinions are common and perceived as healthy scientific discourse that results in a thoughtful, relevant systematic review. Therefore, in the end, study questions, design, methodologic approaches, and/or conclusions do not necessarily represent the views of individual technical and content experts.

The authors gratefully acknowledge Robin Paynter, MLIS, and the following individuals for their contributions to this project:

Operational Partners

Operational partners are system-level stakeholders who have requested the report to inform decision-making. They recommend Technical Expert Panel (TEP) participants; assure VA relevance; help develop and approve final project scope and timeframe for completion; provide feedback on draft report; and provide consultation on strategies for dissemination of the report to field and relevant groups.

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Technical Expert Panel (TEP)

To ensure robust, scientifically relevant work, the TEP guides topic refinement; provides input on key questions and eligibility criteria, advising on substantive issues or possibly overlooked areas of research; assures VA relevance; and provides feedback on work in progress. TEP members are listed below:

Leila Kozak, PhD
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Peer Reviewers

The Coordinating Center sought input from external peer reviewers to review the draft report and provide feedback on the objectives, scope, methods used, perception of bias, and omitted evidence. Peer reviewers must disclose any relevant financial or non-financial conflicts of interest. Because of their unique clinical or content expertise, individuals with potential conflicts may be retained. The Coordinating Center and the ESP Center work to balance, manage, or mitigate any potential nonfinancial conflicts of interest identified.

ABSTRACT

Background: The purpose of this review is to provide the Veterans Health Administration (VHA) with a broad overview of the effectiveness of aromatherapy and essential oils (EOs), and the health conditions for which these interventions have been examined.

Data Sources and Study Selection: We searched multiple databases through February 2019 for systematic reviews (SRs) of aromatherapy and EOs for health conditions. Using pre-specified inclusion criteria, all abstracts and full-text articles were dual-screened for inclusion. When there were several qualified reviews for the same health condition, we selected a single review based on its recency, methods, scope, and applicability.

Data Abstraction: From each review, we abstracted the focus of the SR, the number of controlled trials included, combined number of participants, duration of trials, condition treated, and relevant findings from controlled trials. We abstracted separate data for each of 5 outcome categories: psychological outcomes, nausea/vomiting, pain and other physical outcomes, sleep outcomes, and global health outcomes.

Data Synthesis: For each review and outcome category we assigned values representing the effectiveness level of the intervention and confidence in the evidence and used these values to generate evidence maps. Additionally, we provide a narrative synthesis of the findings.

Results: We included 26 SRs representing the most recent and comprehensive evidence available. There is moderate-confidence evidence that aromatherapy is beneficial for pain in dysmenorrhea. Aromatherapy is potentially effective for pain in labor/childbirth; blood pressure reduction in hypertension; stress, depression, and sleep in hemodialysis patients; stress in healthy adults; anxiety in perioperative patients; and sleep quality in various populations, with low to moderate confidence in the evidence. For EOs applied topically, there is moderate confidence in the potentially positive effect of tea tree oil for tinea pedis. There is insufficient evidence of efficacy for all other conditions examined.

EXECUTIVE SUMMARY

INTRODUCTION

This topic was nominated by Dr. Ben Kligler, National Director of the Integrative Health Coordinating Center (IHCC) and Dr. Peter Glassman, Chair of the Medical Advisory Panel, Pharmacy Benefits Management Services at the Veterans Health Administration (VHA). The purpose of this report is to provide a broad overview of the effectiveness of aromatherapy and essential oils for various health indications. We will summarize the findings of systematic reviews in the form of evidence maps that will be used to guide and support decision-making about these treatment modalities in the VHA. The key question for the evidence map was: What evidence is available that examines the effectiveness of aromatherapy or essential oils for health-related indications?

METHODS

Data Sources and Searches

We developed search strategies in consultation with a research librarian. We searched multiple data sources from database inception through February 2019 for systematic reviews (SRs) and meta-analyses of aromatherapy and essential oils.

Study Selection

Two investigators independently assessed all abstracts and full-text articles for inclusion using pre-specified selection criteria and resolved disagreements through discussion and consensus. We included SRs and meta-analyses that included randomized controlled trials (RCTs) of clinical aromatherapy or topically applied essential oils (EOs) for specific health indications, risk populations, or targeted settings such as healthcare waiting spaces. From these SRs, we excluded results of trials in children, aromatherapy-massage trials without a massage-only control group, and trials that did not control for concurrent interventions. We excluded data from interventions in which EOs were applied to mucosal membranes, either orally, vaginally, or taken via ingestion.

Potentially eligible SRs met all the following quality criteria: 1) clearly reported their search strategy and inclusion criteria; 2) performed a comprehensive search of at least 2 electronic databases; and 3) assessed the included studies for potential risk of bias and reported the findings. When there were several qualified SRs of an intervention for the same health condition, we selected a single review to represent the evidence for that health condition or population, based on recentness, methodological quality, scope, and applicability.

Data Abstraction

From each SR selected for the evidence map, we abstracted the following data: targeted health condition or population of the SR, intervention modalities and comparators used among trials, number of eligible RCTs and CCTs, sample size, and findings. Data were abstracted by 1 investigator and confirmed by at least 1 additional reviewer.

We abstracted outcome data in 6 categories: psychological symptoms, nausea/vomiting, pain and other physical outcomes, global outcomes (specifically measures of functional status or quality

of life), sleep quality, and adverse effects. If the effect sizes or P-values for the primary trials were not reported in the SR, we relied on the qualitative summary of findings provided by the SR authors.

Quality Assessment

To qualify for inclusion in our evidence map, SRs were required to assess the methodological quality of RCTs using a standardized instrument, among other criteria. We took the adjudications made by the primary SR authors at face value and used their quality assessments to rate the overall body of evidence.

Data Synthesis and Rating the Body of Evidence

Using the vector graphics in Microsoft Excel (2016), we generated scatter plots representing the findings in 2 dimensions: level of effectiveness and confidence in the evidence. Two reviewers independently assessed the effectiveness of the interventions and confidence levels, based on data from eligible trials as reported in the systematic reviews. Each bubble represents the summary of findings for 1 of 5 outcome categories (psychological, nausea/vomiting, pain or other physical, global, and sleep). We did not include harms in the evidence map because they were seldom reported. See the figure below for the map of the evidence.

We classified the effect of the intervention for each health condition and outcome as follows:

- *No effect*: a preponderance of null or negative findings.
- *Unclear*: the systematic review reported mixed findings for a single outcome, or mixed findings across multiple outcomes within the same category, with no preponderance of either benefit or negative effects.
- *Potential positive effect*: multiple outcomes within the same category (pain/physical, nauseas/vomiting, psychological, global health, or sleep) with at least 1 clear finding of benefit; or mixed findings for a single outcome with a preponderance of evidence of a positive effect.
- *Positive effect*: numerous studies or a large sample showing a positive effect.

We classified the levels of confidence in the evidence as follows:

High: Consistent findings from at least 2 studies with a large combined sample size and low risk of bias.

Moderate: Evidence comes from a single large study with no major flaws, or from 2+ studies with limitations in sample size, study quality, applicability, or consistency of findings.

Low: Small combined sample size, or major deficiencies in the body of evidence.

Insufficient: The body of evidence consists of only 1 small study or has unacceptable deficiencies.

For the evidence maps, we grouped together studies with either unclear effect or insufficient level of confidence into a combined category of unclear/insufficient evidence. We also provide a narrative synthesis of findings according to treatment modality and outcome.

RESULTS

Results of Literature Search

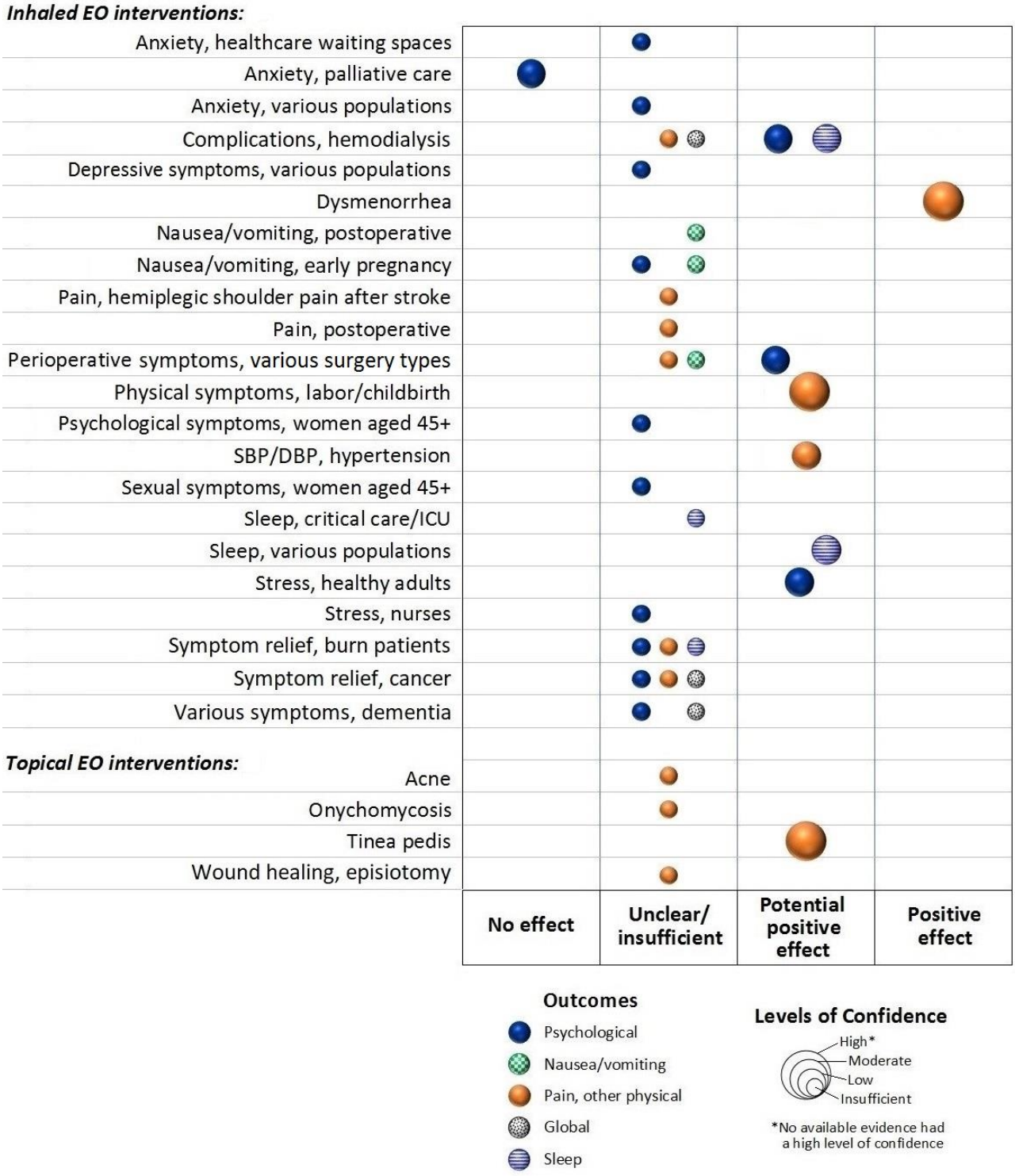
Our search of electronic databases, bibliographies, and other sources resulted in a total of 1,646 citations. After dual review of titles, abstracts, and full-text articles, we selected 25 SRs representing the most recent and comprehensive evidence available on each intervention, as applied to distinct health-related conditions and target populations.

Summary of Results

Twenty-six health-related conditions/target populations were examined by the 25 SRs selected for the evidence map. Twenty-two SRs provide evidence on inhaled EO interventions, which encompass aromatherapy combined with massage (EO-massage) as well as inhaled-only aromatherapy. Three SRs provide evidence on topical EO interventions.

Evidence from 171 eligible trials is represented among the 25 SRs. Hemodialysis, perioperative patients, dysmenorrhea, labor/childbirth, sleep, anxiety, and depression were the most widely studied conditions and/or populations. Aromatherapy interventions were most commonly delivered via inhalation, though the method of application varied widely. SRs of aromatherapy frequently included trials of aromatherapy-massage, which may involve direct dermal exposure through the addition of EO to massage lotion or oil or may be diffused in the room during massage. There is moderate-confidence evidence that inhaled EOs are beneficial for pain in dysmenorrhea. Inhaled EOs have potential benefit for pain in labor/childbirth (moderate confidence) and for blood pressure reduction in patients with hypertension (low confidence). Two SRs provided low-confidence evidence of potential positive effects on sleep quality in various populations. There is moderate-confidence evidence that aromatherapy has no effect on anxiety in palliative care. The effects of inhaled EOs are unclear for nausea/vomiting in all studied populations, and for all other conditions studied. Among the topical EO interventions, there is evidence of potential effectiveness in the use of tea tree oil for tinea pedis and the level of confidence in the evidence is moderate. The effectiveness of topical EOs is unclear for onychomycosis, acne, and episiotomy wound healing.

Figure. Map of the evidence from systematic reviews of inhaled and topical essential oils for targeted health conditions/populations



DISCUSSION

These evidence maps provide a broad overview of the evidence on clinical aromatherapy and topical EO interventions.

The only condition for which we found a preponderance of evidence suggesting benefit was pain in dysmenorrhea. We found several potentially promising areas, including pain in labor/childbirth; blood pressure reduction in those with hypertension; stress, depression, and sleep in patients on hemodialysis; stress in healthy adults; anxiety in perioperative patients undergoing various surgery types; and sleep quality in various populations. We also found evidence of potential effectiveness in the use of topical tea tree oil for tinea pedis. In most of the conditions studied, however, we found insufficient evidence to characterize treatment effects.

Limitations

Evidence maps such as these are not designed to provide definitive conclusions about benefit, and there are several reasons for cautious interpretation: 1) we relied only on SRs and did not search for more recently published trials or conditions for which no SR has been written (so we cannot be definitive in our characterization of the evidence for each condition, nor is this an exhaustive list of conditions/populations for which aromatherapy has been used), 2) we cannot comment on the magnitude of treatment effect, 3) we relied on others' study quality assessments, and 4) our measure of the level of confidence cannot approach the rigor represented by standardized approaches[1] given the previously listed constraints. These maps provide only broad "brushstrokes" regarding the potential benefits of these interventions. One should be particularly circumspect about the "potential for positive effect" findings since these were – by design – weighted toward identifying any potential area of benefit to aid with research prioritization.

Similarly, evidence maps provide a broad overview about evidence gaps, but cannot be definitive in determining an absence of evidence. Data for these evidence maps came from systematic reviews; therefore, individual trials not included in prior reviews or areas for which there were no reviews meeting inclusion criteria are not represented in these evidence maps. It is possible that the maps have identified areas of insufficient evidence in which there is individual trial data, or systematic reviews that did not meet our minimum quality criteria.

Research Gaps/Future Research

The maps highlight many potential areas for future research. The interventions and health conditions for which there was evidence of a "potential positive effect" may be one place to start to prioritize research, since these findings underscore potentially fruitful areas of research. The comparative effectiveness of different, standardized aromatherapeutic approaches should be examined especially in conditions for which there is potential promise. Future studies should capture potential adverse effects data, and the safety of aromatherapy should be examined in patients with comorbidities especially those of the respiratory tract. Furthermore, the use of a non-EO fragrance comparator would improve blinding and allow comparison of effects and harms of aromatherapy containing EO versus synthetically generated fragrance oils.

CONCLUSIONS

There is moderate confidence that aromatherapy is effective for pain in dysmenorrhea. We found potential positive effects of aromatherapy for pain in labor/childbirth; blood pressure reduction in

those with hypertension; stress, depression, and sleep in patients on hemodialysis; stress in healthy adults; anxiety in perioperative patients undergoing various surgery types; and sleep quality in various populations, with low to moderate confidence in the evidence. For EOs applied topically, there is moderate confidence in the potentially positive effect of tea tree oil for tinea pedis. There is insufficient evidence with which to determine whether aromatherapy or topically applied EO is effective for all other examined conditions.

ABBREVIATIONS TABLE

Abbreviation	Term
ADL	Activities of daily living
AT	Aromatherapy
BPSD	Behavioral and Psychological Symptoms of Dementia
CCT	Controlled clinical trial
CDSR	Cochrane Database of Systematic Reviews
CI	Confidence interval
CIH	Complementary and integrative health
DBP	Diastolic blood pressure
EBM	Evidence-based Medicine
EO	Essential oil
EPDS	Edinburgh Postnatal Depression Scale
ESP	Evidence Synthesis Program
ICU	Intensive care unit
KQ	Key Question
MA	Meta-analysis
MADRS	Montgomery–Åsberg Depression Rating Scale
MD	Mean difference
MENQOL	Menopause-specific Quality of Life Questionnaire
NAS	Numeric analog scale
NOS	Not otherwise specified
NR	Not reported
NS	Not significant
OBO	Oil of bitter orange
OPCC&CT	Office of Patient Centered Care and Cultural Transformation
P	P-value
PBO	Placebo
PICOTS	Population, interventions, comparators, outcomes, timing, setting, and study design
pts	Participants
PUQE	Pregnancy-Unique Quantification of Emesis/Nausea
QOL	Quality of Life
RCSQ	Richards-Campbell Sleep Questionnaire
RCT	Randomized controlled trial
REEDA	Redness, Edema, Ecchymosis, Discharge, Approximation
ROB	Risk of bias
RR	Risk ratio

Abbreviation	Term
RSCL	Rotterdam Symptom Checklist
SBP	Systolic blood pressure
SE	Standard error
SMD	Standard mean difference
SR	Systematic review
STAI	State-Trait Anxiety Inventory
TEP	Technical expert panel
TMD	Total Mood Disturbance
TTO	Tea tree oil
US	United States
VAS	Visual analog scale
VHA	Veterans Health Administration