

Health-related Quality of Life in Patients With Long-term Ventilation

A summary of highlights from presentations at the 1st Respiratory Failure and Mechanical Ventilation Conference 2020 by M. Duiverman (Groningen, Netherlands), W Windisch (Cologne, Germany) and F. Magnet (Köln, Germany)

Health-related quality of life (HRQoL) is an important and wide-ranging concept that is highly subjective and is difficult to accurately capture in a questionnaire. The WHO defines it as 'a broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment'.¹ HRQoL is rated highly by individuals; in one study of 4,518 patients undergoing haemodialysis, 92% rated HRQoL as important compared with the 80% for rated life expectancy.² The main factors affecting HRQoL are symptoms, functioning and disease perception which affect physical health, psychological health, and level of independence.^{3,4}

A measure of HRQoL should capture domains that are relevant to the patient, it should be reliable, valid and should be easy to handle. Some generic questionnaires, such as the Short-Form 36 (SF-36), have domains on activities such as ability to do housework, participate in sport, or walk 0.5 km which are not valid for patients confined to a wheelchair of those with COPD.

HRQoL instruments can be:

- Generic – applicable to all but may not be sensitive for aspects associated with specific diseases e.g. SF-36
- Condition-specific - captures relevant domains, sensitive to change but comparison between patient groups is difficult e.g. St George's Respiratory Questionnaire (SGRQ), Chronic Respiratory Disease Questionnaire (CRQ), COPD Assessment Test (CAT), Clinical COPD Questionnaire (CCQ), ALS Functioning Rating Scale Revised (ALSFS-R), Maugeri Foundation Respiratory Failure Questionnaire (MRF-28), Severe Respiratory Insufficiency Questionnaire (SRI) and S3-non-invasive ventilation questionnaire (S3-NIV)

Studies have found that in patients with chronic hypercapnic respiratory failure, fatigue, sleep, cognition/concentration and discomfort were improved by NIV. However, there was little or variable correlation in domains that assessed these issues between the CRQ and the MRF-28 or the SRI questionnaires.^{4,5} The S3-NIV now includes questions on side effects of interventions such as NIV which expands the scope of HRQoL investigations.⁶ Questionnaires concentrate on different aspects; the emphasis in the MRF-28 is on activities of daily living whereas the SRI and the CRQ are more related to anxiety and depression.⁴



The SRI, MRF-28 and S3-NIV have 49, 28 and 10 questions, respectively. This means that some tests will take a long time to complete which may be difficult for some patients. The tests should also not have floor or ceiling effects (in which most patients are given lowest or highest scores on some parameters) and must be internally consistent. HRQoL tests have differing merits; the MRF-28 has a cognition domain but no psychological domain, the SRI is extensively validated and the S3-NIV is short and easy but not extensively validated.

The range of HRQoL questionnaires for HMV is quite large with at least 10 types that are more commonly used with item numbers ranging from 14 (Hospital Anxiety and Depression Scale) to 136 (Sickness Impact Profile).⁷ Generally, questionnaires have become simpler and more rapid to use in recent years to make them easier for patients. HRQoL consists of multiple different items and domains that are affected differently. Studies using SF-36 showed that whilst physical health is severely impacted in patients receiving NIV for COPD, kyphoscoliosis or DMD, mental health is often preserved.⁸ HRQoL therefore, is maximally dependent on the underlying disease. This was also shown in a study of amyotrophic lateral sclerosis patients in which mortality and HRQoL were significantly improved by NIV compared with standard care for non-bulbar disease ($p=0.0059$ and $p=0.0004$) but not for bulbar disease ($p=0.92$ and $p=0.26$).⁹

HRQoL is a complex construct and patients have widely differing views on which aspects are most important. The SRI questionnaire recognises this and is based on patient input and comprises seven subscales; it is important to consider performance on each of these and the items beneath them to accurately assess a patient's HRQoL rather than simply looking at the overall score.^{8,10} Disease-specific

questionnaires are more sensitive to change than generic types. An investigation of patients with respiratory disease (COPD, restrictive thoracic disease, NMD, obesity-related hypoventilation and other respiratory conditions, n=137) found that the improvements detected after 1 month and 1 year HMV were greater using SRI than SF-36.¹¹ This study also found that side effects were an issue with HMV and their impact should be part of HRQoL assessment.

The HRQoL effects of NIV can be variable and apparent outcomes differ with generic vs specific questionnaires. A key randomised study of long-term nocturnal oxygen therapy (LTOT) + NIV in stable hypercapnic COPD (n=144) found that NIV +LTOT improved survival compared with LTOT alone but worsened quality of life, as measured using SF-36.¹² Another notable randomised study, found that in patients with stable COPD (n=195) additional NIV PSV resulted in mortality of 33% vs 12% for standard treatment alone (p=0.0004). Both SRI and St George's Respiratory Questionnaires showed significant improvements in HRQoL whereas SF-36 showed no significant difference.¹³ A further study of oxygen therapy + NIV compared with oxygen therapy alone found large differences in admission-free survival up to 6 months but HRQoL benefits were only apparent up to 3 months but not thereafter.¹⁴ This suggested that continued NIV may not be beneficial in some patients.

A recent European Respiratory Society (ERS) analyses of multiple clinical studies found that in stable patients with long-term stable COPD outcomes from ventilation were variable.¹⁵ However, long-term home NIV was beneficial to HRQoL (standard mean difference for treatment = 0.49) and dyspnoea (standard mean difference = -0.51). The analysis also found that long-term home NIV was beneficial to HRQoL after an episode of acute hypercapnic respiratory failure (mean random difference = -2.89). These findings prompted the ERS to recommend long-term home NIV in these indications. A more recent randomised study (n=67) found the home initiation of long-term high-intensity NIV was non-inferior to the same treatment in hospital in terms of reducing PaCO₂ but that costs were substantially reduced.¹⁶ The study also showed that all SRI subscales were similarly improved at home and in hospital.

Maintaining good HRQoL in individuals receiving invasive ventilation, particularly tracheotomised patients is often difficult. This is an increasing problem due to greater numbers failing to wean from MV largely as a result of the admission of more severely ill and older patients.¹⁷ However, some strategies can be used to improve HRQoL.

An investigation of patients receiving long-term invasive HMV (n=32, NMD: 14, lung disease: 18) found that SRI scores were generally better for those with NMD than for those with COPD.¹⁸ Despite the invasive nature of the MV, some patients were seen to have good HRQoL and full work and social lives. Some patients, however, had much poorer HRQoL due to factors such as loss of speech due to tracheotomy and consequent inability to interact with social contacts. The varied HRQoL found in this study was emphasised by patient testimonies; some expressing satisfaction or enjoyment of life (mostly in NMD group) but others having regrets about tracheostomy and some wanting to die (mostly in COPD group).¹⁸ A follow-up study of this group of patients revealed that patients were most satisfied with aspects such as technical aids for hygiene and physiotherapy.¹⁹ Patients were least satisfied with aspects of mobility (unable to: get out of bed [4%], leaving the house [36%], take

excursions [48%] and travel [92%]) and aspects of communication (unable to: speak [52%], write [76%], text [44%], hear [96%], communicate non-verbally [100%]). Patients showed intermediate satisfaction with other aspects such as medical care, daily routine and living situation. Patients with COPD were substantially less satisfied with their mobility but more would choose tracheostomy again than those with NMD. However, over a third would have chosen to die if offered the tracheostomy decision again. A 10-year experience study of tracheostomy in DMD and respiratory patients (n=77) generally showed satisfaction with invasive HMV and would choose it again. The majority of caregivers were satisfied with the tracheostomy although it was a great burden to many, particularly at night.²⁰

HRQoL therefore, is highly dependent on the underlying disease and is a critical component of patient management but knowing what aspects should be assessed is key. Both generic and disease-specific questionnaires should be used to allow group comparisons and gain an accurate assessment. Shorter HRQoL questionnaires facilitate patient assessment but need further validation. HRQoL can be improved using NIV at home and in hospital but assessments are greatly affected by the choice of questionnaire. HRQoL findings in patients receiving either invasive or non-invasive MV differ widely between patients depending on their circumstances. Where HRQoL is poor, there are often issues of mobility, communication and social contact which must be addressed to improve long-term outcomes.

References

1. WHOQOL: Measuring quality of life - Introducing the WHOQOL instruments. 2020.
2. Janssen IM, Gerhardus A, von Gersdorff GD, et al. Preferences of patients undergoing hemodialysis – results from a questionnaire-based study with 4,518 patients. *Patient Prefer Adherence* 2015;9:847-55.
3. Cejudo P, Lopez-Marquez I, Lopez-Campos JL, et al. Factors associated with quality of life in patients with chronic respiratory failure due to kyphoscoliosis. *Disabil Rehabil* 2009;31:928-34.
4. Duiverman ML, Wempe JB, Bladder G, Kerstjens HA, Wijkstra PJ. Health-related quality of life in COPD patients with chronic respiratory failure. *Eur Respir J* 2008;32:379-86.
5. Duiverman ML, Wempe JB, Bladder G, et al. Nocturnal non-invasive ventilation in addition to rehabilitation in hypercapnic patients with COPD. *Thorax* 2008;63:1052-7.
6. Dupuis-Lozeron E, Gex G, Pasquina P, et al. Development and validation of a simple tool for the assessment of home noninvasive ventilation: the S(3)-NIV questionnaire. *Eur Respir J* 2018;52.
7. Windisch W. Home mechanical ventilation. In: M. T, ed. *Principles & Practice of Mechanical Ventilation*; 3rd edition. New York, USA: Mc Graw Hill; 2012.
8. Windisch W, Freidel K, Schucher B, et al. Evaluation of health-related quality of life using the MOS 36-Item Short-Form Health Status Survey in patients receiving noninvasive positive pressure ventilation. *Intensive Care Medicine* 2003;29:615-21.
9. Bourke SC, Tomlinson M, Williams TL, Bullock RE, Shaw PJ, Gibson GJ. Effects of non-invasive ventilation on survival and quality of life in patients with amyotrophic lateral sclerosis: a randomised controlled trial. *Lancet Neurol* 2006;5:140-7.
10. Windisch W, Budweiser S, Heinemann F, Pfeifer M, Rzehak P. The Severe Respiratory Insufficiency Questionnaire was valid for COPD patients with severe chronic respiratory failure. *J Clin Epidemiol* 2008;61:848-53.
11. Windisch W. Quality of life in home mechanical ventilation study G. Impact of home mechanical ventilation on health-related quality of life. *Eur Respir J* 2008;32:1328-36.
12. McEvoy RD, Pierce RJ, Hillman D, et al. Nocturnal non-invasive nasal ventilation in stable hypercapnic COPD: a randomised controlled trial. *Thorax* 2009;64:561-6.
13. Kohnlein T, Windisch W, Kohler D, et al. Non-invasive positive pressure ventilation for the treatment of severe stable chronic obstructive pulmonary disease: a prospective, multicentre, randomised, controlled clinical trial. *Lancet Respir Med* 2014;2:698-705.
14. Murphy PB, Rehal S, Arbane G, et al. Effect of Home Noninvasive Ventilation

With Oxygen Therapy vs Oxygen Therapy Alone on Hospital Readmission or Death After an Acute COPD Exacerbation: A Randomized Clinical Trial. *JAMA* 2017;317:2177-86.

15. Ergan B, Oczkowski S, Rochweg B, et al. European Respiratory Society guidelines on long-term home non-invasive ventilation for management of COPD. *Eur Respir J* 2019;54.
16. Duiverman ML, Vonk JM, Bladder G, et al. Home initiation of chronic non-invasive ventilation in COPD patients with chronic hypercapnic respiratory failure: a randomised controlled trial. *Thorax* 2020;75:244-52.
17. Polverino E, Nava S, Ferrer M, et al. Patients' characterization, hospital course and clinical outcomes in five Italian respiratory intensive care units. *Intensive Care Medicine* 2010;36:137-42.
18. Huttmann SE, Windisch W, Storre JH. Invasive home mechanical ventilation: living conditions and health-related quality of life. *Respiration* 2015;89:312-21.
19. Huttmann SE, Magnet FS, Karagiannidis C, Storre JH, Windisch W. Quality of life and life satisfaction are severely impaired in patients with long-term invasive ventilation following ICU treatment and unsuccessful weaning. *Ann Intensive Care* 2018;8:38.
20. Marchese S, Lo Coco D, Lo Coco A. Outcome and attitudes toward home tracheostomy ventilation of consecutive patients: a 10-year experience. *Respir Med* 2008;102:430-6.