



Original Article

Variability in Home Mechanical Ventilation Prescription[☆]

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ABSTRACT

Introduction: Few studies have analyzed the prevalence and accessibility of home mechanical ventilation (HMV). The aim of this study was to characterize the prevalence of HMV and variability in prescriptions from administrative data.

Methods: Prescribing rates of HMV in the 37 healthcare sectors of the Catalan Health Service were compared from billing data from 2008 to 2011. Crude accumulated activity rates (per 100 000 population) were calculated using systematic component of variation (SCV) and empirical Bayes (EB) methods. Standardized activity ratios (SAR) were described using a map of healthcare sectors.

Results: A crude rate of 23 HMV prescriptions per 100 000 population was observed. Rates increase with age and have increased by 39%. Statistics measuring variation not due to chance show a high variation in women (SCV=0.20 and EB=0.30) and in men (SCV=0.21 and EB=0.40), and were constant over time. In a multilevel Poisson model, hospitals with a respiratory medicine unit were associated with a greater number of cases (beta=0.68, $P<.0001$).

Conclusions: High variability in prescribing HMV can be explained, in part, by the attitude of professionals toward treatment and accessibility to specialist centers with a respiratory medicine unit. Analysis of administrative data and variability mapping help identify unexplained variations and, in the absence of systematic records, are a feasible way of tracking treatment.

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Variabilidad en la prescripción de la ventilación mecánica a domicilio

RESUMEN

Introducción: Hay pocos estudios que hayan analizado la prevalencia y la accesibilidad a la ventilación mecánica a domicilio (VMD). El objetivo del presente estudio es describir la prevalencia de la VMD y estudiar la variabilidad a partir de datos administrativos.

Métodos: Se compararon las tasas de VMD en las 37 áreas de salud a partir de los datos de facturación del Servicio Catalán de la Salud, durante el período 2008–2011. Se calcularon las tasas brutas de actividad acumulada (por 100.000 habitantes) utilizando el componente sistemático de variación (CSV) y empírico Bayes (EB). Las razones de actividad estandarizada (REA) se describieron mediante un mapa de sectores de salud.

Palabras clave:

Ventilación mecánica a domicilio

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Resultados: La tasa bruta VMD fue de 23 usuarios/100.000 habitantes. Las tasas aumentan con la edad y han crecido un 39%. Los estadísticos que miden la variación no debida al azar muestran una variación elevada en mujeres (CSV = 0,20 y EB = 0,30) y en hombres (CSV = 0,21 y EB = 0,40), y constante a lo largo del tiempo. En un modelo de Poisson multinivel la existencia de un hospital con servicio de neumología se asoció con un mayor número de casos ($\beta = 0,68$; $p < 0,0001$).

Conclusiones: La variabilidad elevada de la VMD puede explicarse, en parte, por la actitud de los profesionales hacia el tratamiento y la accesibilidad a centros que disponen de especialista de neumología. El análisis de los datos administrativos y la confección de mapas de variabilidad permiten identificar variaciones no explicadas y, en ausencia de registros sistemáticos, es una manera factible de realizar el seguimiento de un tratamiento.

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Introduction

Home mechanical ventilation (HMV) was introduced due to the need to treat survivors of the poliomyelitis epidemic who only required long-term ventilatory support after discharge from hospital.¹ Until the 1980s, few mechanical ventilation systems were available for these patients,² and most were ventilated via tracheotomy, with survival rates of over 20 years.³ Studies describing the successful delivery of ventilation via the nasal passage^{4,5} led to significant changes in HMV.

References to HMV in our setting go back to the mid-1980s,^{6,7} although isolated cases of patients ventilated at home for years using an “iron lung” have been reported. Home non-invasive ventilation (NIV) was developed simultaneously in Hospital Universitari de Bellvitge⁸ and Hospital San Pedro de Alcántara⁹ (Spain) at the end of the 1980s. Since then, the number of centers and patients using HMV has steadily increased, most notably after the introduction of (bi-level) pressure-cycled ventilators.¹⁰

Despite this growing interest, few studies have analyzed the prevalence of HMV. As well as being indicated in patients with neuromuscular and/or restrictive diseases (in whom ventilatory pump failure is a common occurrence), the practice of extending the indication for long-term NIV to include patients with chronic obstructive pulmonary disease (COPD) and obesity hypoventilation syndrome (OHS) is steadily gaining ground. There is, however, no evidence to support the validity of this criterion.¹¹

Variability in clinical practice has been widely recognized and analyzed for more than 30 years.¹² Decision-making is a complex issue, and clinical practice is established taking into account not only scientific evidence, but also local circumstances, professional skills and above all, patient values.¹³ The magnitude of variability must be studied in order to introduce specific actions for improvement, and to guarantee equal access to effective treatment. A systematic study of variability requires accurate registers to be maintained over time in order to observe trends. However, these are costly and require systematic updates if they are to remain useful. Another option is to use the information available in the national health system.

The aim of this study was to analyze the prevalence of HMV and make a preliminary study of its variability, taking into account both population figures and the information available in the Health Services.

Methodology

Variations in clinical practice are analyzed by comparing rates of hospitalization, intervention or care activity carried out in the healthcare sectors included in a particular geographical area. This study compared the HMV prescription rates in the different healthcare sectors of Catalonia (Spain). Patients were identified using the Catalan Health Service (CatSalut) billing database, selecting cases in which HMV was invoiced to CatSalut between 2008 and 2011

(inclusive). Cases were assigned to each geographical area according to each patient's healthcare area of residence. The denominators were calculated using population data from the CatSalut central registry of insured persons (CRI).

The analysis included all 37 healthcare sectors where health promotion, disease prevention, public health and social-healthcare activities are provided and coordinated at the primary care and specialist level. Assigning cases to each geographical area is a key element in analyzing variations in clinical practice. Each patient's healthcare sector of residence was determined on the basis of billing data.

The description of the results is based on variation rates and statistics calculated using the direct standardization method, while those based on expected values were obtained by indirect standardization. Crude cumulative activity rates (per 100 000 inhabitants) for the study period were first calculated with respect to the population of each healthcare sector; these are described in terms of percentiles and a dot plot in which each sector is represented by a point. Following this, the usual variability statistics used in the analysis of small areas were calculated: the variance ratio (VR) for sectors in the 5th (P5) and 95th percentile (P95) (ratio between activity in the P95 and P5 sectors, VR_{5-95}); the systematic component of variation (SCV), which uses the inter-sectorial variation (which is expected to be systematic), the intra-area variation (expected to be random), and the empirical Bayes (EB) method. Standardized activity ratios (SAR) were then constructed, and described using a map of healthcare sectors. The SAR was obtained to compare the real activity billed for the residents in an area (observed activity) with the activity they would have had (expected activity) if the use made by each of their 5-year age and sex groups had been equal to that of the reference standard: the whole population of Catalonia included in the integrated public health system of Catalonia (SISCAT). Finally, sectors were grouped in clusters, corresponding to the sectors allocated to the various service distribution companies. After totaling the number of cases by sex and 5-year age group, a multilevel Poisson model was constructed where the grouped patients were the analysis unit, the sectors the second level, and the clusters the third level. Using this model, we were able to study the possible effect on each sector of service distribution companies and the presence of a hospital with a Respiratory Medicine department. Data analysis and processing were performed using STATA, version 11.2 and R, version 3.00.0.

Results

A total of 240 760 patients who received some type of home respiratory therapy funded by the public system were identified between 2008 and 2011. Of these, 75.8% used continuous positive airway pressure (CPAP) equipment, 17.3% various forms of oxygen supply, 4.2% nebulized therapy, 2.5% HMV and 0.2% miscellaneous treatments.

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