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Original Article

Multimorbidity in people with type 2 diabetes in the Basque Country (Spain): Prevalence, comorbidity clusters and comparison with other chronic patients

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ABSTRACT

Background: Multimorbidity is a common problem in ageing societies and has a wide range of individual and social consequences. The objective of this study was to compare multimorbidity in a population with type 2 diabetes (T2DM) with that in other chronic patients, and identify disease clusters in patients with T2DM.
Methods: We included all citizens in the Basque Health Service aged ≥ 35 years, and identified the population with chronic conditions (from a list of 51 diseases) and those with T2DM. We performed a descriptive analysis of both populations, including their comorbidities. The average of chronic conditions unadjusted and adjusted by socioeconomic variables was obtained. Further, among patients with T2DM, we performed agglomerative hierarchical clustering to identify clinically relevant subgroups with the same concurrent conditions.
Results: In 2011, out of a population of 1,473,937, 15.2% had T2DM and 48% some other type of chronic condition. Overall, 87.6% men and 92% of women with T2DM had multimorbidity, while the figures were respectively 54.2% and 57% in chronic patients without T2DM. Patients with T2DM had a higher risk than the general chronic population of having 21 of the 51 chronic conditions considered. We identified 10 relevant disease clusters in patients with T2DM.
Conclusions: There are notable differences between chronic patients with and without T2DM, the prevalence of multimorbidity being greater among the former. Multimorbidity is a complex phenomenon and more research is required to establish the clinical implications of the disease clusters found, to guide the introduction of integrated care management programmes.

1. Introduction

Type 2 diabetes mellitus (T2DM) is among the chronic conditions with the greatest impact on health. Reports of the International Diabetes Federation indicate that the prevalence of this condition has reached epidemic proportions worldwide, affecting some 290 million individuals, and the human, social and economic costs are a cause for concern [1]. In Spain, the prevalence of diabetes mellitus is estimated to be 13.8% among those over 17 years old, with 6% of population undiagnosed [2].

It is so common for patients to have several chronic diseases concurrently that multimorbidity is considered the most prevalent chronic condition [3], a recent systematic review of 41 studies across the world reporting rates of multimorbidity of 55% to 98% among people over 65 years old [4]. The different sources of information used (surveys, administrative database diagnoses, prescriptions and primary care records) lead to different results in terms of prevalence. Further, most studies have only included certain population groups, such as health service users [5,6], health centre users who participate in certain

Abbreviations: OR, odds ratio; T2DM, type 2 diabetes mellitus.
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programmes [7], or those for whom data meet certain quality criteria [6, 8–11].

Multimorbidity is a common problem in ageing societies and has a wide range of individual and social consequences. Further, the costs associated with chronic patients significantly increase with the number of comorbidities. Considering the impact of multimorbidity on patients, their families and caregivers, and in health systems and societies, it is time to explore innovative approaches for ensuring high quality care [12].

Some common factors related to multimorbidity have been identified, such as age and unfavourable socio-economic conditions [6,9]. In a study carried out in the Basque Country [13], similar patterns have been found in patients with T2DM.

In this context, the objective of our study was to analyse and compare multimorbidity in the population with T2DM with that in the general population of chronic patients, and to identify disease clusters in patients with T2DM.

2. Material and methods

2.1. Ethical considerations

The study protocol was approved by the Clinical Research Ethics Committee of Euskadi (PI2014074), Spain. Informed consent was not obtained because patient health records were made anonymous and deidentified prior to analysis.

2.2. Data sources and selection criteria

We carried out a descriptive analysis including all chronic patients aged 35 years old or above provided with care through Osakidetza (the Basque Health Service). In Osakidetza, diagnoses from discharge summaries, databases of emergency departments and records of primary care doctors are coded according to the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) [14], while the coding system used by primary care doctors for drugs is the Anatomical, Therapeutic, Chemical Classification System [15]. In addition, data was collected on demographic and clinical variables, from the Minimum Basic Data Set [16] and notes in the electronic medical records from primary care and emergency departments between 1 September 2007 and 31 August 2011, 4-year period.

Using the aforementioned sources, we identified all patients living in the Basque Country who had been prescribed antidiabetic medication or had diagnoses related to diabetes (ICD-9-CM, code 250.xx) or its complications, during the period study. Patients who had at least one diagnosis related to type 1 diabetes mellitus were considered to have this other type of diabetes and excluded from the study database. We also excluded patients who were only prescribed one or more types of insulin and had not any diagnosis related to diabetes to minimise the risk of including patients with type 1 diabetes mellitus.

2.3. Variables and analysis

For the multimorbidity analysis, we used a list of 51 chronic conditions, which was defined by consensus among the research team. Specifically, this was based on the adaption of two pre-existing lists, published by other authors: the 40 diseases selected by Barnett et al. [7] and the chronic conditions considered in the Technical Reference Guide of the Johns Hopkins Adjusted Clinical Group system [17]. According to the characteristics of each disease, we employed different criteria, which could be: the presence of specific Read codes in the patient medical records, prescription of medications to treat such conditions or a combination of diagnoses and prescriptions. To avoid the presence of inactive health problems, in some situations they established a period for the diagnosis or prescription to be considered.

As a social indicator, we used a deprivation index based on census tracts. Tracts are the smallest units for which the census data are available in Spain, and are mainly defined by population size, though geographical and man-made features in the area are also taken into account. The median population per census tract is just 1200 people, this small size means that the households within each tract tend to be socio-economically similar. This index was constructed based on employment-related indicators (rates of unemployment, and of manual and casual work) and education (rates of low educational attainment overall and among young people) [18]. For this study, the deprivation index was categorised into quintiles, the first indicating areas with the least social deprivation and the fifth the most deprived areas.

For the analysis, two groups were compared: patients with T2DM and those without T2DM but with at least one other chronic condition. A descriptive analysis was performed of the distribution of the two subgroups by sex, age range and deprivation index. The number of chronic conditions per patient was ascertained. An ordinary least square (OLS) was carried out to measure the variability explained by sociodemographic factors in the number of chronic diseases. Further, logistic regressions were performed to study the effect of having T2DM on the probability of presenting each one of chronic conditions used in this study adjusting by age bands, sex and deprivation index.

Finally, cluster analysis was run, obtaining dendrograms for patients with T2DM. For this analysis, we considered only the chronic conditions with a prevalence of above 2% (28 out of a total of 51). To identify clinically relevant subgroups with the same concurrent conditions, we opted for agglomerative hierarchical clustering. In this clustering method, each chronic condition starts with its own cluster. Then, the two most similar groups are merged, the new group replacing the previous groups. This process continues until one cluster contains all the others [19]. The main algorithm for this study was based on Ward's minimum variance method. This method is widely used as it minimises the variance within groups and produces similar-sized clusters [19]. Pearson's dissimilarity was used to measure distances between clusters. Once the graph had been plotted, we selected appropriate cut-off points for the number of groups based on clinical importance.

The statistical analysis was carried out using Stata Data Analysis and Statistical Software, Release 12 (StataCorp, LP, College Station, TX).

3. Results

3.1. Population and multimorbidity

Out of a population of 1,473,937 individuals aged 35 years old or above, 126,889 had a diagnosis of T2DM, that is, 8.6% of the study population. A total of 834,861 people had at least one chronic illness (53% of men and 60.7% of women), that is, 57%. A total of 15.2% of these chronic patients had T2DM. The distribution of the population, both chronic patients overall and those with T2DM, by sex, age range and deprivation index is shown in Table 1.

Though, in general, there were more female chronic patients than male, more men than women had T2DM. Further, among chronic patients with T2DM, we observed a rising gradient with deprivation index, that is, the number of patients with T2DM increases as we move down to the lower socio-economic ladder.

We found that 87.6% of men and 92% of women with T2DM had at least one other chronic condition. Among T2DM-free patients with at least one chronic condition, 54.2% of men and 57% of women had at least two chronic conditions. On the other hand, it should be highlighted that 1.7% of men and 1.9% of women with T2DM had 10 or more chronic conditions (including T2DM) (See Table 2).

Taking into account the differences observed between both populations, an OLS was performed to adjust the number of chronic conditions by sociodemographics' factors (Table 3). The observed average of chronic diseases was high among T2DM patients. However, when the number of chronic conditions was adjusted by socioeconomic factors, this difference decreased. Moreover, all factors utilised in the model were statistically significant. We observed, that the average of chronic