SUPPLEMENTAL MATERIAL

Appendix 1. Search terms and strategies for the systematic searches relating to oxygen therapy and smoking from the databases Embase and MEDLINE, until 2023-05-31

#	Search History	Results
1	home oxygen therapy/ or oxygen supply/ or oxygen breathing/	783
2	smoking reduction/ or smoking prevention/ or exp smoking/ or smoking cessation/ or smoking cessation program/	25266
3	1 and 2	24

Table S1. Criteria from the landmark studies and guideline recommendations in summary regarding HOT and smoking.

Year	Guidelines/Study	Statement/Criteria
1979	MRC (1)	Smoking was a contraindication. However, about 45% of the patients were smokers. The influence of smoking on the effect of HOT was not stated.
1979	NOTT (2)	Smoking was a contraindication. However, about 40% of the patients were smokers. The influence of smoking on the effect of HOT was not stated.
1988	Sweden (3)	Contraindication
1992	Canada (4)	Contraindication
1995	ERS (5)	Contraindication
1997	BTS (6)	Contraindication
1998	Australia and New Zealand (7)	Contraindication
2015	BTS (8)	No absolute contraindication. “The risks of prescribing oxygen to active smokers should be considered on a case-by-case basis:”
2016	Australia & NZ (9)	No smoking
2017	Germany (10)	No absolute contraindication. ”Avoid noxae for unspecified time”
2020	ATS (11)	No absolute contraindication. ”Safety” and ”not indoors”

References: **(1)** Nocturnal Oxygen Therapy trial Group. Continuous or nocturnal oxygen therapy in hypoxemic chronic obstructive lung disease. Ann Intern Med 1980; 93:391-8. **(2)** Medical Research Council Working Party. Report of long-term domiciliary oxygen therapy in chronic hypoxic cor pulmonale complicating chronic bronchitis and emphysema. Lancet 1981; 1:681-6. **(3)** Strom K, Boe J. - A national register for long-term oxygen therapy in chronic hypoxia: preliminary results. Eur Respir J, 1988, 1, 952-958. **(4)** Canadian Thoracic Society Workshop Group. Guidelines for the assessment and management of chronic obstructive pulmonary disease. Can Med Assoc J 1992; 147:420-8. **(5)** Siafakas NM, Vermeire P, Pride NB, Paoletti P, Gibson J, Howard P, Yernault JC, Decramer M, Higenbottam T, Postma DS. Optimal assessment and management of chronic obstructive pulmonary disease (COPD). The European Respiratory Society Task Force. Eur Respir J 1995; 8(8):1398-420. **(6)** BTS Guidelines for the Management of Chronic Obstructive Pulmonary Disease. Thorax 1997; 52(5 suppl):1S-27S. **(7)** Young IH, Crockett AJ, McDonald CF. Adult domiciliary oxygen therapy. Position statement of the Thoracic Society of Australia and New Zealand. MJA 1998; 168:21-5. **(8)** Hardinge M, Suntharalingam J, Wilkinson T; British Thoracic Society. BTS. British Thoracic Society guidelines for home oxygen use in adults. Thorax. 2015 Jun;70(6):589-91. **(9)** McDonald CF, Whyte K, Jenkins S, Serginson J, Frith P. Australia NZ 2016 Clinical Practice Guideline on Adult Domiciliary Oxygen Therapy: Executive summary from the Thoracic Society of Australia and New Zealand. Respirology. 2016 Jan;21(1):76-8. **(10)** Magnet FS, Schwarz SB, Callegari J, Criée CP, Storre JH, Windisch W. Long-Term Oxygen Therapy: Comparison of the German and British Guidelines. Respiration. 2017;93(4):253-263. **(11)** Jacobs SS, Krishnan JA, Lederer DJ, Ghazipura M, Hossain T, Tan AM, Carlin B, Drummond MB, Ekström M, Garvey C, Graney BA, Jackson B, Kallstrom T, Knight SL, Lindell K, Prieto-Centurion V, Renzoni EA, Ryerson CJ, Schneidman A, Swigris J, Upson D, Holland AE. Home Oxygen Therapy for Adults with Chronic Lung Disease. An Official American Thoracic Society Clinical Practice Guideline. Am J Respir Crit Care Med. 2020 Nov 15;202(10):e121-e141.

Table S2. Statements for PICO (target population-intervention-comparator-outcome) and questions together with votes from the task force.

PICO	Question	Statements and votes
1.	How should smoking be assessed before and during HOT?	• Clinical history and physical examination (all votes for strong recommendation). • Information, alliance with the patient around common goals, shared decision-making (all votes for strong recommendation). • Home visits should be performed if possible (8 strong and 2 conditional votes) • COHb analyzed at arterial blood gas assessments (all votes for conditional recommendation) • Other tests such as exhaled CO or U-cotinine should not be used (8 strong and 2 conditional votes).
2.	How should smoking be managed and followed up in people evaluated for or treated with HOT?	• Education and knowledge of professionals prescribing and involved in oxygen therapy (all votes for strong recommendation). • Evidence-based smoking cessation interventions (all votes for strong recommendation). • Longitudinal management and support (all votes for strong recommendation).
3.	Should HOT be offered to people that meet the eligibility criteria but who continue to smoke (either at starting or during oxygen therapy)?	• Home oxygen therapy should be offered to people that meet the eligibility criteria but who continue to smoke (either at starting or during oxygen therapy) (4 strong against and 6 conditional votes for the recommendation). • Oxygen therapy should not be offered to people with impaired decision making who continue to smoke, who have increased risk of insufficient adherence or complications of the therapy and smoking (all votes for strong recommendation). • Guidelines should be established how to manage oxygen therapy in smokers to improve quality and equality of care (all votes for strong recommendation).
4.	Should the patient be required to have stopped smoking for a certain amount of time before being considered eligible for starting HOT?	• If possible, smoking cessation interventions before starting oxygen therapy (5 strong, and 5 conditional votes).

Supplemental S4.

Question 4: Which legal aspects (laws and regulations) are relevant when considering HOT among active smokers?

The following description pertains mainly to Swedish legislation, but the principal legal considerations are valid and applicable to the European Union and many other settings. The central issue is how risk and risk assessment are dealt with in the applicable legal system. Regardless of whether the system is based on patient's rights or obligations of the provider, the legal community tends to weigh risk assessment in a complex way, especially when risks are unclear, and the risk assessment is multi-faceted. The whole body of law needs to be considered, from the human rights principles regarding fairness, respect, equality, dignity, and autonomy, to more detailed administrative regulations.

Health authorities and health professionals are obliged to offer patients good health care based on the best available evidence and clinical expertise. The overall assessment of the patient's needs should determine the care that is offered. The patient can then, after being fully informed, choose to accept or refuse the offered health care. When considering HOT among active smokers, to deny or limit medical treatment presumes that smoking makes the oxygen treatment significantly less efficient and/or substantially increases the risk of adverse events such as for burn injury or fire accidents. There must be underpinning empirical evidence in the individual case, to even discuss a limitation of the care and treatment that the patient needs.

Regarding HOT, the tradeoffs between potential benefit and risks from a utility perspective, needs to be assessed with regard to the regulations involving prioritization. Risks that can be causally linked to smoking, as well as to conditions related to risky leisure time activities or alcohol overconsumption etc., can be discussed in terms of self-inflicted injuries. In Sweden, such harms have been discussed in the preparatory works for the priority legislation (SOU 1995:5 page 127, Prop. 1996/97:60 page 24). The current legislation can be found in the Health and Medical Services Act [2017:30] and includes three principles. First, the *human dignity principle* occupies a central role for priority setting and states that all people have equal rights and equal value. Second, resources should be allocated according to the *needs and solidarity principle*. Third, the *cost-effectiveness principle* implies that health care has a duty to utilize its resources as effectively as possible. The three ethical principles have a joint

ranking placing the principle of human dignity first, followed by the principle of needs and solidarity, followed by the principle of cost effectiveness. Deprioritizing patients due to self-inflicted injuries, conflicts with the two first principles constitute discriminatory praxis, mainly because of the interrelationship between lifestyle factors and social status in society. When a patient is denied treatment because of smoking, the patient must therefore be provided with proper support to make a change in lifestyle. The support must be feasible and adjusted to the individual circumstances and personal needs of the patient.

The third chapter of the Patient Act (2014:821) states that the patient and relevant persons (such as informal caregivers) should be provided with versatile information about the treatment, including relevant information about essential risks and their prevention. The information should be tailored for the individual, and the health professionals are obliged to ensure that the patient has understood the information.

After individually tailored information has been provided to the patient, the patient must consent to the offered intervention before it can be implemented (Patient Act, chapter 4). HOT must not be given without the patient's informed consent. It assumes that the patient has really understood the potential harms associated with the treatment and how to minimize the risks. Consent means that the patient, the health care provider and health professionals agree on the treatment and how it should be carried out in a safe manner.

If the national law includes regulations regarding surrogate decision makers for patients who have impaired capacity to consent and make informed decisions regarding healthcare, these must be taken into careful consideration. However, Swedish law lacks any guidelines regarding consent from patients who lack decision making capacity. In the absence of regulations regulating how to handle the issue of consent in these cases, a practice has emerged in healthcare that is based on using the patient's presumed will as the basis for providing health care and treatment. However, to start from the patient's presumed will for treatment which involves potential risk of harm is very questionable, not least because such consent in itself is legally questionable.

The administration of HOT calls for active participation by the patient. Sometimes the national law provides guidance on how the responsibility should be distributed between care provider/health care professionals on the one hand and the patient on the other in such

cases. The Swedish National Board of Health and Welfare has issued regulations on the assessment of whether a health care measure can be carried out as self-care (SOSFS 2009:6). This regulation confirms the interpretation of the law with regards to HOT. According to the regulation, there must be an assessment of whether the patient is exposed to risk of injury or not before a specific treatment can be granted. This assessment must also consider if the patient with the help of informal caregivers can safely carry out a healthcare measure as self-care. A healthcare measure may not be judged as self-care if the assessment shows that there is a risk that the patient will be harmed. If applied on HOT, the regulation does not prohibit HOT in patients who continue to smoke, unless the risks connected to smoking cannot be avoided through smoking and safety precautions, including handling of the machine, help from informal caregivers, a fire-safe environment, etc.

Leaving the health care setting behind, the risk of fire hazard must also be taken into separate consideration legally. If HOT among patients who continue to smoke substantially increases the risk of fire hazards, the Civil Protection Act (2003:778) can be relevant in Sweden. The state and municipality have the overall responsibility to reach the goals of this law - safeguarding life, health, property and the environment against all types of incidents, accidents and emergencies - but the primary responsibility lies on the individual, who must take adequate measures for protection and take the measures necessary to prevent fire and to prevent or limit damage in case of fire. The Civil Protection Act, however, does not apply to health care as referred to in the Health and Medical Services Act. For health care and medical interventions, it is instead the health care provider who has the responsibility to provide good care. However, an exception is formulated to clearly outline the municipalities and regions' responsibility for ensuring that inpatient care and patient transports are conducted in a patient-safe manner (SOU 2002:10 and prop. 2002/03:119). HOT to a smoker is not covered by this exemption, as the treatment is not provided in a healthcare facility. Whether or not the patient has interventions from social services or municipal healthcare, the individual's home falls under the responsibility of municipality's supervision. Smoking in these situations can be considered a risk factor. The oxygen treatment should therefore be planned in collaboration with the municipality or other services involved in the home care, so that a complete risk assessment can be carried out and appropriate measures be taken [1].

Supplemental S5.

Question 5: What ethical considerations are relevant when considering HOT among active smokers?

According to a widely used analytic framework, ethical challenges in healthcare can be evaluated as dilemmas within, or between, the four ethical principles of: 1) beneficence, 2) non-maleficence, 3) distributive justice, and 4) respect for autonomy [2]. We will use the first three to discuss the question "would it be ethically justified to offer HOT to active smokers?".

The *principle of beneficence* states that to the extent that there is effective treatment, it should be offered, whereas ineffective treatment should not be offered. In Swedish medical law this principle is articulated for instance in the Patient Safety Law. The more effective a treatment is, the stronger is the ethical case for offering it. The central ethical question, then, is whether HOT is effective among active smokers. To be able to judge the ethical case for offering HOT to active smokers, we would ideally want to know exactly how effective it is, regarding all possible positive effects of HOT including improved cognitive function, QoL, and survival. We would also want to know if/how these effects vary across a range of smoking habits and levels of treatment adherence. Pending strong evidence, we need to operate with an estimate of the above as well as with a metric for dealing with the uncertainty.

The *principle of non-maleficence* states that unreasonably risky treatment should not be offered and that healthcare should actively work to reduce any risks associated with treatment. The most dramatic risk in HOT (both among non- and active smokers) is the risk of fire and burn injuries. This is a risk not only to the patient herself but also to third parties. Although medical decisions sometimes *affect* third parties – as when failure to treat a contagious disease leads to risk of infection in third parties – it is uncommon (besides pregnancy and breast feeding) that a treatment incurs *risk* for third parties. Third party radiation exposure following some radio-metabolic treatments [3] and the risk of increased aggressive behaviour in the wake of some psychotropic drugs [4] are some rare exceptions to this rule. To our knowledge there is no comprehensive ethical analysis of treatments which involve risks to third parties. Following convention within research ethics and vaccination ethics [5], it seems reasonable to claim that medical risks of treatment to third parties should be seen as more serious than risks only to the patient since third parties do

not enjoy the potential benefit of treatment. Other than the risk of fire, HOT has possible adverse effects which mainly pertain to the patient only, including perceived loss of freedom, risk of stigmatization and fall injuries. All in all, the ethical relevance of non-maleficence in the case of HOT for active smokers requires a thorough description of the possible risks involved, again across a range of different smoking habits.

Once the risks of positive and negative treatment effects are described, it is time to balance beneficence against non-maleficence. In so doing, possible lack of evidence, regarding any of the above factors, must be accounted for. For further discussion on positive and negative effects of treatment, see other sections in this position paper.

In Sweden, the *principle of distributive justice*, is operationalized through the "Ethical Platform for priority setting" [6]. Of particular importance here is the fact that the ethical platform expressly forbids making treatment decision based on a patient's smoking status or similar aspects *to the extent that these have contributed to the need for treatment*. If a patient's smoking status radically alters the feasibility of treatment or prognosis with and without treatment, this may, however, be accounted for. For the present purposes the ethical platform thus functions as a principle of formal justice, instructing potential decision-makers to ignore a patient's smoking status *except to the extent it substantially alters treatment outcomes.* As already mentioned, the principle of distributive justice provides us ethical guidance when deciding whether patients' smoking status radically alters HOT treatment outcomes or not.

The insistence that active smokers should be treated like non-smokers (except where feasibility of treatment or prognosis differs) suggests another ethical issue. Empirical data suggests that health care professionals are not immune to the stigmatization of smokers [7]. We therefore encourage health care professionals to consider how their medical decision making may be influenced by potentially stigmatizing views of active smokers or by their desire to reduce smoking in society. There are indications that the commitment to reduce smoking may lead health care personnel to overestimate the risks of smoking in certain clinical situations or to let the end justify the means in ways that could be ethically problematic [8]. It is vital that the initiation of HOT is a purely a medical decision and never used by health care personnel to coerce patients to stop smoking. Lastly, there is a risk that singling out active smokers as a patient group unfit for certain treatments may further

stigmatize this specific subgroup of patients and could thereby impact the non-judgmental communication and trust which are cornerstones of an effective patient-health care professional relationship.

References for S4 and S5:

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