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Introduction

Up to 90% of end-of-life patients experience terminal respiratory secretions (TRS), or the ‘death rattle’, which can be very distressing to families, caregivers, and practitioners (Lokker et al., 2014). Caregivers often describe the death rattle as sounding like their loved one is drowning or suffocating (Shimizu et al., 2014). Current pharmacological approaches to reduce TRS (i.e., atropine sulfate, hyoscyamine and scopolamine) are often ineffective and have side effects such as restlessness, hallucinations, palpitations, constipation, and urinary retention (Lokker et al., 2014; Shimizu et al., 2014).

*Hyssopus officinalis*, (hyssop) has been used for respiratory illnesses and coughs in herbal, folk, and Traditional Chinese Medicine (Wang and Yang, 2010). The chemical constituents of hyssop have been moderately studied; however, the essential oil has not. Hyssop essential oil has nevertheless been successful in reducing TRS in the home hospice setting. The purpose of this project was to review the literature on the effectiveness of topically applied *Hyssopus officinalis* (hyssop) essential oil for TRS reduction in patients at end-of-life.

Methods

The following databases were searched for articles on TRS and essential oils published in English since 2005: CINAHL, Ovid Medline, PubMed, and Web of Science. Keywords included: death rattle, essential oils, ester, hyssop, ketones, monoterpane alcohols,
monoterpene hydrocarbons, phenylpropanoids, and terminal respiratory secretions (TRS), resulting in 245,067 articles. A downward filtering approach was utilized to narrow the results first by respiratory, human, and clinical trial, and then by topical, resulting in no articles. The filtering method is shown in Figure 1.

**Results**

The literature review found insufficient evidence-based knowledge regarding the use of topically applied hyssop essential oil for reduction of TRS in patients at end-of-life (Figure 1). No human studies were found using hyssop essential oil for TRS or any other purpose. Two animal studies were found utilizing hyssop for respiratory purposes:

a) A pilot study using hyssop as part of an internal herbal blend for recurrent airway obstruction in horses demonstrated positive but insignificant results (Pearson et al., 2007).

b) A study using intraperitoneal-injected hyssop demonstrated a significant difference in airway remodeling inhibition compared to dexamethasone in a mouse model of chronic asthma (Ma et al., 2014).

Current pharmacological approaches to TRS

Current pharmacological approaches to managing TRS include antimuscarinic and anticholinergic agents such as atropine, scopolamine, glycopyrrolate, and hyoscine butylbromide. Studies to ascertain the effectiveness of antimuscarinic and anticholinergic agents in TRS-reduction, such as the following two examples, have either failed to demonstrate efficacy, contained threats to validity, or both:

a) A study evaluating the TRS-reducing efficacy of atropine, hyoscine butylbromide, and scopolamine via every four hour subcutaneous injection or intravenous infusion found no significant

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**Figure 1.** Filter used to identify appropriate research articles written in English.
difference between medications one hour post-administration, and at every time point measured up to 48 hours. It was noted that medication administration was more effective in patients with lower baseline TRS (Wilders et al., 2009).

b) A retrospective study of 22 dying patients treated with sublingual atropine 1% ophthalmic solution every two hours yielded the following results: 19 had decreased TRS, and three were non-responders. It was noted that non-responders died more rapidly than responders. Limitations of this study included no valid or reliable TRS evaluation tool and no statistical analysis (Protus et al., 2012).

Possible aromatherapeutic approach to TRS

One aromatherapeutic approach to TRS-reduction is the use of topically applied hyssop essential oil, which has been used in the hospice setting. As an aromatherapist and former full-time hospice case manager, I have personally observed the use of hyssop essential oil for patients with TRS. The standing hospice order for patients at end-of-life was to apply one drop of undiluted hyssop essential oil to the neck and chest area every four hours as needed for TRS. I have observed good success in TRS reduction using topically applied hyssop in this way, except when patients experienced rapid transition. Transition is defined as movement from one state to another (Thomas, 2005); in hospice care, transition refers to the movement from life to death. The hyssop essential oil used at this hospice was obtained from Slovenia via herb steam distillation. A review of hyssop essential oil's key chemical constituents (Table 1) and its proposed mechanisms of action (Table 2) revealed potential mucolytic, dehydrating, muscle relaxing, and acetylcholinesterase-inhibiting TRS-reducing properties, similar to anticholinergic agents. Schnaubelt (2011) described how topically applied essential oils elicit physiological changes at the site of application and in high concentrations bind to the phospholipid bilayer of the cell membrane. It is through this cellular change that I hypothesize the use of undiluted hyssop essential oil reduces TRS in patients at end-of-life.

Conclusions

The possible TRS-reducing capacity of topical *Hyssopus officinalis* (hyssop) essential oil has yet to be explored beyond aromatherapy anecdotal evidence and case studies. However, this baseline evidence may indicate that hyssop essential oil has the potential to ease emotional distress in families, caregivers, and healthcare professionals caring for patients at end-of-life, thus warranting further research.

Table 1. *Hyssopus officinalis* chemical groups and key constituents (Tisserand & Young, 2014; Shutes, 2013)

<table>
<thead>
<tr>
<th>Chemical Groups</th>
<th>Key Constituents*</th>
<th>~ Percent in EO*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esters</td>
<td><em>Myrtenyl methyl ether</em></td>
<td>0 – 3.9%</td>
</tr>
<tr>
<td>Ketones</td>
<td><em>α-Thujone</em></td>
<td>0 – 0.1%</td>
</tr>
<tr>
<td></td>
<td><em>β-Thujone</em></td>
<td>0 – 0.3%</td>
</tr>
<tr>
<td></td>
<td><em>Isopinocamphone</em></td>
<td>30.9 – 39.2%</td>
</tr>
<tr>
<td></td>
<td><em>Pinocamphone</em></td>
<td>31.2 – 42.0%</td>
</tr>
<tr>
<td>Monoterpene Alcohols</td>
<td><em>α-Terpineol</em></td>
<td>0 – 1.0%</td>
</tr>
<tr>
<td></td>
<td><em>Myrtanol</em></td>
<td>0.4 – 2.1%</td>
</tr>
<tr>
<td>Monoterpene Hydrocarbons</td>
<td><em>β-Pinene</em></td>
<td>4.0 – 8.8 %</td>
</tr>
<tr>
<td></td>
<td><em>β-Myrcene</em></td>
<td>0.7 – 1.2%</td>
</tr>
<tr>
<td></td>
<td><em>Sabinene</em></td>
<td>1.3 – 1.7%</td>
</tr>
<tr>
<td>Phenylpropanoids</td>
<td><em>Methyleugenol</em></td>
<td>0 – 0.5%</td>
</tr>
</tbody>
</table>
Current planning is underway to assess differences in TRS reduction between *Hyssopus officinalis* and *Hyssopus officinalis var. decumbens* essential oils along with an exploration of family and caregiver perceptions of TRS-related suffering at end-of-life.

### References


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Linda Smith RN,MS,HN-BC,HTCP,HTSM-CP/I,CCA who mentioned hyssop essential oil for the death rattle in her presentation: ‘*End of Life Transitions Made Easier with Intention, Energy Healing and Medicines of the Earth*’ during the 31st Annual American Holistic Nurses Association Conference, June 2011, Louisville, KY.