



Assessment of health status and program performance in patients on long-term oxygen therapy

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Frailty;
Integrated care

Summary

Background: Despite well established clinical guidelines, performance of long-term oxygen therapy (LTOT) programs shows marked variability among territories. The current study assessed the LTOT program and the health status of patients on LTOT prior to the deployment of community-based integrated care in an urban health district of Barcelona (Spain).

Aims: To assess: *i*) the LTOT program and health status of the patients on LTOT in the health district; *ii*) their frailty profile; and, *iii*) the requirements for effective deployment of integrated care services for these patients.

Methods: Cross-sectional observational study design including all patients ($n = 406$) on LTOT living in the health district. Health status, frailty, arterial blood gases, forced

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spirometry and hand-grip muscle strength were measured. Network analysis of frailty was carried out.

Results: Adequacy of LTOT prescription ($n = 362$): 47% and 31% of the patients had $\text{PaO}_2 \leq 60$ mmHg and ≤ 55 mmHg, respectively. **Adherence to LTOT:** 31% of all patients used LTOT ≥ 15 h/d; this figure increased to 67% in those with $\text{PaO}_2 \leq 60$ mmHg. **Assessment of frailty:** Overall, LTOT patients presented moderate to severe frailty. **Care complexity** was observed in 42% of the patients.

Conclusions: Adequacy and adherence to LTOT was poor and many patients were frail and complex. The outcomes of the network analysis may contribute to enhance assessment of frailty in LTOT patients. These observations suggest that an integrated care strategy has the potential to improve the health outcomes of these patients.

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Introduction

Integrated Care has demonstrated a remarkable potential to enhance health outcomes and contain economic costs [1] in chronic patient management. This requires the efficient transfer of care complexities from hospital-based specialized care to the community. A key learning observation in the deployment process undertaken in Barcelona [1] was the need to formulate and assess community-based integrated care services (ICS) for frail chronic patients.

The current study was prompted by the hypothesis that patients on Long-Term Oxygen Therapy (LTOT) may present requirements that could be efficiently covered by community-based ICS with potential to improve LTOT outcomes and raise healthcare efficiencies [2].

It is of note that current clinical indications and logistics for administration of LTOT are based on the results of two classical studies carried out, in patients with Chronic Obstructive Pulmonary Disease (COPD), more than three decades ago [3,4]. Moreover, despite well defined clinical guidelines on LTOT [5–8], there are deficits in LTOT indications and administration, as well as large variability among programs [9]. It is assumed that all these issues could be better addressed within an integrated care scenario.

As a baseline evaluation, prior to the deployment of ICS in the health district, we (1): assessed the adequacy of prescription and the adherence to LTOT of all patients receiving LTOT in one of the urban health districts of Barcelona (Barcelona-Esquerria, 540.000 inhabitants) in Spain; (2) characterized comprehensively their health status, frailty, care complexity and use of healthcare resources; and, (3) applied network analysis to examine the associations among different dimensions of frailty and their impact on healthcare use. The results of the study should provide the basis for the design of a novel integrated care service for these patients to be prospectively evaluated during 2015 [10].

Methods

Study design and ethics

This cross-sectional observational study enrolled all patients older than 40 years of age on prescribed LTOT in

Barcelona-Esquerria (Spain) according to the Catalan Health Care (CatSalut) single-payer registry. The regional LTOT is highly regulated, but both prescription and follow-up are done on a conventional care basis which implies fragmentation of information and care. Hospital-based specialized physicians, pulmonologists or internists, can prescribe LTOT and respiratory specialists are responsible for LTOT follow-up (see additional organizational details in the on-line supplementary material). Standard LTOT eligibility criteria were applied [3,4]. Briefly, LTOT prescription was adequate in clinically stable patients with optimal medical therapy showing $\text{PaO}_2 \leq 55$ mmHg breathing room air or patients in the grey area regarding PaO_2 that present at least one of the following conditions: poliglobulia; pulmonary hypertension (cor pulmonale); or oxygen desaturation ($\leq 85\%$) during exercise. The study protocol was approved by the Ethics Committee of the 3 hospitals attending patients in Barcelona-Esquerria (Hospital Clinic, Hospital Sagrat Cor and Hospital Plató). All participants signed their informed consent.

Patient characterization

Patient characterization was carried out at the patient's home by nurses and physiotherapists duly trained for the study in 3 sequential home visits of 40 min each during 3 weeks, and included (Table 1S): (1) a standardized interview and self-administered questionnaires (see on line document for details); (2) arterial blood gas measurement [11], (3) forced spirometry [12], (4) hand-grip muscle strength quantification [13], as displayed in (Fig. 1). Additional information was obtained from patient electronic health records following the current legislation on access and confidentiality of the clinical data. The information was grouped into five dimensions according to the structure proposed by WHO [14] to describe the characteristics of chronic patients, namely: *i*) socio-demographics; *ii*) health team and system related factors; *iii*) characteristics of patient's chronic conditions; *iv*) risk factors and treatment; and, *v*) patient dependence factors.

Frailty is a multifactorial condition defined as a clinical state in which there is augmented individual's vulnerability for developing increased dependency and/or mortality when exposed to a stressor [15]. The patient

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