An Evaluation Of Health Technology For Home-Based Heated Humidified High-Flow Therapy For Respiratory Disorders

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[1,2,3]Respiratory therapy.

Abstract:

This health technology assesses the safety and efficacy of home-based heated humidified high-flow therapy (HHHFT) for children with obstructive sleep apnea who are unable to tolerate traditional respiratory therapies at home, as well as for individuals with respiratory conditions who lack alternative treatment options to provide equivalent respiratory support at home. Additionally, it assesses the experiences, preferences, and values of individuals with respiratory diseases as well as the financial implications of publicly funded home-based HHHFT. Methods: We conducted a thorough search of the literature to find clinical evidence supporting the safety and efficacy of home-based HHHFT for the categories. Due to a lack of evidence, we did not perform a main economic review despite conducting a systematic search of the economic literature. In Ontario, we examined the financial effects of publicly funded home-based HHHFT for children with pediatric OSA as well as for adults and children with various respiratory disorders. We sought to interview individuals and caregivers of children in Ontario who had firsthand experience with respiratory disorders, both with and without direct HHHFT, in order to contextualize the possible benefits of home-based HHHFT. Conclusions: We found several studies carried out in different settings that showed the advantages of HHHFT, such as better oxygenation, lower respiratory rates, less severe OSA, and fewer acute exacerbations of chronic obstructive pulmonary disease when used in hospitals and at home. However, we did not find any studies that specifically assessed the comparative efficacy and safety of home-based HHHFT in relation to our research questions. Additionally, HHHFT is standard care in Ontario hospitals, where it is widely utilized and largely regarded as clinically beneficial. Over the next five years, we project that publicly funded home-based HHHFT in Ontario would save children with pediatric OSA and add $2.5 million to the expenses of treating adults and children with other chronic respiratory illnesses. We calculate that fewer hospital visits, fewer outpatient visits, and fewer inpatient days would be avoided if home-based HHHFT were publicly funded. Home-based HHHFT was seen favorably by caregivers of children with respiratory disorders; for many, it became a necessary treatment after all other choices failed. Cost was a significant obstacle to receiving this treatment, though.

Keywords: Health technology, Respiratory, Therapy Respiratory, An evaluation.

Introduction:

The term "respiratory conditions" refers to a broad category of illnesses that impact the lungs and other respiratory system components, such as idiopathic pulmonary fibrosis (IPF), bronchiectasis, obstructive sleep apnea (OSA), and chronic obstructive pulmonary disease (COPD).The impact and severity of these ailments varies widely, ranging from minor, temporary problems to long-term, fatal illnesses. They may affect the lung tissue, the blood vessels in the lungs, or the airways (Lin S, 2020).

By supplying a mixture of heated, humidified air and oxygen at moderate to high flow rates, HHHFT enhances conventional oxygen treatment. It has been demonstrated to diminish therapeutic discomfort and condensation problems, provide more accurate oxygen regulation, lessen breathing effort, and provide a different noninvasive support technique. Depending on the type, additional oxygen can be blended in when needed. The HHHFT systems currently available on the market offer a flow rate of up to 60 or 70 L/min of room air. The systems have a flow controller or mixing chamber that properly mixes oxygen and room air. To improve comfort and avoid drying out, this air-oxygen mixture is then heated to body temperature and humidified as nearly as feasible to physiological values (O'Donnell , 2006; McGowan , 2016).

Depending on the type and severity of the respiratory condition, treatment options may include pulmonary rehabilitation, medications like corticosteroids or bronchodilators, surgical procedures like lung transplants or the removal of damaged lung tissue, and respiratory therapies like mechanical ventilation, continuous positive airway pressure (CPAP), bilevel positive airway pressure (BiPAP), conventional oxygen therapies, or HHHFT (McKenzie et al., 2021).

In Italy, individuals who have utilized home-based HHHFT while in the hospital before being released are also eligible for public funding. This funding uses a daily cost-based leasing basis (Wilson et al., 2020).

A Medtech innovation briefing on the use of myAirvo2 to treat COPD was published in 2018 by the National Institute for Health and Care Excellence in the United Kingdom. Uncertainties over which patient groups would benefit most from this technology in a community

context and whether it should be utilized in addition to or instead of present treatments were noted in the briefing. Currently, the National Health Service in the United Kingdom's Norfolk and Waveney region provides funding for home-based HHHFT for ten to twelve patients annually. Certain individuals with any of the following ailments are supported by this funding: COVID-19, end-of-life illnesses, conditions requiring tracheostomy or laryngectomy, and conditions that result in hospital discharge on HHHFT (Ruangsomboon et al., 2020).

According to the 2021 Danish Respiratory Society guidelines, individuals with severe bronchiectasis with frequent exacerbations, persistent hypercapnic COPD, or interstitial lung disease with hypoxic failure who are unable to tolerate long-term noninvasive ventilation may benefit from home-based HHHFT.

Equity Context: In our evaluations of health technology, we expressly take health equity into account using the PROGRESS-Plus paradigm. A paradigm for health equity called PROGRESS-Plus is used to pinpoint individual and population traits where disparities in health may occur. Place of residence, race or ethnicity, culture, language, gender or sex, handicap, occupation, religion, education, socioeconomic level, social capital, and other important factors that stratify health outcomes and opportunities are some of these characteristics. In order to examine the results of the clinical literature search, we searched for studies that evaluated the impact of PROGRESS-Plus parameters on care access (Stripoli et al ., 2019; Fishman et al., 2023).

To design and enhance the study objectives, review methodologies, and review results, as well as to contextualize the data on HHHFT to Ontario, we consulted specialists in the fields of respiratory therapy, critical care medicine, and respirology.

Hospital-Based HHHFT in Excluded Studies:

HHHFT has demonstrated very encouraging outcomes in hospital settings for patients with acute respiratory failure who are under "do not intubate" (DNI) or "do not resuscitate" (DNR) orders. For instance, a systematic review showed that, in comparison to alternative treatments like noninvasive ventilation and traditional oxygen therapy, HHHFT increased oxygenation and decreased respiratory rates. According to crossover randomized research, patients with palliative requirements who had hypoxemic respiratory failure and DNI status experienced less severe dyspnea during the first hour of treatment with HHHFT. However, evaluating the advantages of using HHHFT at home was the main goal of our review (Nagata et al., 2018).

found no improvement in neuroventilatory drive, respiratory rate, or gas exchange when compared to traditional oxygen therapy in a crossover randomized controlled trial (RCT) assessing the efficacy of hospital-based HHHFT in tracheostomy patients who had just been weaned off a ventilator. Other possible advantages of HHHFT, such as less tracheal trauma, better patient comfort, or a decreased chance of tracheostomy tube occlusion, were not evaluated in this study. Because our focus was on comparing hospital-based and home-based HHHFT exclusively for patients with a tracheostomy who relied on HHHFT as their only treatment option, this trial did not match the inclusion criteria for our evaluation (Storgaard , 2018).

We out a crossover RCT at the Hospital for Sick Children in Toronto to evaluate the efficacy of CPAP and HHHFT in treating OSA in kids with medical complications or obesity. Adverse effects, especially intolerance to the pressures utilized during titration, were observed in the participants. According to polysomnography, the study discovered that both treatments resulted in comparable decreases in OSA severity. However, because the therapy was given in a hospital under observation rather than at home, we did not include this trial in our evaluation (Rea et al., 2010).

Home-Based HHHFT in Excluded Studies:

People with chronic respiratory illnesses, especially those with COPD, have benefited from HHHFT in the home. For instance, it was discovered that six weeks of HHHFT plus LTOT enhanced health-related quality of life and decreased hypercapnia in individuals with stable hypercapnic COPD when compared to LTOT alone. showed that in patients with COPD and chronic hypoxemic failure, adding HHHFT to standard therapy (including LTOT) decreased acute exacerbations, hospital admissions, and respiratory symptoms (Dolidon et al., 2019).

found that long-term HHHFT prolonged the time to first exacerbation and improved lung function and quality of life in patients with COPD and bronchiectasis as compared to standard therapy. Although these trials' findings highlighted the promise of home-based HHHFT, our analysis concentrated on persons with COPD for whom HHHFT is the only practical course of treatment. We searched for studies that compared home-based HHHFT with hospital-based HHHFT instead of research that compared HHHFT with other home-based respiratory technologies because of this restricted focus. Our strategy was motivated by the requirement to match research with our target population and ensure comparability between treatment and control groups. It was outside the purview of our research objectives to include studies that involved comparison with other home-based technologies, as this would have implied that those receiving home-based HHHFT would be eligible for alternative respiratory therapies (Ignatiuk , 2020; Ehrlich et al., 2023).

We performed a retrospective analysis with a focus on patients getting therapy via tracheostomy tube or nasal cannula to assess the use patterns and results of long-term HHHFT in their institution. They discovered that HHHFT administered via tracheostomy tube decreased exacerbations in patients with cancer, chronic airway illness, neuromuscular disease, and chest wall disease. These results on exacerbations, however, did not differentiate between hospital and home environments. Although the authors made an effort to separate data by accounting for arterial blood gas values, it was unclear whether there would be a delay between hospital discharge and the start of home-based HHHFT (Milne , 2022).

Studies that assessed home-based HHHFT :

We found five foreign studies that assessed home-based HHHFT and had some relevance to Ontario. We found no evidence for home-based HHHFT in children; all five studies assessed it for adults. One study assessed home-based HHHFT for individuals with a tracheostomy or hypoxemic respiratory failure, while the other three assessed it for individuals with moderate to severe COPD or bronchiectasis. The analytical methods used in the included studies varied: three were cost-utility analyses, one was a budget effect analysis, and one was a noncomparative costing research (Groessl , 2023).

was a noncomparative costing study; the other studies contrasted normal care, which frequently included long-term oxygen therapy, with home-based HHHFT with usual care. Three of the included studies used a trial-based cost-effectiveness analysis, one employed a Markov model, and one was retrospective registry research. expected savings from using home-based HHHFT. The authors stated that the anticipated cost of home-based HHHFT would probably be less than the inpatient charges that patients with hypoxemic respiratory failure would have paid, even though they did not perform a formal comparison of these devices. predicted slight cost increases related to the use of HHHFT at home (Sørensen , 2021).

In each of the four comparison studies, lower hospitalization rates were linked to lower expenditures. The capital and equipment costs of home-based HHHFT were amortized in four studies. This modeling choice suggested that a home-based HHHFT gadget may be used by someone else after the user had finished using it. If public funding meant that people owned the device, it's uncertain how cost-effective home-based HHHFT would be.

Recommendations:

The economic literature assessing home-based HHHFT was reviewed by us. This review's main merit was how thorough it was in summarizing the most recent economic data supporting home-based HHHFT. Evidence from numerous jurisdictions assessing the utility of home-based HHHFT for a variety of adult chronic diseases was found.

The limited application of our findings was one of the review's other weaknesses. There was no indication that using HHHFT at home for pediatric patients was cost-effective. Additionally, we were unable to find any Canadian evidence for either adult or pediatric patients. Additionally, we were unable to measure the impact of modeling choices and the internal validity of crucial clinical trials on economic results for several of them.

Primary Economic review: For several reasons, we did not carry out a primary economic review. First, there were no comparable effectiveness estimates found in the clinical evidence review to back up this kind of research. Furthermore, no papers that explicitly addressed our study questions were found in the economic evidence evaluation. Due to these restrictions, a primary economic analysis would probably yield numbers that are too ambiguous to make any significant judgments regarding the cost-effectiveness of home-based HHHFT. However, we evaluated the uncertainty of these estimates using a variety of scenario studies and integrated possible changes in resource use and costs into a budget effect study.

Conclusion:

Every person we spoke with had a very positive opinion of home-based HHHFT. They highlighted its significant benefits for controlling respiratory symptoms, improving their child's general quality of life, and lowering the frequency of hospital and specialist visits. Many parents found that home-based HHHFT was a crucial therapy choice for their child, particularly when other therapies were ineffective or inappropriate. Participants did, however, also note that there were significant obstacles to the treatment, including the upfront and continuing expenses, which might be difficult for families. Participants emphasized that the deployment of home-based HHHFT should prioritize equal access.

We were unable to locate any studies that compared home-based HHHFT with other home-based oxygen therapies or no treatment for children's obstructive sleep apnea, or that specifically assessed the efficacy of home-based HHHFT versus hospital-based HHHFT for the treatment of respiratory conditions in adults or children. We did, however, find studies that showed clinical benefits of HHHFT, such as better oxygenation, lower respiratory rates, less severe obstructive sleep apnea, and fewer acute exacerbations of chronic obstructive pulmonary disease, either in hospital settings or in populations receiving alternative treatments at home. Additionally, HHHFT is standard care in Ontario hospitals, where it is widely utilized and largely regarded as clinically beneficial. No cost-effectiveness studies that directly addressed our study questions were found in our

economic evidence analysis. Therefore, it is unknown if home-based HHHFT is cost-effective. Over the following five years, we project that publicly financing home-based HHHFT for children with obstructive sleep apnea in Ontario would result in cost savings of $185,981. An anticipated 127 fewer outpatient visits and 99 fewer inpatient visits contributed to the savings. Over the following five years, we project that publicly financing home-based HHHFT for adults and children with various respiratory disorders in Ontario would cost an extra $2.5 million. We calculate that 653 inpatient days would be avoided if home-based HHHFT were publicly funded. These estimates of the budget impact are quite unclear due to data limitations. Every participant we spoke with had a very favorable opinion of home-based HHHFT. They emphasized its significant advantages in controlling respiratory symptoms, enhancing their child's general quality of life, and lowering the frequency of hospital and specialist visits. Home-based HHHFT was a crucial therapeutic alternative for many, particularly when traditional therapies were ineffective or inappropriate. However, participants pointed out that the initial and continuing costs were a major obstacle to obtaining home-based HHHFT.

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