Inhaled therapy is commonly used treatment in older people with chronic respiratory diseases. Asthma and chronic obstructive pulmonary disease (COPD) are common conditions in people in residential aged care. Nearly 30% of people aged 75 years and older have COPD. Despite falling death rates, COPD is still a leading cause of death and disease burden after heart disease, stroke and cancer. It is estimated 7 to 15% of Australians aged 65 years or over have asthma.

Both conditions can be well controlled by treatment with:
- Short- and long-acting beta2-agonists
- Anticholinergic bronchodilators
- Inhaled corticosteroids

Short-acting beta2-agonists (SABAs) include salbutamol (Ventolin, Asmol, Asthyn), terbutaline (Bricanyl); and salmeterol (Serevent), eformoterol (Oxis, Foradile), indacaterol (Onbrez) are long-acting beta2-agonists (LABAs). Anticholinergic bronchodilators or long-acting muscarinic agents (LAMAs) include tiotropium (Spiriva), aclidinium (Bretaris), umeclidinium (Incruse) and glycopyrronium (Seebri). Inhaled corticosteroids (ICS) include fluticasone propionate (Flixotide), budesonide (Pulmicort), Ciclesonide (Alvesco) and beclomethasone (Qvar).

Combination products are also available:
- ICS/LABA – Flutiform, Symbicort, Seretide, Breo
- LAMA/LABA – Ultibro, Spiolto, Anoro, Brimica

Even with good inhaler technique a significant proportion of these medicines are deposited in the oral cavity and oropharynx. The oropharynx is the middle part of the pharynx (throat) behind the mouth. It includes the back one-third of the tongue, soft palate and the side and back walls of the throat. Consequently, inhaled drugs can have a clinically significant impact on oral health.

Several oral conditions such as xerostomia (dry mouth), dental caries, candidiasis, dysphonia, ulceration, gingivitis, periodontitis and taste changes have been associated with inhalation therapy for asthma and COPD.

### Xerostomia
Dry mouth or xerostomia is observed with all inhaled therapies. Prolonged use of beta2-agonists can reduce salivary flow by around one-third. They can also increase the bacterial count in the mouth, especially *Lactobacilli* and *Streptococcus mutans*.

Residents with xerostomia may complain of difficulty talking or swallowing, altered taste, mouth soreness, burning sensation and poor retention of dentures. There may also be generalised redness of mucous membranes.

Early recognition and management of xerostomia is important to prevent adverse dental effects. Saliva substitutes are effective in reducing the discomfort of a dry mouth, as well as providing the antibacterial enzymes, buffers, calcium and fluoride necessary to prevent dental caries.

### Dental caries
Tooth decay and cavities (caries) may occur due to diminished saliva flow rate and buffering capacity of saliva due to beta2-agonists. The risk of caries increases in people with dentures.

Some dry powder inhalers contain sugar (lactose monohydrate) to improve the taste of the active ingredient. However frequent inhalation of these sugar-containing products, combined with a decrease in salivary flow rate may contribute to an increased risk of caries.

### Oral candidiasis
Low salivary flow rates and local deposition of inhaled corticosteroids in the mouth and oropharynx are risk factors for oropharyngeal candidiasis or oral thrush. Typically thrush presents as white, soft lesions, usually on the tongue or inner cheeks. Sometimes oral thrush may spread to the roof of the mouth, gums or tonsils, or the back of the throat. Residents may complain of tenderness, burning and dysphagia (difficulty or discomfort in swallowing). This side effect is mainly seen among patients who use high doses of inhaled corticosteroids.

### Oral health with inhalers

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Dysphonia
Dysphonia or hoarse voice is another common side effect of inhaled corticosteroids, and can be minimised by use of a spacer with metered-dose inhalers and rinsing the mouth after use.

Ulceration
Ulceration of the oral mucosa is seen mainly due to dry mouth and immunosuppression caused by inhaled therapy. Burning and tingling may be experienced prior to eruption of an ulcer.

Gingivitis
Gingivitis is an inflammation of the gums, usually caused by a bacterial infection. Left unchecked, gingivitis can cause the gums to separate from the teeth, often with irritation, redness and swelling of gums.

Gingivitis is observed with the use of inhaled corticosteroids.

Periodontitis
Periodontitis is an advanced gum disease that may occur if gingivitis is not treated. The infection damages the soft tissue and destroys the bone that supports teeth. A decrease in bone mineral density associated with inhaled corticosteroids may also cause periodontal disease. Saliva plays an important role in restricting periodontal disease.

Taste changes
Taste disturbances may be experienced with long-acting antimuscarinic agents (LAMAs) and nedocromil (Tilade).

Inhaled corticosteroids
The lowest possible dose of inhaled corticosteroids to maintain good control should be prescribed. Most of the benefit of inhaled corticosteroids is achieved with doses at the upper limit of the low-dose range. On average, higher doses provide relatively little extra benefit, but are associated with a higher risk of adverse effects.

According the COPD-X guidelines, inhaled corticosteroids should only be used in people with COPD with a FEV$_1$ less than 50% predicted and two or more exacerbations in the previous 12 months.

In asthma, people prescribed moderate-dose or high-dose inhaled corticosteroids should be stepped down to a lower dose if they have experienced good asthma control for 2 to 3 months and are at low risk of flare-ups. Most adults with asthma require a regular preventer medicine.

Prevention
The most effective strategy is prevention of these oral complications associated with inhaled therapy. All residents should use a spacer with metered-dose inhalers. Spacers assist with coordination of actuation and inhalation, optimising deposition of the medicines in the lungs, as well as minimising deposition in the mouth and oropharynx.

Rinsing the mouth after use of inhaled corticosteroids is essential to prevent oral candidiasis. This is required for all devices including metered-dose inhalers and dry powder inhalers including Accuhaler, Ellipta and Turbuhaler. Dentures should be removed for rinsing as powder may accumulate under the dentures.

Immediate brushing of the teeth after using an inhaler should be avoided as it may damage tooth enamel due to acidic pH.

Summary
Inhaled therapies are the cornerstone of management of respiratory conditions such as COPD and asthma. Whilst these therapies are very effective in controlling lung function and symptoms when used regularly and effectively, they may impact negatively on oral health. Regular assessment of device technique and use of spacers with metered-dose inhalers is critical to minimise oropharyngeal deposition. Early detection and management of oral health problems may alleviate long-term complications and improve quality of life.

References
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