

# Trends in psychiatric hospitalization for alcohol and drugs in Castilla y León between 2005 and 2015

## *Tendencias en la hospitalización psiquiátrica por alcohol y drogas en Castilla y León entre 2005 y 2015*

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### Abstract

It has been estimated that alcohol, tobacco, and illicit drugs were responsible for more than 10 million deaths worldwide in 2016, and there are many opportunities for improvement. Regarding innovative data analysis, advances have been made in the extraction of information from administrative databases for analytics purposes. We studied trends in hospitalization rates for alcohol and drug abuse over eleven years with Joinpoint Trend Analysis software. This is a descriptive study of cross-associations in 3,758 hospital admissions of patients admitted with a main diagnosis of alcohol and drug abuse or dependence in psychiatry units of public health centres of Castilla y León (Spain) between 2005 and 2015. Hospitalization trends for alcohol and drug related conditions declined over the eleven-year period. Separately, there was a statistically significant decrease in alcohol and cocaine related conditions, but a strong upward trend in cannabis related conditions between 2013 and 2015. Alcohol was the main cause of admission to psychiatric units with a diagnosis of addiction. In the 11 years researched, there was a progressive and constant reduction in admissions for substance use except for cannabis. The innovative statistical methodology has already proven to be useful for identifying trends and changes in different pathologies over time.

**Keywords:** Psychiatry; substance-related disorders; hospitalization; diagnosis-related groups; health information systems.

### Resumen

A nivel mundial, se ha estimado que el alcohol, el tabaco y las drogas han sido responsables de más de 10 millones de muertes en 2016, y que existe mucho margen para reducir la mortalidad. Se han realizado avances en la extracción de información de bases de datos administrativas con el fin de analizar grandes volúmenes de datos sanitarios. Hemos estudiado las tendencias en las tasas de hospitalización con diagnóstico de adicción a alcohol y drogas durante once años con el software Joinpoint Trend Analysis. Se trata de un estudio descriptivo de asociación cruzada de 3.758 ingresos hospitalarios de pacientes con diagnóstico principal de abuso o dependencia de alcohol y drogas en unidades de Psiquiatría de centros públicos de Castilla y León entre 2005 y 2015. Las tendencias en la hospitalización por adicción al alcohol y/o drogas disminuyeron a lo largo de los once años. Además de una reducción estadísticamente significativa de los ingresos por alcohol y cocaína, se apreció una fuerte tendencia al alza en los ingresos por cannabis entre 2013 y 2015. El alcohol fue durante todo el periodo de estudio la principal causa de ingreso y el que más días de hospitalización ha generado. No obstante, en los 11 años se observó una reducción progresiva y constante en los ingresos por todas las sustancias a excepción del cannabis. La metodología utilizada ya ha demostrado ser muy útil para identificar cambios de tendencias en diferentes patologías.

**Palabras clave:** Psiquiatría; trastorno por uso de sustancias; hospitalización; grupos relacionados por el diagnóstico; sistemas de información médicas.

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The period 1990 to 2016 saw a considerable worldwide increase in the number of people with disorders caused by alcohol and drug use, driven by population growth and aging (GBD 2016 Alcohol and Drug Use Collaborators, 2018). There is evolutionary and biological evidence that humans are predisposed to consume alcohol, illicit drugs, and nicotine (Anderson, Gual & Rehm, 2018). The use of tobacco, alcohol, and drugs are among the top 20 risk factors for mortality, years of life lost, and disability. Most of the morbidity and mortality burden is attributable to tobacco, followed by alcohol, and drugs in third place (GBD 2013 Risk Factors Collaborators, 2015). All of these substances, especially alcohol, have a significant impact on the health of the European population. The burden of disease derived from alcohol and drugs use is substantial; together, they represent 11% of the disability-adjusted life years (DALYs) lost in the European Union (EU) (GBD 2016 Alcohol and Drug Use Collaborators, 2018). Drug use is a complex behaviour, sometimes hidden, stigmatized and difficult to quantify (Hammarlund, Crapanzano, Luce, Mulligan & Ward, 2018). Almost all information in this respect comes from population surveys or more original strategies, such as the analysis of wastewater to identify products of human metabolic excretion. In both cases, the aim is to obtain real-time information on geographic and temporal patterns of substance abuse. The limitations of both methods have led to their combination and integration into a common strategy to obtain a clearer picture of this problem (Castiglioni, Borsotti, Senta & Zuccato, 2015). EU countries together reported more than 161,000 hospital discharges for mental and behavioural disorders arising from the use of illicit drugs and a further 707,000 for alcohol use in 2010 (Lievens, Vander Laenen & Christiaens, 2014). In Europe, most drug addiction treatments are provided on an outpatient basis. Approximately 1.1 million EU citizens with an alcohol use disorder were estimated to have received treatment in 2015 (Rehm et al., 2015) while in the same year approximately 1.4 million people were treated for use of illicit drugs in the EU, according to the European Report on Drugs (EMCDDA, 2017). In Spain, about 192,000 drug users and 27,500 alcohol users received treatment in 2015, the majority in outpatient settings, and in the last decade, the number of patients admitted to treatment each year has been between 47,000 and 53,000 (European Monitoring Centre for Drugs and Drug Addiction, Spain Country Drug Report 2018). The basic minimum data set, hereafter referred to as BMDS, is the widest-ranging clinical administrative database in Spain. It is mandatory to complete corresponding questionnaires in all public hospitals belonging to the Spanish national health system, and it is the largest database of those officially registered. The main advantage is that its large sample size provides significant statistical power

(Meléndez Frigola, Arroyo Borrell & Saez, 2016). In this study, we carried out a statistical analysis of the BMDS of the autonomous province Castilla y León to provide epidemiological and clinical information (mean age, sex, rural or urban origin) and reference parameters regarding the case records and operation of hospitals (diagnosis, average stay, as well as type of admission and discharge) and to highlight trends regarding addictions.

Covering 94,223 km<sup>2</sup> (18.6% of the total area of Spain), Castilla y León is one of the largest regions in Europe. It has a population of approximately 2.5 million, 5.16% of the total Spanish population (Population Census, National Statistics Institute, Castilla y León, 2017), distributed in a balanced way across rural and urban areas, and within the latter, in large, medium and small cities. It also has a productive structure, as well as regionally uneven economic development. Such diversity means Castilla y León offers a unique context in Spain and Europe in which to carry out epidemiological studies.

The study of trends in the prevalence of addictions and other pathologies plays a central role in epidemiology and public health (Miquel et al., 2018a; Ruch et al., 2019). The analysis of hospitalization rates linked to these diseases is useful for determining their real impact, and the results of the study could help, for example, in the interpretation of the effectiveness of drug prevention campaigns, or provide a model of health policy assessment. Further, administrative databases, which allow the analysis of large volumes of health data (Russ et al., 2019), in this case relating to hospital admissions, have been useful in obtaining epidemiological information on different processes in the absence of specific records (Gfroerer, Adams & Moien, 1988).

The aim of this study was to determine changes in trends regarding hospitalization rates for alcohol and drug addiction in psychiatric units over 11 years. The results of this study can provide the basis for a method to assess the effectiveness of future health interventions in the field of addiction.

## Method

A cross-association study of the basic minimum data set (BMDS) of hospital discharges from hospital centres in Castilla y León was carried out between 2005 and 2015. Patients were selected according to the International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM).

For the purposes of this study, we considered the main diagnoses according to ICD-9-CM (ICD-9-CM, Coding manual) at discharge, using the following codes: alcohol (303, 305.0), opioids (304.0, 304.7, 305.5), cocaine (304.2, 305.6), cannabis (304.3, 305.2), sedatives (304.1, 305.4), amphetamines (304.4, 305.7), hallucinogens (304.5, 305.3)

and other/unspecified drugs (304.6, 304.8, 304.9, 305.8). This study analyses hospitalizations, and the same patient may have been hospitalized on several occasions.

Hospitalization rates per inhabitant were also calculated using population data from Castilla y León, 2005-2015. We applied a general descriptive statistical analysis (considering all addiction diagnoses) for each substance under study, covering hospitalization rates/100,000 inhabitants/year and trend throughout the 11 years studied, overall and by sex. Hospital mortality rates/1000 hospitalizations and trends were also obtained for the 11 years studied, overall and by sex.

The trend analysis to determine if there were changes with statistically significant differences over time in the rates was performed using joinpoint linear regression (Joinpoint Trend Analysis Software provided by US National Cancer Institute, Surveillance Research Program). This test assesses the trend over time (years) for selected hospital discharges. In this analysis, the points of change (joinpoints) show statistically significant changes in the trend (ascending or descending). Graphically, joinpoint models applied to the logarithm of the rate describe a sequence of connected segments. The point at which these segments come together is a joinpoint, and represents a statistically significant change in trend. For each segment, the annual percentage change for each trend was also calculated using generalized linear models, assuming a Poisson distribution and showing the associated level of statistical significance with 95% confidence intervals (95% CI) in each case, as well as hospitalization and mortality rates stratified by sex with their respective 95% CI and statistical significance. Open access software from the Research and Surveillance Program of the United States National Cancer Institute was used. Values of  $p < 0.05$  were considered statistically significant differences. Statistical analysis was performed with the SPSS v21.0 program.

The data supporting the findings of this study are available from the Dirección General de Sistemas de Información, Calidad y Prestación Farmacéutica, Valladolid (Spain), subject to legal restrictions (Law 16/2003, May 28, on the cohesion and quality of the Spanish National

Health System). Appropriate authorization was obtained to use these data in our study; access conditions can be found here <https://www.boe.es/eli/es/1/2003/05/28/16>.

## Results

The hospital network in Castilla y León comprises 14 centres, of which three are regional, six provincial and five reference centres, structured according to health area and the availability of different medical specializations.

The BMDS of hospital discharges in Castilla y León between 2005 and 2015 consisted of 3,359,572 records, of which 52,692 corresponded to discharges from psychiatric units. From these, the diseases under consideration were selected using the codes shown above, with 3,758 hospitalizations registered (7.1%) for these diseases between 2005 and 2015. The most frequently found diagnosis was alcohol-related disorders, making up 3,044 of the 3,758 (81%). The total number of 52,692 hospitalizations for psychiatric diagnoses was used to calculate the ratio (Table 1).

Of the discharges analyzed, 74.9% were men compared to 25.1% women. This ratio is quite stable for cases related to alcohol, opiates, cocaine, cannabis, amphetamines and other drugs. However, in the case of sedatives, the percentage of women rose to 40.4%, with a correspondingly smaller difference to men (59.6%).

The sample had a mean age of 43.3 years, with a range from 31.4 years in the cannabis group to 45.11 years in the alcohol group. Alcohol was the substance involved in most cases (81%), followed by opiates (5.3%), cocaine (4%), cannabis (4%) and sedatives. (2.4%). A total of 3.4% of cases were classified as abuse or dependence on other substances, or not specified.

Regarding the origin of subjects, there was a clear predominance of urban over rural origin (7:3), both in the sample as a whole and for the different drugs.

Regarding the type of hospitalization, subjects were much more frequently admitted for emergencies than for scheduled visits (9:1), except in the case of opiates, where the difference between both types of hospitalization was smaller (56.8% and 43.2%), respectively.

Table 1. Sociodemographic and clinical characteristics for the sample as a whole and by diagnostic groups.

	Global	Alcohol	Cannabis	Amphetamines	Cocaine	Opioids	Sedatives
Cases	3758	3044	148	52	148	199	89
Age	43.4 (10.7)	45.11 (10.1)	31.47(9.9)	34.06 (10.6)	35.27 (8.5)	37.95 (7.8)	42.4 (11.9)
Average stay (days)	10.7 (11.3)	10.5 (11.3)	9.6 (12.2)	9.2 (7.3)	8.8 (8.4)	12.9 (12.1)	12.8 (13.1)
Sex (%)							
Men	74.9	74.7	77.7	73.1	79.7	81.9	60
Women	25.1	25.3	22.3	26.9	20.3	18.1	40

Note. Number of cases, mean age (with standard deviation), and percentages by sex. Mean hospital stay (with standard deviation) for each group of drugs analysed (alcohol, cannabis, amphetamines, cocaine, opioids, and sedatives) during the eleven years studied.

Medical discharges made up 93% of all hospitalizations (discharged on doctor's advice), compared to 6.9% of hospitalizations ending with voluntary discharge (against medical advice), although in hospitalizations where the main diagnosis was opioid abuse/dependence, the percentage of voluntary discharges was 15.1%. The average stay for the entire group was 10.7 days. Five patients died (0.13% of the total), all of whom had a primary diagnosis of alcohol abuse/dependence.

#### Analysis of trends in hospitalization rates

From 2005 to 2015, there was a downward trend in the hospitalization rate involving alcohol or other drug abuse or dependence as the main diagnosis (Figure 1), except for cannabis, which saw a rising trend between 2013 and 2015 (Figure 2; B).

- 1) In the case of alcohol abuse/dependence as the main diagnosis, the same downward trend was maintained as for the entire sample in the number of admissions between 2005 and 2015, taking into account that alcohol abuse/dependence represented the majority of the sample analysed (Figure 2; A).
- 2) For opioid abuse/dependence, the downward trend in the number of admissions was less noticeable than for other substances (Figure 2; E).
- 3) For sedative abuse/dependence, there was a downward trend in the number of admissions (Figure 2; F).
- 4) For cocaine abuse/dependence, there was a very significant downward trend in the number of admissions (Figure 2; D).
- 5) For cannabis abuse/dependence, the number of admissions remained stable between 2005 and 2013, but between 2013 and 2015 there was a very significant annual increase of 29.3% (Figure 2; B).

- 6) The number of admissions for abuse/dependence on amphetamines and other drugs also decreased (Figure 2; C).
- 7) The number of admissions for other drugs fell annually and continuously by 4.4% (not statistically significant) (Figure 2; G).
- 8) The number of admissions for polydrug use remained stable, at around 0.25% of hospitalizations, without significant changes (Figure 2; H).

## Discussion

This study offers three innovative aspects in the field of addictions in our context. Firstly, the use of a database such as the BMDS of hospital discharges, the analysis of which converts data into useful information for health-related decision-making, not only in the context of the years analyzed but also currently, given that no similar information has been published recently. Secondly, the application of a cross-association study, common in epidemiological research, and more than a mere description given its coverage of the clinical reality of discharges across a wide network of hospitals (Meléndez Frigola et al., 2016). Finally, the statistical methodology used, joinpoint regression models, which have already proven very effective in identifying trend changes in different pathologies over time (Kim, Fay, Feuer & Midthune, 2000).

The results of the study showed a general tendency for hospitalization rates to decrease for alcohol and drug-related conditions during the 11 years analyzed; this could be linked to prevention and outpatient treatments, strategies of the successive Regional Plans on Drugs of Castilla y León (Junta de Castilla y León, 2010, Plan Regional sobre Drogas de Castilla y León). This decrease is similar to that of hospitalizations related to the abuse or dependence

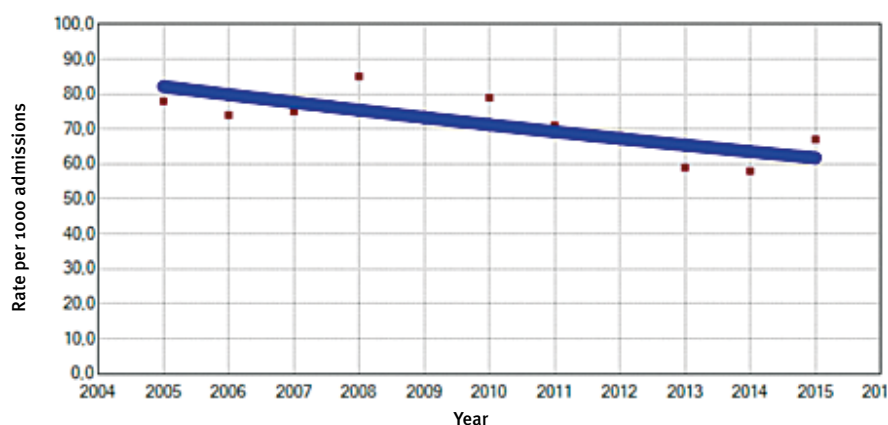


Figure 1. Admission rates for addictions (all codes: 303; 304; 304.0; 304.1; 304.2; 304.3; 304.4; 304.5; 304.6; 304.7; 304.8; 304.9; 305; 305.2; 305.3; 305.4; 305.5; 305.6; 305.7; 305.8; 305.9) per 1,000 admissions.

Note. From 2005 to 2015, there were 0 joinpoints; the APC de 2005–2015 was  $-2.81$  (CI 95%,  $-4.6$  a  $-1$  p  $< 0.05$ ). APC: annual percentage change; CI 95%: confidence interval of 95%. [\*]: statistically significant APC. Red points: exact annual value. Lines represent trends, the blue line represents only a monotonic trend. X axis: years (from 2004 to 2016). Y axis: discharge rate for addictions (alcohol and all drugs studied); medication discharge rates/1,000 hospital discharges.

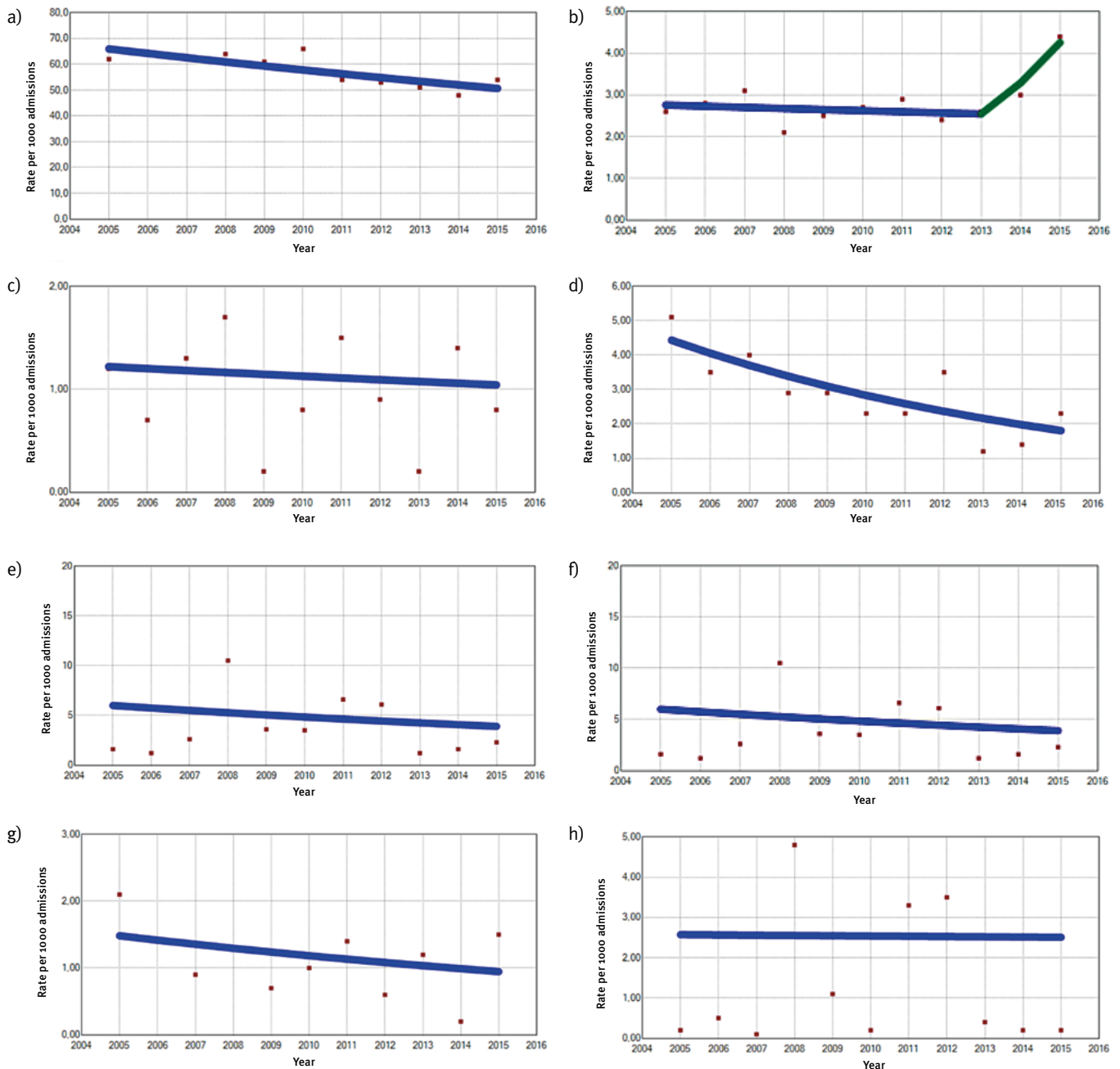


Figure 2. Admission rate per 1,000 admissions. Group analysis of the diseases studied. The points of change represent the joinpoints and the APC (Annual Percentage Change).

Note. [A] alcohol, 0 joinpoints, APC 2005–2015  $-2.60$  [CI 95%,  $-4.0$ – $-1.2$ ]  $p < 0.05$  \*; [B] cannabis, 1 joinpoint (2013), APC 2005–2013  $-1.00$  [CI 95%,  $-5.6$  to  $3.8$ ,  $p < 0.6$ ], APC 2013–2015  $29.3$  [CI 95%,  $11.5$ – $88.8$ ,  $p < 0.1$ ]; [C] amphetamines, 0 joinpoints, APC 2005–2015  $-1.56$  [CI 95%,  $-11.2$  to  $9.2$ ,  $p < 0.7$ ]; [D] cocaine, APC 2005–2015  $-8.6$  [CI 95%,  $-13.6$  to  $-3.2$ ],  $p < 0.05$  \*; [E] opioids, 0 joinpoints, APC 2005–2015  $-4.21$  [CI 95%,  $-21.8$  to  $-17.4$ ,  $p < 0.6$ ]; [F] sedatives, 0 joinpoints, APC 2005–2015  $-5.53$  [CI 95%,  $-12.7$  to  $-2.3$ ,  $p < 0.1$ ]; [G] other specified pharmaceuticals, 0 joinpoints, APC 2005–2015  $-4.39$  [CI 95%,  $-12.6$  to  $4.6$ ,  $p = 0.3$ ]; [H] pharmaceutical combinations, 0 joinpoints, APC 2005–2015  $0.25$  [CI 95%,  $-28.9$  to  $39.9$ ,  $p < 1.0$ ]. APC: annual percentage change; CI 95%: confidence interval of 95%. (\*): statistically significant APC. Red points: exact annual value. Lines represent trends, with colours changing where joinpoints were identified. A blue line represents only a monotonic trend. X axis: years (from 2004 to 2016). Y axis: discharge rate for each drug studied; medication discharge rates/1,000 hospital discharges.

of psychoactive substances reported in the Community of Madrid between 2003–2015 (Comunidad de Madrid, 2017, Informe sobre evolución por abuso o dependencia de sustancias psicoactivas CMBD 2003–2015). Among the findings, we can highlight that alcohol is the substance with the greatest impact on hospitalization, causing the highest number of hospitalizations (3,044) and a mean stay of  $10.5 \pm 11.3$  days, similar to the overall mean stay ( $10.7 \pm$

$11.3$  days). In this regard, the findings seem to be consistent with those observed in previous studies (Miquel et al., 2018a; Miquel et al., 2018b).

Our attention, however, is drawn to the change in trend that occurred between 2013 and 2015 for cannabis, with an annual increase of 29.3% in hospitalizations linked to the use of this substance during the two-year period. The Eurobarometer survey shows a slight increase in cannabis

use between 2011 and 2014 among young people in the European Union (Flash Eurobarometer 330, 2011) (Flash Eurobarometer 401, 2014). In its 2015 World Report on Drugs, the United Nations Office on Drugs and Crime showed data from 2013 indicating that cannabis use is increasing and remains high in western and central Europe. Furthermore, the last decade has seen a growth in the potency of cannabis, usually measured by the degree of concentration of THC ( $\Delta^9$ -tetrahydrocannabinol, the main psychoactive ingredient in cannabis), in many markets, giving rise to increasing concern regarding the potential of cannabis to cause serious health problems. In addition, synthetic cannabinoids have entered the market (López Corbalán, Seguí Ripoll, Romero Escobar, Luna Ruiz-Cabello & Luna Maldonado, 2014), and their use has also been linked to serious adverse health events such as hospitalization (United Nations Office on Drugs and Crime, 2017, World Report on Drugs). Regarding Spain, the 2017 Report of the European Monitoring Centre for Drugs and Drug Addiction indicates that the prevalence of cannabis use in the population aged 15 to 64 who use cannabis daily increased between 2013 and 2015, although the total number of admissions to outpatient treatment for cannabis use in 2015 was slightly lower than that registered in 2013 and 2014. Among users presenting problems related to the use of cannabis as the main drug, it is estimated that one in five receive hospital treatment. Perhaps the results of the study regarding increased cannabis-related hospitalizations are due to changes in the composition of the drug, with an increase in the 'psychotizing' effects leading to an increase in morbidity, or simply a consequence of increased use. We have failed to find comparable scientific evidence with which to assess these results against others in Spain, but due to the magnitude of the increase and the large sample, it cannot be an incidental finding (Leos-Toro, Rynard, Murnaghan, MacDonald & Hammond, 2019; Nosyk, Wood & Kerr, 2015).

Another group that also deserves special attention is opioid hospitalizations, which have seen a downward trend (PAC: -4.21%). Opioid substitution therapy reduces use and injection risk, improves physical and mental well-being, and reduces mortality (Mattick, Breen, Kimber, & Davoli, 2009). Our data do not support the hypothesis of a new opioid-use epidemic, such as that endured in Spain in the 1980s and 1990s (Mur Sierra & Ortigosa Gómez, 2014) or currently afflicting the USA (Smith, 2017). However, this study has the limitation that it considered exclusively admissions with the main diagnosis of drug use, while this population is frequently hospitalized for other reasons. It must be taken into account that diagnoses of addiction are not the only pathologies contributing to the global burden of disease attributed to the use of alcohol and drugs. A high proportion of the disease burden linked to them would be due to an increased risk of accidents, unintentional

injuries, suicide, cancer and the consequences of chronic HIV and/or hepatitis C infection, etc. It is clinically relevant that the five patients who died during period studied were alcohol users, although hospital mortality is very low in any case (Schoepf & Heun, 2015).

Regarding the analysis by sex, hospitalization for alcohol and drugs is much more frequent in men (74.9% vs. 25.1%). The smallest difference between both sexes was for sedatives (50.9% vs. 49.1%, respectively). These data are interesting since the social stigma for women caused by requesting health care for an addictive pathology can mask the real data, which is not the case with hospital records such as the BMDS, thus highlighting the need to include the gender perspective at all levels of the health process and promote treatments aimed at women.

The limitations of the study are that the data were obtained retrospectively from a nonspecific clinical administrative database; although coding has not changed over the years and in different hospitals, individual coding practices may differ slightly between clinicians and encoders. Nevertheless, the study of large homogeneous and consolidated databases such as the BMDS is recognized as a reliable and trustworthy approach when seeking to investigate the reality of a pathology. A further limitation of this study is that it considers exclusively hospitalizations where drug use is the main diagnosis, and this population is frequently hospitalized for other pathologies that could also contribute to the global burden of disease attributed to the use of alcohol and drugs.

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## Conflict of interests

The authors declare no conflicts of interest.

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