

## Evaluating the effects of diffused lavender in an adult day care center for patients with dementia in an effort to decrease behavioral issues: a pilot study

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### ABSTRACT

**Objectives:** To evaluate the effects of diffused lavender on the frequency of behavioral issues [BIs], defined as a composite of restlessness/wandering [RW], agitation [AGT], anger [ANG], and anxiety [ANX] in an adult day care center. Secondary objectives evaluate systematic differences on the frequency of BIs between age cohorts, gender, and individual behaviors.

**Design:** Pre-post quasi-experimental study.

**Setting:** Private nonprofit adult day care center for patients with dementia.

**Participants:** Elderly patients older than 65 years of age with a clinical diagnosis of dementia, who require daytime monitoring.

**Intervention:** Lavender aromatherapy twice a day for 20 min during a two-month period during active clinic days.

**Measurements:** Behavioral issues were recorded using the behavior/intervention monthly flow record during the pre- and post-intervention periods.

**Results:** There was no significant difference on frequency of BIs between pre-intervention and post-intervention periods ( $p = .06$ ). There was a significant difference between pre-intervention and post-intervention total number of AGT occurrences (129 vs. 25;  $p$  value  $< .01$ ). There was no significant difference between age cohorts for computed difference of RW, ANG, and ANX issues. There was a significant difference between age cohorts for computed difference of AGT ( $p$  value  $= .04$ ) as the 70–85 age cohort showed less agitation compared to the 85–100 age cohort.

**Conclusion:** The use of diffused lavender twice daily has shown to reduce the frequency of agitation in elderly patients with dementia, especially in the 70–85 age cohort. Though diffused lavender did not show statistical differences in the frequency of other behaviors (restlessness/wander, anger, anxiety), the study population may have been too small to find a difference.

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Lavender; agitation; alternative therapies; dementia; aromatherapy; essential oils

## Introduction

Elderly patients suffering from dementia commonly present with concomitant psychological and behavioral issues. These comorbidities might lead to the overuse or misuse of anti-psychotic drugs, which has been suggested to increase mortality in this patient population [1,2]. Recognizing the increased use of polypharmacy in elderly patients with dementia, the Centers for Medicaid and Medicare Services (CMS) encourages health care providers to seek alternative approaches in treating these individuals [3]. Some of the non-pharmacological treatment approaches include consistency in caregivers, individualization of routine care, and selection of activities that are appropriate for the patient's cognitive abilities. Aromatherapy and essential oils have been used medicinally for thousands of years in China, Israel, Egypt, Europe, and ancient Greece [4], and they should be

investigated as an additional non-pharmacologic approach in this patient population.

Lavender (*Lavandula angustifolia*) contains the active compounds linalyl acetate and  $\beta$ -linalool which have been used for their sedative, analgesic, and anxiolytic properties as alternative therapy in the treatment of pain, anxiety, and stress [5–7]. Lavender may exert anxiolytic effects by inhibiting voltage gated calcium channels primarily in the neurons of the hippocampal region. Additional studies indicate that autonomic arousal is suppressed with the use of lavender [5,8]. A recent meta-analysis conducted by Perry et al. examined 15 randomized controlled trials that evaluated the effects of lavender on anxiety and mood [9]. The authors concluded that due to the lack of conclusive evidence of the effects of lavender on behavioral issues, further studies are warranted to fully evaluate its potential as an alternative therapy. Furthermore, a double-blind randomized trial comparing oral

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lavender to placebo showed that the former was both efficacious and safe for the relief of anxiety disorder not otherwise specified without causing adverse drug events [10]. Additionally, a small multi-center study evaluated the effects of lavender aromatherapy on 24 nursing home patients who suffered from anxiety and disturbed sleep patterns. The nursing staff's perceptions of the patient's behaviors including mood, activity, sleep quality, and unrestfulness were recorded as well as any changes in medication use. It was found based on the nursing perceptions that 40% ( $n = 10$ ) of the patients had a good/very good response to the lavender aromatherapy intervention [11]. While existing evidence shows promising results, data on the use of lavender in treating behavioral issues in the elderly population, especially those with dementia, needs to be elucidated. Our study's purpose was to evaluate the effects of diffused lavender in decreasing the occurrence of behavioral issues in a geriatric population with dementia.

## Methods

This was a pre-post quasi-experimental study conducted over a four-month period between June and September of 2013. The primary objective was to determine the impact of diffused lavender on the frequency of behavioral issues [BIs], defined as a composite of restlessness/wandering [RW], agitation [AGT], anger [ANG], and anxiety [ANX]. Secondary objectives included comparisons of age cohorts, gender, and individual behavior frequencies. Inclusion criteria consisted of patients over the age of 65 with a clinical diagnosis of dementia and enrolled in the River Garden Adult Day Care Center in Jacksonville, Florida. River Garden is a private non-profit institution that provides elder care services in residential, outpatient, and community based settings. The adult day care program is a center dedicated to assist elderly patients who are able to live at home but require monitoring during daytime hours. Patients enrolled in this program must also be able to take all medications prior to attending the daycare program or after. No medications are administered within the daycare center. Patients that were not enrolled in the day care program were excluded from this study.

Lavender aromatherapy was implemented immediately after a two-month pre-intervention observation phase. As methods of administration of aromatherapy show wide variation among studies, there is no current gold standard or recommended regimen. In this study, lavender essential oils (Young Living Essential Oils™, Lehi, UT) [12] were diffused using the Advanced Essential Oil Diffuser (Abundant Health, LLC., Spanish Fork, UT) [13] in the day care center common area for 20 min twice a day, once in the morning and once in the mid afternoon during active clinic days. The Advanced Essential Oil Diffuser allows the lavender to be diffused directly from the oil bottle. This diffuser, due to the 6.5 PSI pump power allows for a saturated area up to 1000 square feet. The common area in the adult day care center is ~1000 square feet in size and is a moderately open space [13]. The estimated oil output ranges from 0.75 to 1.3 ml over 15 min. We used this information to estimate that 1 ml of oil would be diffused per 15 min of use for the high setting on the

diffuser. Since we chose to diffuse for 20 minutes twice a day based on the daily program schedule, one 15 ml bottle of lavender was used in 5 days. During the pre- and post-intervention phases, a single un-blinded observer recorded unique BIs using the Behavior/Intervention Monthly Flow Record (MED-PASS Inc. and Heaton Resources, Dayton, OH) (Figure 1). This form allows for the systematic monitoring and documentation of BIs as well as interventions needed to address these issues. The observer was a certified nurse assistant with training and experience on using the form and documenting information comprehensively for all patients in the program. BIs that occurred during the study period were addressed as per center protocol with either one on one staff time or use of diversional activities appropriate for each behavior. Adverse events to the use of diffusers were noted for each patient.

The average number of observations per day was computed for the four BIs to adjust for variation in days. The difference between post-intervention and pre-intervention frequencies was calculated and compared with the Wilcoxon's signed-rank test. This method was used to evaluate whether the median differences were centered around zero, which would indicate no change from pre-intervention to post-intervention. Wilcoxon's rank-sum test was used to analyze the computed differences between age groups and sex. Data management and analysis were conducted using SAS version 9.3 (SAS Institute, Cary, NC). The study protocol was approved by the Institutional Review Boards of both the University of Florida and Baptist Health Jacksonville. A waiver of informed consent was granted by the review and privacy boards.

## Results

Twenty-three patients were included in the study. Males comprised 34.7% of the study population, and 95.6% were Caucasian. The mean age was 83 years old, ranging from age 73 to 97. Of the two age cohorts analyzed, 60.8% and 39.2% fell into the age cohorts of 70–85 and 86–100, respectively (Table 1). Although the number of BIs was lower in the post-intervention period compared to the baseline observational phase, the frequency of BIs did not reach statistical significance (pre-intervention  $n = 487$ , post-intervention  $n = 310$ ;  $p = .06$ ) (Table 2). In the analysis of individual BIs, there was a statistically significant difference found for the frequency of AGT (pre-intervention  $n = 129$ , post-intervention  $n = 25$ ,  $p = .001$ ) (Table 3). There was no difference in the frequency of observations for RW, ANG, or ANX. There was a significant difference between the age groups for the computed difference of agitation with patients in the 70–85 cohort being less agitated than the 86–100 cohort ( $p = .04$ ). There was no significant difference for effects of sex on the computed differences of any of the four BIs (Table 3).

## Discussion

Use of lavender aromatherapy decreased the overall frequency of BIs in a group of patients with dementia, yet this

change did not reach statistical significance. The use of lavender had the biggest effect on the frequency of agitation episodes for which a statistically significant decrease was observed. The change in agitation was also more notable in the 70–85 age cohort. These results have to be interpreted cautiously as the sample size was small, and the study might have been underpowered to detect differences in specific BIs. Nevertheless, this pilot study shows that diffused lavender may be considered as an adjunct to drug therapy to reduce the frequency of agitation in patients 70–85 years old with dementia. It is important to note that these effects were seen with no adverse effects reported by patients adding to the potential benefits of this intervention.

Due to the quasi-experimental study design, lack of randomization might have introduced some bias to the results. Notwithstanding this limitation, the pre–post study design used the exact same patient sample during both phases. In addition, patients were aware of the intervention and that they were being monitored, which may have produced a Hawthorne effect and confounded results. To mitigate the impact of this effect, the observer selected in the study was part of the normal staff and already known to the patients. Using a single observer during the entire study period has

the advantage of increasing the accuracy of recorded information; however, errors in misclassification of BIs could have occurred based on the subjective assessment of the behavior. This might be evident in the finding of agitation as the only statistically significant change. Future studies should aim at having an objective measurement of BIs based on validated scales such as Cohen–Mansfield Agitation Inventory (CCMAI) and the Pittsburgh Agitation Scale (PAS) [14,15]. Alternative causes cannot be disregarded in the interpretation of the results of this study. Confounding variables include changes in temperature between the two observational periods and variability with support staff which could impact a patient’s behavior.

A recent Cochrane systematic review assessed the role of aromatherapy on patients with dementia and concluded that more well-designed randomized controlled trials are needed [16]. Despite the scarcity of current evidence on the use of lavender, there seems to be some potential benefits of its use. A study by Sakamoto et al. showed that lavender olfactory stimulation may reduce falls and agitation in nursing home residents [17]. Another study by Holmes et al. showed modest efficacy in treating agitated behaviors in patients with severe dementia [14]. Implementing blinding in these

**BEHAVIOR/INTERVENTION MONTHLY FLOW RECORD** SIDE ONE  
Regulations: 42 CFR 483.25 I

**DIRECTIONS:** Enter target behavior in one of the Behavior Sections.  
Record the number of episodes by shift with initials.  
Enter the Intervention Code, Outcome Code and Side Effects Codes with initials for each shift. See side two for list of behaviors and potential side effects.  
C = Continuous D = Day E = Evening N = Night

**BEHAVIOR 1**

**INTERVENTION CODES (see Care Plan)**  
1. Redirect 7. Give food  
2. 1 on 1 8. Give fluids  
3. Refer to nurse's notes 9. Change position  
4. Activity 10. Adjust room temperature  
5. Return to room 11. Backrub  
6. Toilet

**OUTCOME CODES**  
+ Improved 0 Unchanged - Worsened

**SIDE EFFECTS** (Blank box indicates no side effects observed)  
A. \_\_\_\_\_  
B. \_\_\_\_\_  
C. \_\_\_\_\_

**BEHAVIOR 2**

**INTERVENTION CODES (see Care Plan)**  
1. Redirect 7. Give food  
2. 1 on 1 8. Give fluids  
3. Refer to nurse's notes 9. Change position  
4. Activity 10. Adjust room temperature  
5. Return to room 11. Backrub  
6. Toilet

**OUTCOME CODES**  
+ Improved 0 Unchanged - Worsened

**SIDE EFFECTS** (Blank box indicates no side effects observed)  
A. \_\_\_\_\_  
B. \_\_\_\_\_  
C. \_\_\_\_\_

Facility \_\_\_\_\_ Room No. \_\_\_\_\_ Date \_\_\_\_\_ Allergies \_\_\_\_\_ Nurse Reviewer \_\_\_\_\_

Physician \_\_\_\_\_ Diagnosis \_\_\_\_\_ Psychoactive Drug/Dose \_\_\_\_\_

Resident Name \_\_\_\_\_

Resident Status:  
 Safety Concern  
 Threat to Self  
 Threat to Others  
 Interacts with Staff's ability to deliver care

Form # MP9945 (Rev. 10/08)  
Reorder From: MED-PASS 800-438-9884  
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Figure 1. Behavior intervention monthly flow record. Reprinted with permission from MED-PASS, Inc. and Heaton Resources.



SIDE TWO

BEHAVIOR																																Behavior Sub Totals		
<b>3</b>  <b>INTERVENTION CODES (see Care Plan)</b> 1. Redirect 2. 1 on 1 3. Refer to nurse's notes 4. Activity 5. Return to room 6. Toilet 7. Give food 8. Give fluids 9. Change position 10. Adjust room temperature 11. Backrub 12. _____ 13. _____ 14. _____ 15. Medication (should not be first intervention)	# of Behavior Episodes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	D	
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	Intervention																																	
	Outcome																																	
	Side Effect																																	
<b>OUTCOME CODES</b> + Improved 0 Unchanged - Worsened <b>SIDE EFFECTS</b> (Blank box indicates no side effects observed)	# of Behavior Episodes																																N	
	Intervention																																	
	Outcome																																	
	Side Effect																																	
<b>BEHAVIOR TOTALS</b>																																	Behavior Totals	

  

SPECIFIC BEHAVIORS	POTENTIAL SIDE EFFECTS	SPECIFIC TO: ▲ = Antipsychotic ■ = Anxiolytic, Sedative/Hypnotic (AKA Benzodiazepines) + = Antidepressant * = Antiepileptic
1. Afraid/panic 2. Agitated* 3. Angry* 4. Anxiety* ▲ 5. Biting 6. Compulsive ▲ 7. Continuous crying ▲ 8. Continuous screaming/yelling ▲ 9. Continuous pacing 10. Danger to self ▲ 11. Danger to others 12. Depressed/withdrawn* ▲ 13. Extreme fear ▲ 14. Fighting ▲ 15. Finger painting faces ▲ 16. Hallucinations/paranoia/delusions ▲ 17. Head banging ▲ 18. Insomnia* ▲ 19. Kicking ▲ 20. Mood changes*	▲ 21. Noisy* ▲ 22. Pinching* ▲ 23. Poor eye contact* ▲ 24. Pulling enteral feeding tube ▲ 25. Pulling I.V. lines ▲ 26. Pulling urinary catheter ▲ 27. Restless ▲ 28. Scratching ▲ 29. Slapping ▲ 30. Spitting ▲ 31. Striking out/throwing ▲ 32. Throwing objects ▲ 33. Uncooperative* ▲ 34. Wandering* 35. Other: _____ 36. Other: _____ 37. Other: _____	▲ 1. Dystonia; torticollis (stiffness of neck) ▲ 2. Pseudoparkinsonism: a. Cogwheel rigidity b. Bradykinesia c. Tremors ▲ 3. Confusion ▲ 4. Akathisia: a. Restlessness b. Pacing c. Inability to sit still d. Anxiety e. Sleep disturbances ▲ 5. Tardive dyskinesia a. Lip smacking/chewing b. Abnormal tongue movement c. Spasmodic movement of arms/legs d. Rocking/swaying ▲ 6. Anticholinergic symptoms a. Dry mouth, blurred vision b. Constipation, urinary retention ▲ 7. Hypotension ▲ 8. Sedation/drowsiness ▲ 9. Hangover effect ▲ 10. Increased falls/dizziness ▲ 11. Cardiac abnormalities (tachycardia, bradycardia, irregular H.R., Neuroleptic Malignant Syndrome NMS) ▲ 12. Anxiety/agitation ▲ 13. Appetite change/weight change ▲ 14. Headache ▲ 15. Insomnia ▲ 16. Blood abnormalities ▲ 17. Urinary retention/hesitancy ▲ 18. Sore throat ▲ 19. Seizures ▲ 20. Weakness ▲ 21. Visual disturbances ▲ 22. Sweating/rashes ▲ 23. Gastrointestinal disturbances ▲ 24. Hepatic or renal abnormalities ▲ 25. Ataxia ▲ 26. Photosensitivity 27. Other: _____ 28. None

For which quantitative documentation is desirable for residents with only a diagnosis of Organic Mental Syndromes.

Behaviors which by themselves don't justify AP drugs

Figure 1. Continued

Table 1. Baseline demographics, n = 23.

Sex, male, number (%)	8 (34.7%)
Age cohort 70–85 years, number (%)	14 (60.8%)
Age cohort 86–100 years, number (%)	9 (39.2%)
Race	
Caucasian	22 (99%)
African American	1 (1%)

Table 2. Frequency of behavioral issues.<sup>a</sup>

	Pre-intervention	Post-intervention	p value
Total number of behavioral incidences	487	310	.06
Restlessness/wandering	343	282	.8
Agitation	129	25	.001
Anger	10	5	.5
Anxiety	5	0	1.0

<sup>a</sup>Behavioral incidences included the combination of restlessness/wandering, agitations, anger, or anxiety.

studies might be challenging, but perhaps researchers could use artificial fragrances that resemble the oil being tested, without the natural properties believed to be beneficial. To the best of our knowledge, none of the studies reported in the literature have reported adverse effects of lavender aromatherapy. Recognizing that polypharmacy might have

Table 3. Frequencies of behavioral incidences<sup>a</sup> using subgroup comparisons.

	Pre-intervention	Post-intervention	p value
Total number of incidences			
Age			p = .5
70–85	331	228	
86–100	156	82	
Gender			p = .3
Male	391	299	
Female	96	11	
Agitation	129	25	p = .001
70–85	58	17	
86–100	71	8	
Restlessness/wandering	343	282	p = .8
Anxiousness	5	0	p = 1.0
Anger	10	5	p = .5

detrimental effects in the elderly, non-pharmacological approaches such as aromatherapy need to be revised.

### Conclusion

The use of diffused lavender twice daily has been shown to reduce the frequency of agitation in elderly patients with dementia. Although diffused lavender did not show statistical difference in reducing the frequency of other behaviors (restlessness/wander, anger, anxiety), the study population may

have been too small to find a difference; a trend towards decreased BIs was seen. Future studies on the use of diffused lavender in elderly patients with dementia should include a larger sample size to assess impact on agitation and anxiety and should aim to determine the optimum dose of diffused lavender.

## Transparency

### Declaration of funding

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### Declaration of financial/other interests

The authors report no conflicts of interest. The peer reviewer on this manuscript has no relevant financial relationships to disclose.

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## References

- [1] Sayorwan W, Siripornpanich V, Piriyaupunaporn T, et al. The effects of lavender oil inhalation on emotional states, autonomic nervous system, and brain electrical activity. *J Med Assoc Thai.* 2012;95:598-606.
- [2] Ray WA, Chung CP, Murray KT, et al. Atypical antipsychotic drugs and the risk of sudden cardiac death. *N Engl J Med.* 2009;360:225-235.
- [3] Dementia Care in Nursing Homes: Clarification to Appendix P State Operations Manual (SOM) and Appendix PP in the SOM for F309 – Quality of Care and F329 – Unnecessary Drugs. 2013 [Internet]; [cited 2015 Jan 31]. Available from: <http://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/Survey-Certification/GenInfo/Downloads/Survey-and-Cert-Letter-13-35.pdf>.
- [4] Upson T, Susyn A, Georita H, et al. *The Genus Lavandula*. Portland (OR): Timber Press; 2004.
- [5] Sayorwan W, et al. The effects of lavender oil inhalation on emotional states, autonomic nervous system, and brain electrical activity. *J Med Assoc Thai.* 2012;95:598-606.
- [6] Chen MC, Fang SH, Fang L. The effects of aromatherapy in relieving symptoms related to job stress among nurses. *Int J Nurs Pract.* 2015;21:87-93.
- [7] Olapour A, Behaeen K, Akhondzadeh R, et al. The effect of inhalation of aromatherapy blend containing lavender essential oil on cesarean postoperative pain. *Anesth Pain Med.* 2013;3:203-207.
- [8] Schuwald AM, Nöldner M, Wilmes T, et al. Lavender oil-potent anxiolytic properties via modulating voltage dependent calcium channels. *PLoS One.* 2013;8:e59998.
- [9] Perry R, Terry R, Watson LK, et al. Is lavender an anxiolytic drug? A systematic review of randomised clinical trials. *Phytomedicine.* 2012;19:825-835.
- [10] Kasper S. Silexan, an orally administered *Lavandula* oil preparation, is effective in the treatment of 'subsyndromal' anxiety disorder: a randomized, double-blind, placebo controlled trial. *Int Clin Psychopharmacol.* 2010;25:277-287.
- [11] Johannessen B. Nurses experience of aromatherapy use with dementia patients experiencing disturbed sleep patterns: an action research project. *Complement Ther Clin Pract.* 2013;19:209-213.
- [12] Lavender Essential Oil. Young Living Essential Oils, 2015. Available from: [http://www.youngliving.com/en\\_US/products/essential-oils/singles/lavender-essential-oil](http://www.youngliving.com/en_US/products/essential-oils/singles/lavender-essential-oil). Accessed on January 30, 2015.
- [13] Advanced Essential Oil Diffuser. Abundant Health, 2015. Available from: [http://www.youngliving.com/en\\_US/products/essential-oils/singles/lavender-essential-oil](http://www.youngliving.com/en_US/products/essential-oils/singles/lavender-essential-oil). Accessed on January 30, 2015.
- [14] Holmes C, Hopkins V, Hensford C, et al. Lavender oil as a treatment for agitated behaviour in severe dementia: a placebo controlled study. *Int J Geriatr Psychiatry.* 2002;17:305-308.
- [15] Snow LA, Hovanec L, Brandt J. A controlled trial of aromatherapy for agitation in nursing home patients with dementia. *J Altern Complement Med.* 2004;10:431-437.
- [16] Forrester LT1, Maayan N, Orrell M, et al. Aromatherapy for dementia. *Cochrane Database Syst Rev.* 2014;2:CD003150.
- [17] Sakamoto Y, Ebihara S, Ebihara T, et al. Fall prevention using olfactory stimulation with lavender odor in elderly nursing home residents: a randomized controlled trial. *J Am Geriatr Soc.* 2012;60:1005-1011.