Economic impact of dry eye disease in Spain: A multicentre retrospective insurance claims database analysis

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Abstract

Purpose: To analyse the occurrence and cost of dry eye disease in Spain in the recent years.
Methods: A cross-sectional analysis based on anonymised data from an insurance claims database that includes data from 1997 to 2015 from public and private hospitals and healthcare centres; 36,081 patients were eligible for the study after duplicate elimination. Five ICD9 codes associated with dry eye were used for patient selection, including vitamin A deficiency with xerophthalmic scars of cornea, xerophthalmia due to vitamin A deficiency, keratoconjunctivitis sicca not specified as Sjögren’s, dry eye syndrome and keratoconjunctivitis sicca Sjögren’s disease.
Results: Over 88% of the patients were female, and the mean age was 66 years. Patients with keratoconjunctivitis sicca Sjögren’s disease represented more than 89% of all patients and had the highest percentage of women. Both the annual number of patients and the number of admissions have increased exponentially since 1997 raising from 1079 to 3097 and from 1344 to 5938, respectively. The in-hospital length of stay was 9.6 (standard deviation = 11.6) days where more than 65% of the admissions were due to emergencies. Total costs were found to increase from €4.9 to €30.3 million during the study period; in parallel, there was an increase in the mean annual cost per patient, which was on average €7379.
Conclusion: Disease incidence is likely to increase due to the influence of modern-day workplace, and it is important to take into account the high economic burden and the large decrease in quality of life in regards to Spanish society and health policies.

Keywords
Dry eye disease, economic impact study, claims database analysis, Spain

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Introduction

The currently established definition of dry eye disease (DED) describes it as a chronic and progressive multifactorial disorder characterised by a tear film and ocular surface alteration.1-3 The cause of this phenomenon may be either tear deficiency or excessive evaporation of the lacrimal fluid, which may cause ocular discomfort, irritation, ocular fatigue, visual disturbance and tear film instability, ultimately leading to potential damage to the ocular surface. An increased osmolarity of the tear film and inflammation of the ocular surface can also be observed. All these factors contribute to a noticeable decrease in quality of life (QoL).4

Risk factors associated to DED include adverse environmental conditions such as lack of humidity, chemicals and atmospheric dust, prolonged computer and electronic device usage, contact lenses and ionising radiation. It is therefore very closely associated to modern-day offices and will only lead to an incidence increase throughout the years.2-5

According to the cause of tear film defect, DED can be subcategorized into Sjögren’s syndrome (SS) DED and non-SS DED in the case of tear deficiency.6 In regards to excess evaporation, the most common cause is meibomian gland dysfunction (MGD).7

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The importance of knowing the number of cases, cost and epidemiology of the disease lies in the fact that DED is among the most frequently diagnosed ophthalmologic diseases and leads to a large economic and social burden by means of a decrease in patient QoL. The impact is associated to both the patients and the healthcare system due to direct and indirect costs concerning medical visits, therapies, surgeries, the frequent use of eye drops and a decrease in professional productivity caused by a reduced QoL.

Many studies indicate that the occurrence of the disease increases with age and is more commonly diagnosed in women. However, reports disagree when it comes to the prevalence range. While some imply that DED affects 5%-33% of the worldwide population, others argue that it can reach as much as 50% or as little as 0.02%. A second fact that most publications acknowledge is that DED has a higher prevalence in Asiatic or Far Eastern countries relative to Europe or the United States. The most common hypothesis is the existence of a genomic factor associated to the disease.

Because of its close association to the work environment, disease occurrence is expected to increase during the following years generating more costs for both health service and patients.

There is a clear lack of research regarding the number of cases and the cost of DED; however, it is apparent that the economic burden of the disease is not negligible.

The most recent and seemingly the only publication regarding DED occurrence in Spain is that of Viso et al. The article discusses the epidemiology of DED in over 40-year-old patients in the northwestern region of the country exclusively. A second publication by the same authors evaluates the occurrence of MGD, a subcategory of DED, in the same region.

A comparative study discusses the occurrence and annual costs of DED in France, Germany, Italy, Spain, Sweden and the United Kingdom among patients managed by ophthalmologists. However, there are no other references available regarding DED-related costs. Consequently, there is an obvious need to update the available information regarding DED.

Herein we study the number of cases and the cost of DED in Spain throughout recent years by means of the analysis of data obtained from an insurance claims database containing private and public hospital and healthcare centre records concerning the whole territory.

**Methods**

A total of 62,156 records of patients with DED were obtained from a national hospitalisation database codified by means of the International Statistical Classification of Diseases and Related Health Problems – Ninth Revision (ICD9) codes. In order to obtain patients’ records for DED, five ICD9 codes were used. The codes that were considered corresponded to vitamin A deficiency with xerophthalmic scars of cornea (ICD9 264.6), xerophthalmia due to vitamin A deficiency (ICD9 264.7), keratoconjunctivitis sicca not specified as Sjögren’s (ICD9 370.33), dry eye syndrome (ICD9 375.15) and keratoconjunctivitis sicca Sjögren’s disease (ICD9 710.2), all under the scope of DED.

The national hospitalisation database contains information regarding records generated from both private and public hospitals and health centres available since 1997 up to 2015, on account of recent reports not yet being published. Ophthalmological care generally takes place within these centres; on the contrary, specialised private ophthalmology clinics are likely to be excluded from the database. Parameters such as health centres and medical history identifiers have been re-coded in order to maintain records anonymised.

After discarding duplicate data, corresponding to patients that have been visited more than once, the final analysed data consisted of 36,081 records, which correspond to patients that have developed the pathology at some point in time. Ethics Committee ruled that approval was not required for this study.

**Data analysis**

Data presentation and analysis are generally descriptive, having not tested any specific hypothesis. Data are presented as mean values followed by standard deviation (SD) or as percentages.

The number of visits and number of patients per year have been calculated. Patient characteristics and most common comorbidities have also been studied individually for each pathologic condition.

The years 1997 and 1998 were excluded from the cost analysis to ensure data consistency after the detection of irregularities seemingly related to the introduction of the euro.

**Results**

Out of a total of 36,081 patients, 4310 (12.0%) were male and 31,767 (88.0%) were female (Table 1). Both sex groups had similar means in regards to age; the mean age of male patients was 65.2 (SD = 16.5) years, whereas that of female patients was 65.6 (SD = 15.1) years. The majority of the patients (89.2%) were diagnosed with keratoconjunctivitis sicca Sjögren’s disease, while patients diagnosed with xerophthalmia due to vitamin A deficiency were the youngest and included a majority of males.

The number of patients with DED has steadily increased throughout the years; as a consequence, the number of healthcare visits also increased (Table 2). This is partially explained by the chronic nature of the disease. However, visits per year increase more abruptly as a result of an increment in the number of patients that have been
visited more than once or an increase in the number of visits per patient.

Hospitalisations had a mean length of stay of 9.6 days, and 8430 out of the recorded 62,050 visits (13.6%) were readmissions (Table 3). This length of stay was slightly lengthier in patients with keratoconjunctivitis sicca not specified as Sjögren’s, and patients with xerophthalmia due to vitamin A deficiency registered more readmissions, understood as subsequent admissions for the same motive registered within 30 days after discharge. Most hospital admissions, regarding both inpatient (day care) and outpatient (at least one night stay) hospitalisations, were due to emergencies (65.5%), whereas 34.2% were scheduled. Regarding the nature of hospital discharge, patients were most frequently sent home (92.4%), and a minimal portion of them were transferred to another hospital (1.9%) or were discharged voluntarily (0.2%).

The most common DED-associated comorbidities (Table 4) were hypertension (31.7%), rheumatoid arthritis (15.7%), unspecified lipidaemias and hyperlipidaemias (10.4%), diabetes mellitus (10.1%) and atrial fibrillation (9.8%).

Total annual costs and mean cost per patient were calculated using the information provided within the hospital and health care centre database (Table 5). The mean annual cost per patient increases from €4301 to €9801 during the study period. This general tendency is also observed in the analysis of costs in patients diagnosed with dry eye syndrome and keratoconjunctivitis sicca Sjögren’s disease but not equally obvious in conditions with a smaller number of patients.

Consequently, that total cost of DED grows annually, increasing more than six times over a period of 17 years. This escalates the total annual cost from €4.9 million in 1999 to €30.3 million in 2015. Keratoconjunctivitis sicca

| Year | Visits | No. of patients |
|------|--------|----------------|
| 1997 | 1344   | 0              |
| 1998 | 1367   | 0              |
| 1999 | 1724   | 0              |
| 2000 | 2006   | 0              |
| 2001 | 2142   | 0              |
| 2002 | 2266   | 0              |
| 2003 | 2646   | 0              |
| 2004 | 2632   | 0              |
| 2005 | 2802   | 1              |
| 2006 | 2885   | 0              |
| 2007 | 3117   | 0              |
| 2008 | 3378   | 0              |
| 2009 | 3976   | 0              |
| 2010 | 4133   | 2              |
| 2011 | 4399   | 0              |
| 2012 | 4617   | 0              |
| 2013 | 5198   | 1              |
| 2014 | 5616   | 0              |
| 2015 | 5938   | 1              |
| Total| 62,156 | 36,081         |

ICD9: International Statistical Classification of Diseases and Related Health Problems – Ninth Revision.

ICD9 codes are as follows: 264.6 – vitamin A deficiency with xerophthalmic scars of cornea; 264.7 – xerophthalmia due to vitamin A deficiency; 370.33 – keratoconjunctivitis sicca not specified as Sjögren’s; 375.15 – dry eye syndrome; 710.2 – keratoconjunctivitis sicca Sjögren’s disease.
Sjögren’s disease, the condition accounting for 89% of the patients, accounted for 91.6% of all costs.

Discussion

In general terms, to measure the number of cases of DED can be challenging due to a series of aspects as the multifactorial nature of the disease, the scarce research available and its differential definitions, which the 2007 Report of the International Dry Eye Workshop (DEWS) attempted to address. In addition, according to the severity of the disease, patients might opt to self-treat instead of visiting a health care centre and therefore are not accounted for in the databases.

The results described in this article are within the scope of most past publications in regards to DED occurrence. The number of cases of DED in Spain between 2006 and 2015 is contained within the normal range and is in line with previous measurements in the northwestern region of the country. Results also confirm the disease’s direct association with age and sex, affecting a majority of women.

The literature regarding the cost of DED in France, Germany, Italy, Spain, Sweden and the United Kingdom suggest an occurrence of DED of 0.03% in Spain. Nevertheless, the value was calculated by means of the information provided by a survey addressed at consultant ophthalmologists who might have only treated the most severe cases of the disease. This particular study therefore excludes self-treated patients and patients treated by general practitioners and generalist ophthalmologists, which may explain the inconsistent results.

In particular, the Salnes Eye Study examined a total of 654 subjects from the northwestern region of Spain, 37.2% of them being male, with a mean age of 63.6 (SD = 14.4) years, ranging from 40 to 96. In comparison, our study includes 36,081 patients from across the country, 12.0% of which were male, with a similar mean age of 65.6 (SD = 15.2), ranging from 0 to 105 years.

While the 2009 Salnes Eye Study only found rosacea to be associated to DED, the 2012 publication concerning symptomatic and asymptomatic MGD prevalence also describes diabetes and cardiovascular disease as the most common comorbidities for asymptomatic MGD and rosacea and rheumatoid arthritis in regards to symptomatic MGD. These findings are consistent with our research, considering diabetes mellitus and rheumatoid arthritis as
the two most frequent comorbidities, and adding hypertension, hyperlipidaemias and atrial fibrillation to the list.11 The small number of patients registered with some of the conditions analysed impeded the extraction of any conclusions on comorbidities individually, although similar tendencies can be observed in most cases.

Previously published data regarding DED-related annual costs are based on the information obtained from surveying ophthalmologists between the years 2003 and 2004. The 2009 report estimated the annual burden per patient in six European countries: United Kingdom (approximately US$1100), Spain (approximately US$800), Italy (approximately US$600), Germany (approximately US$500), Sweden (approximately US$400) and France (approximately US$300).9

A direct comparison is not feasible; however, considering the herein calculated mean costs per patient and per visit during the years 2003 and 2004, when data were collected for the Clegg et al. study, large discrepancies are observed. The values of €6273 in 2003 and €6366 in 2004 per patient have been obtained, whereas a much lower cost was considered in the previous publication.

This could be a consequence of the use of very distinctive data acquisition methodologies: on one hand, data acquired from healthcare records from hospitals and healthcare centres and, on the other, based on ophthalmologist surveys.

Another limitation that influences the results of this study is the lack of more specific ICD9 codes that would allow a more profound analysis of the aetiopathogenesis of the disease in each case. Further research oriented to evaluate such factors will be required in Spain.

Conclusion

The analysis of total hospitalisation records of DED in Spain indicates that DED-related hospitalisations entailed a mean annual cost per patient of €7379.

Estimated DED incidence is likely to increase due to the influence of modern-day workplace and lifestyle. For that reason, it is important to take into account the high economic burden and the large decrease in QoL in regards to the Spanish society and health policies.

Author contributions

J.D. contributed to the investigation by interpreting the economic current situation of DED in Spain taking into account the introduction of the new treatment, contributed significantly to the intellectual content revision and gave final approval of the version to be published. M.A. analysed the current occurrence rate of DED in Spain, analysed and interpreted the statistical data and contributed significantly in writing the manuscript. Both authors read and approved the final manuscript.
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