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Geographical Variation in Mental Hospital Discharges in Greece: A Nationwide Study (1999–2012)

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Abstract: Background: The primary goal of this study is to estimate the pattern of hospital discharges throughout Greece due to mental disorders between 1999 and 2012. Methods: Data for discharges were obtained from the Hellenic Statistical Authority. A sex- and age-adjusted proportional hospitalization ratio (PHR) was used to estimate the ratio between the hospitalizations in each prefecture and the overall hospitalizations. Additionally, age-adjusted admission rates and hospitalization days were calculated for each sex. Descriptive and time series analysis were conducted to understand the epidemiological characteristics and to investigate the trend of annual PHR, respectively. Correlation between disorders and sociodemographic characteristics was also tested. Global and local spatial analysis was conducted to assess the spatial homogeneity of disorders and to detect any clusters of similar values. Results: More males (55%) were hospitalized. Schizophrenic and other psychoses were stated as the primary diagnosis of discharges (54.3%) for mental disorders, contributing to the highest annual mean number of hospitalization-days for male (296.9) and female patients (341.0). Most patients were out of the workforce, and most patients with drug dependence (74.5%) and schizophrenia and other psychoses (55.9%) remained unmarried. Higher PHRs were discovered in the north, while schizophrenic and other psychoses (R = 0.492), affective psychoses (R = 0.534), senile and presenile organic psychotic conditions (R = 0.543) were correlated with alcohol consumption ($p < 0.001$). Conclusions: The study provides evidence of geographical variation of discharges due to mental disorders and a significant association between disorders and alcohol consumption, marriage status and absence of the workforce.

Keywords: mental disorders; hospital discharges; hospitalization; Greece; epidemiology; spatial analysis; discharge notes

1. Introduction

Mental disorders are generally characterized by cognitive, emotional and behavioral disturbances which could culminate in impaired mental functioning. These disorders include depression, bipolar disorder, schizophrenia and other psychoses, dementia, and developmental disorders, including autism [1]; individuals of any age may be affected by these disorders, from childhood and adolescence through to adulthood [2]. In the European Union, it is estimated that each year, 38.2% of the population—or approximately 164.8 million individuals—suffer from a mental disorder [3]. In Greece specifically, the most common mental disorder is generalized anxiety disorder, with an estimated prevalence of

4.1%, followed by depression (2.9%), phobias (2.79%), mixed anxiety–depression (2.67%), panic disorder (1.88%) and obsessive-compulsive disorder (1.69%) [4]. The prevalence of dementia has been estimated at 5% for the population aged 65 years and over [5].

Several socioeconomic (income, employment), demographic (age, gender, marital status, education) and environmental factors have been found to affect psychiatric morbidity [4]. For example, females are twice as likely to suffer 12-month mood and anxiety disorders compared to males, while males are more likely to experience alcohol abuse disorders [6]. Likewise, residence may play a role in the development of specific mental disorders; inhabitants of rural areas have a lower prevalence of major depressive episode(s) than those in urban areas [7]. Environmental factors that are considered to be involved in the development of mental diseases, in particular affective and schizophrenia psychoses, include infection during pregnancy (e.g., from influenza or *T. gondii*), drug abuse, and physical/psychological stress such as parental loss, adversities, abuses, brain injury or migration [8,9].

Mental disorders are an emotional, financial and social burden to patients, their families and their social network. Indicatively, in Europe (2010), the four most disabling single conditions were depression, dementia, alcohol use and stroke [3]. The primary reasons for admissions to hospital are the presence of acute mental illness, confusion, disorientation, risk of violence to others, risk of self-harm and non-compliance with prescribed medication [10]. Moreover, admissions attributed to mood disorders and schizophrenia have the highest number of all-cause 30-day hospital readmissions among adult Medicaid patients, reflecting the chronic, relapsing course of these conditions [11]. Hospital admission of patients suffering from mental disorders indicates both patients' outcome and the fact that symptoms cannot be safely managed outside of an institutional setting [12]. Data about the number and length of hospital admissions provide the first step for further studies on other epidemiological characteristics of mental disorders, in order to determine associated factors, disease etiology and monitor or reveal spatial, temporal and demographic differences [13,14]. Furthermore, these data can be used to inform health policies for allocating resources, increasing medical coverage and possible prevention planning, as well as raising awareness and general understanding of mental disorders among the general public and health care professionals [15].

The first aim of the present study was to estimate the pattern of hospital admissions throughout Greece due to mental disorders between 1999 and 2012, and further, to analyze the spatial distribution of hospitalizations in Greece using a geoepidemiological cluster analysis. We analyzed hospital discharges and length of hospitalization as these are important surrogate measures for progressive disease and increased demand on healthcare resources. Moreover, the identification of spatial clusters could provide the basis for future analytical studies on the etiology of the disease. The results of many studies on this subject suggest that socioeconomic factors such as social disadvantage or deprivation, lack of infrastructure and support, emigration, social mobility, and population density may have an effect on the geographical variation of rates of treated psychiatric illness in different parts of the world [16].

2. Materials and Methods

The statistical analysis applied has previously been described in detail [17]. This ecological study was conducted in Greece, a country located in southeast Europe with an area of 132.049 km^2 and a population of 10,816,286 as of 2011 [18].

Statistical analysis was conducted using national data obtained from the Hellenic Statistical Authority (ELSTAT) database for mental disorders, according to hospitalization discharge notes. ELSTAT compiles data concerning the number of patients discharged, focusing mainly on their demographic characteristics including age, sex, prefecture (nomos) of residence, marital status, profession as well as; the disease for which they were hospitalized [19]. The classification of mental disorders and diseases of the nervous system was based on the International Classification of Diseases, Ninth Revision (ICD-9), codes

290–359 (Table 1). The patient's occupation is classified in accordance with the national classification STEP92 (similar classification with the classification of the International Labor Organization (ISCO-8)) [20].

Table 1. International Classification of Diseases, Ninth Revision (ICD-9), codes 290–359.

ICD-9 Codes	Diseases
320–359	Diseases of the nervous system Inflammatory diseases of the central nervous system (320–326) Hereditary and Degenerative diseases of the central nervous system (330–337) Other disorders of the central nervous system (340–349) Disorders of the peripheral nervous system (350–359)
290–319	Mental disorders
290	Senile and presenile organic psychotic conditions
291–295	Schizophrenic and other psychoses
296	Affective psychoses
303	Alcohol dependence syndrome
304	Drug dependence

The 51 Greek prefectures were the second-degree organization of local government. Age was categorized according to 4 almost timely and populationally equal age groups (0–24, 25–44, 45–64, 64+ years). Data were based on hospital discharges in which patients were hospitalized due to a mental disorder in either public hospitals, legal entities under private or public law, or private hospitals for at least 24 h [19].

Firstly, we used the proportional hospitalization ratio (PHR) which was sex- and age-adjusted according to total national hospitalizations in order to calculate the ratio between hospitalizations in each prefecture and hospitalizations of the Greek population [21–24]. An adjustment for sex was also conducted since the occurrence of mental disorders by sex is not the same. A PHR of 1 indicates that the observed number of hospitalizations was the same as the expected number of hospitalizations, according to overall hospitalizations due to mental disorders in Greece [24]. Secondly, we calculated age-adjusted discharge rates for each sex and prefecture using as a standard population the population of Greece. Finally, we calculated the hospitalization days using the number of discharges and the length of hospitalization.

To investigate the trend of PHR values and the length of hospitalizations during the study period, we conducted time series analysis on the annual values of age-adjusted PHR and annual average hospitalization-days of each sex, using the auto-regressive integrated moving-average model.

To visualize the sex- and age-adjusted PHR of prefectures throughout the study period, we used the overall sex-and age-adjusted PHR value from 1999 to 2012. Geospatial information was associated with the PHR, and each prefecture is depicted according to a graduated color palette. To visualize the trend of the age-adjusted PHR values, we use color-coded maps which represent the statistically significant increase (red) or decrease (green) of the age-adjusted PHR.

In this study, the purpose of the spatial autocorrelation analysis was to probe the correlation from the spatial domain and search for potential cluster regions, which primarily included global and local spatial autocorrelation analyses. The global spatial autocorrelation with the indicator of global Moran's I statistic reflects the spatial dependence of patients' hospitalizations due to a mental disorder. Specific cluster patterns and areas were detected by local spatial autocorrelation, which was expressed by local indicators of spatial autocorrelation (LISA) [25,26].

Based on maps of LISA, Local Moran's I indicator makes it possible to identify areas with statistically significant high and low spatial values, in addition to elements that are not statistically significant [26]. Four types of association could be seen on the maps [25,26]: high–high cluster (HH); high–low outlier (HL); low–low cluster (LL); and low–high outlier (LH).

Pearson's correlation coefficient was used to measure the strength of a linear association between sex- and age-adjusted PHR of mental disorders, diseases of the nervous system, and the number of psychiatrists per 10,000 inhabitants and sociodemographic characteristics. The analysis was conducted using sex- and age-adjusted PHR' values of each prefecture in addition to the number of psychiatrists per 10,000 inhabitants, education level and the gross domestic product (GDP) per capita gross. Data for each prefecture was obtained from ELSTAT [27].

The PHR, admission rates and hospitalization days calculations were conducted using Microsoft Excel. Geographical distribution and global and local autocorrelations of PHR were visualized using ArcGIS software version 10.1 (ESRI, Redlands, CA, USA). Time series analysis and Pearson's correlation coefficient were carried out using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). All results were considered statistically significant when the *p*-value < 0.05.

3. Results

3.1. Schizophrenic and Other Psychoses

Of all mental disorders, schizophrenia and other psychoses were responsible for the highest number of hospitalizations in Greece, from 1999 to 2012 with a total of 219,046 hospitalizations (annual average of 15,646). Of these hospitalizations, 106,978 (48.8%) occurred between 2006 and 2012. Males had higher hospital admissions compared to females, with male patients comprising 137,237 (62.7%) of hospitalizations and a male to female ratio of 1.7:1. However, the average number of treatment days per year was less for male patients compared to female patients, consisting of 296.9 and 341.0 days, respectively (Table 2). The 25–44-year age group accounted for approximately 47.3% of male hospitalizations and 34.6% of female hospitalizations. The 45–64 age group appears to be the second most vulnerable in both sexes, comprising 32.6% of male, and 31.7% of female hospital admissions. The average admission rate was 89.2/100,000 for males and 46.4/100,000 for females.

Table 2. Hospitalizations in Greece from 1999–2012.

Condition	Total Hospitalizations	Hospitalizations from 2006–2012	Annual Average Hospitalizations	Hospitalization Rate Male:Female	Average Number of Days of Treatment per Year	
					Male	Female
Schizophrenia and other psychoses	219,046	106,978	15,646	1.7:1	296.9	341.0
Affective psychoses	99,234	54,733	7088	1:1.4	45.1	41.0
Senile and presenile organic psychotic conditions	37,279	21,966	2663	1:1.7	64.8	82.5
Alcohol dependence syndrome	24,570	12,636	1755	7.5:1	28.7	25.1
Drug dependence syndrome	23,454	12,945	1675	6.2:1	36.3	19.2

The age-adjusted PHRs in both sexes showed similar patterns during the period from 1999 to 2012. In both sexes, the age-adjusted PHR represented higher values in central and northern Greece and lower age-adjusted PHR values in southern Greece (Figure 1a). Based on global autocorrelation analysis (Table 3) for the time period 1999–2012, a significant positive global correlation existed in age-adjusted PHR in males (I = 0.3309, *p* < 0.001) and females (I = 0.3057, *p* < 0.001). According to the LISA cluster maps (Figure 1b), the local spatial autocorrelation analysis detected HH clusters for both sexes in central and northern Greece. The HH clusters for male age-adjusted PHR were the prefectures of Arta, Larisa, Karditsa, Trikala, Grevena, Kozani, Kastoria and Florina, while the female HH clusters were the prefectures of Trikala, Grevena, Kozani and Larisa (Figure 1b). Among the HH cluster prefectures in males, Karditsa, Grevena and Florina were those with statistically significantly decreased age-adjusted PHR values from 1999 to 2012 (Figure 1c). In Grevena prefecture, a decrease in hospitalization days from 1999 to 2012 was also seen

(Figure 1d). Among the HH cluster prefectures in females, Grevena and Kozani were those with decreased statistically significantly age-adjusted PHR values (Figure 1c).
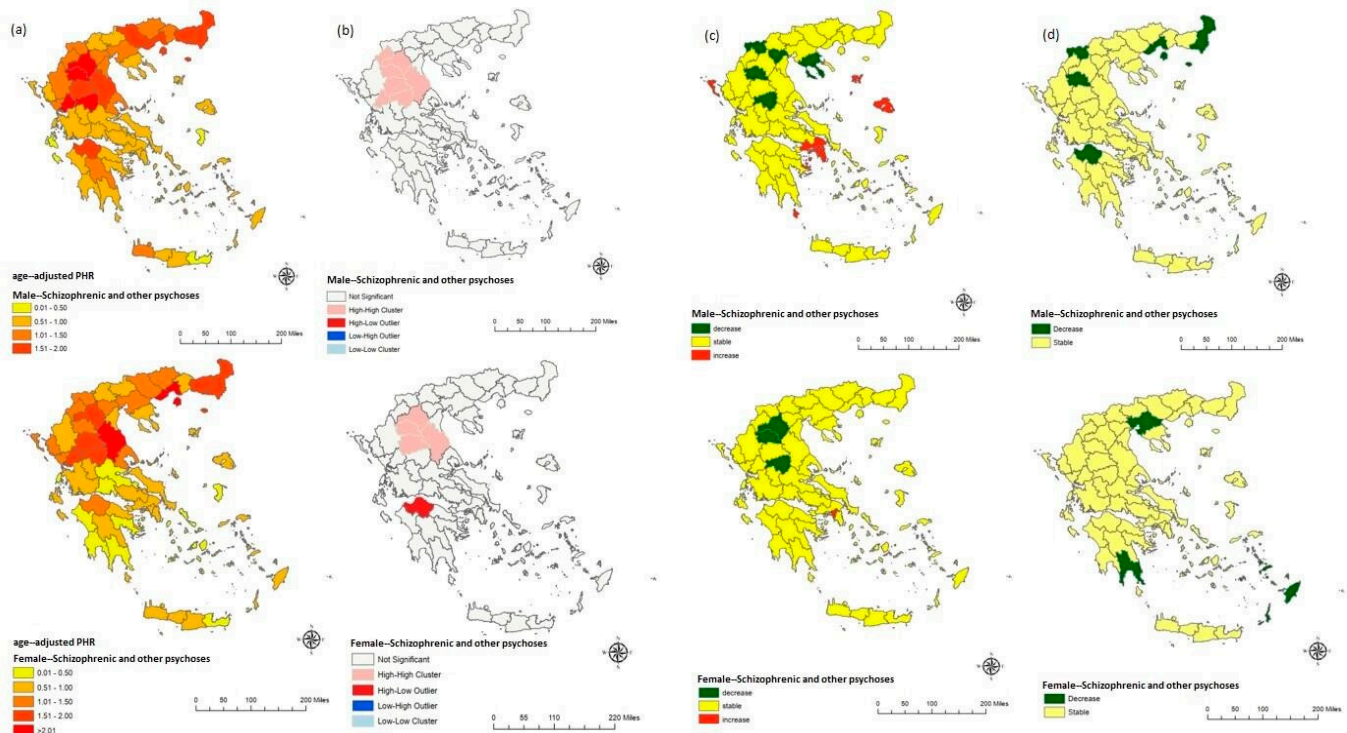

Figure 1. Descriptive (**a**), LISA (**b**) time series of annual PHR values (**c**) and average hospitalization-days (**d**) maps per sex for hospitalizations of patients with schizophrenia and other psychosis from 1999 to 2012 in Greece.

Table 3. Spatial Autocorrelation Analysis.

Sex	Disease	Moran's Index	z-Score	*p*-Value
Male	Mental disorders	0.1554	3.5630	<0.001
	Diseases of the nervous system	0.0571	1.5405	0.123
	Senile and presenile organic psychotic conditions	0.0763	2.0017	0.045
	Schizophrenic and other psychoses	0.2718	4.1254	<0.001
	Affective psychoses	0.1010	1.8694	0.062
	Alcohol dependence syndrome	0.1806	2.83499	0.005
	Drug dependence	0.1728	2.9360	0.003
Female	Mental disorders	0.0987	1.7667	0.077
	Diseases of the nervous system	0.0428	0.9782	0.328
	Senile and presenile organic psychotic conditions	0.0790	1.4651	0.143
	Schizophrenic and other psychoses	0.2294	3.5203	<0.001
	Affective psychoses	0.1532	2.5596	0.010
	Alcohol dependence syndrome	−0.0424	−0.3340	0.738
	Drug dependence	0.0403	0.8764	0.381

3.2. Affective Psychoses

From 1999 to 2012, affective psychoses were the second most common disorders responsible for hospital admissions due to mental disorders in Greece, contributing to a total of 99,234 hospitalizations (annual average of 7088). Of these hospital admissions, 54,733 (55.2%) occurred during the period from 2006 to 2012 (Table 2). For both sexes, most hospital admissions occurred within the 45–64-year age group, with the proportion

of male and female hospital discharges at 44.1% and 48.4%, respectively. The 25–44-year age group appeared to be the second most vulnerable group of each sex, responsible for 35.2% and 27.4% of hospital admissions in male and female patients, respectively. Female patients comprised 57,447 (57.9%) of hospitalizations, with a female to male ratio of 1.4:1. The average number of days of treatment per year was higher for female than male patients (Table 2). The average admission rate was 50.5/100,000 for males and 68.6/100,000 for females.

The age-adjusted PHR in both sexes showed similar patterns from 1999 to 2012. The age-adjusted PHR in males represented higher values in central Greece, and the age-adjusted PHR showed small variations across the country (Figure 1a). The age-adjusted PHR in females represented higher values in central and northern Greece, with lower values in southern Greece (Figure 2a). A significant positive global correlation existed in age-adjusted PHR in females (I = 0.1532, p = 0.010) but not in age-adjusted PHR value for males (I = 01010, p = 0.062). According to the LISA cluster maps (Figure 2b), the local spatial autocorrelation analysis detected HH clusters for males in central Greece and females in central and northern Greece, and LL cluster was detected in southern-eastern Greece. The HH clusters for males were the prefectures of Larisa, Magnesia, Karditsa and Trikala, while for females, they were the prefectures of Larisa, Karditsa, Grevena, Kozani and Kilkis (Figure 2b). The LL cluster for females was the prefecture of Ilia. Among the HH cluster prefectures in males, hospitalization days in the Larisa and Karditsa prefectures increased (Figure 2c,d). Finally, among the HH cluster prefectures in females, Magnesia and Kilkis were those with statistically significantly increased age-adjusted PHR values from 1999 to 2012. Larisa was the prefecture with statistically significantly decreased age-adjusted PHR values but increased hospitalization days (Figure 2c,d).
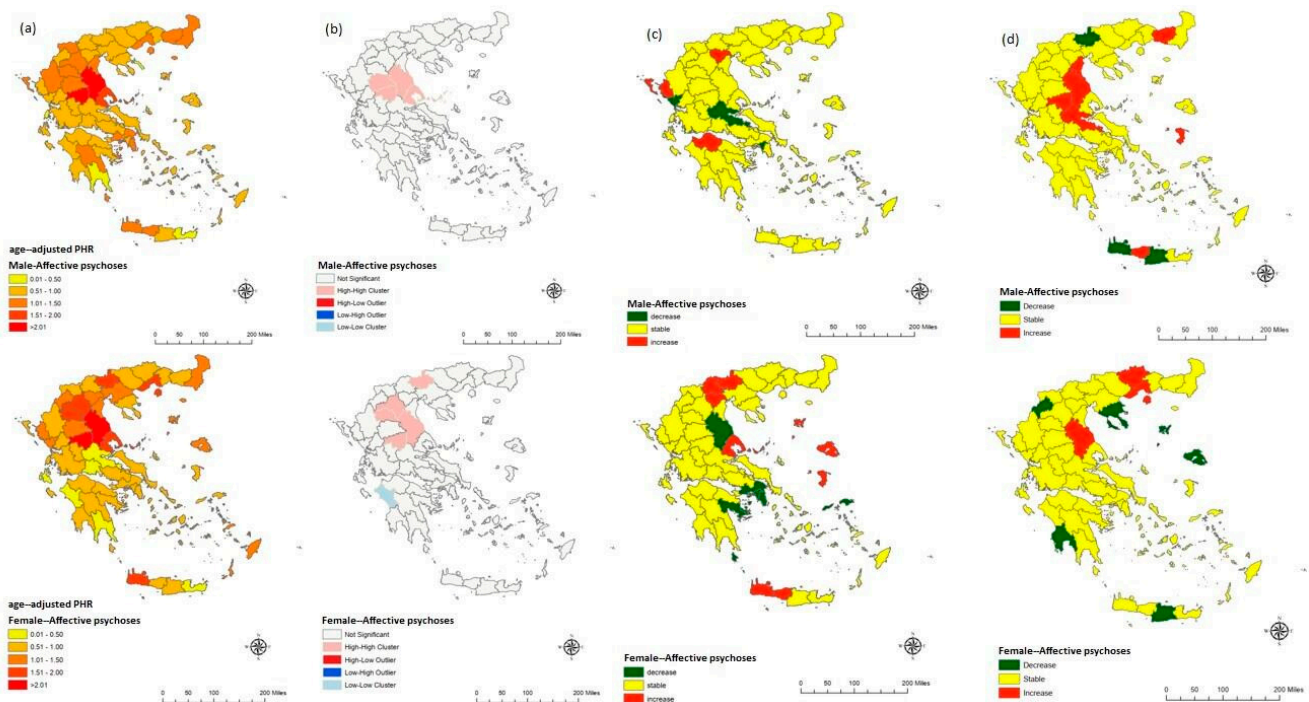

Figure 2. Descriptive (**a**), LISA (**b**) time series of annual PHR values (**c**) and hospitalization-days (**d**) maps per sex for hospitalizations of patients with affective disorders from 1999 to 2012 in Greece.

3.3. Senile and Presenile Organic Psychotic Conditions

From 1999 to 2012, a total of 37,279 hospitalizations due to senile and presenile organic psychotic conditions were reported in Greece, of which 21,966 (58.9%) hospitalizations occurred during the six-year period between 2006 and 2012, with an annual average of 2663 (Table 2). As expected, patients aged 65 years or older comprised the majority (≈96.1%) of

these hospital admissions. Patients between 45 to 64 years of age accounted for 1332 (3.6%) hospitalizations, with 87.7% of them attributed to patients between 55 to 64 years of age. Female patients comprised 23,656 (63.5%) hospitalizations; the female to male ratio was 1.7:1. The average admission rate was 17.8/100,000 for males and 23.2/100,000 for females. The average number of days of treatment per year was greater for female compared to male patients, specifically 82.5 vs. 64.8 (Table 2).

The age-adjusted PHR in both sexes showed similar patterns during the period from 1999 to 2012. The age-adjusted PHR in both sexes represented higher values in central Greece (Figure 3a). Based on global autocorrelation analysis (Table 3), a significant positive global correlation existed in age-adjusted PHR in males (I = 0.0763, p = 0.045) but not in age-adjusted PHR in females (I = 0.0790, p = 0.143). According to the LISA cluster maps (Figure 3b), the local spatial autocorrelation analysis detected HH clusters for both sexes in central Greece and one LH outlier for males in northern Greece. The HH clusters for male age-adjusted PHR were the prefectures of Larisa and Magnesia, the LH outlier was the prefecture of Chalkidiki, and the female HH clusters were the prefectures of Larisa, Magnesia, Karditsa and Eyrytania (Figure 3b). Among the HH cluster prefectures in males, the prefecture of Larisa showed statistically significantly increased age-adjusted PHR values from 1999 to 2012. Magnesia was the prefecture with an increase in annual hospitalization days (Figure 3c,d). Finally, among the HH cluster prefectures in females, Karditsa was the prefecture with increased annual hospitalization days (Figure 3d).
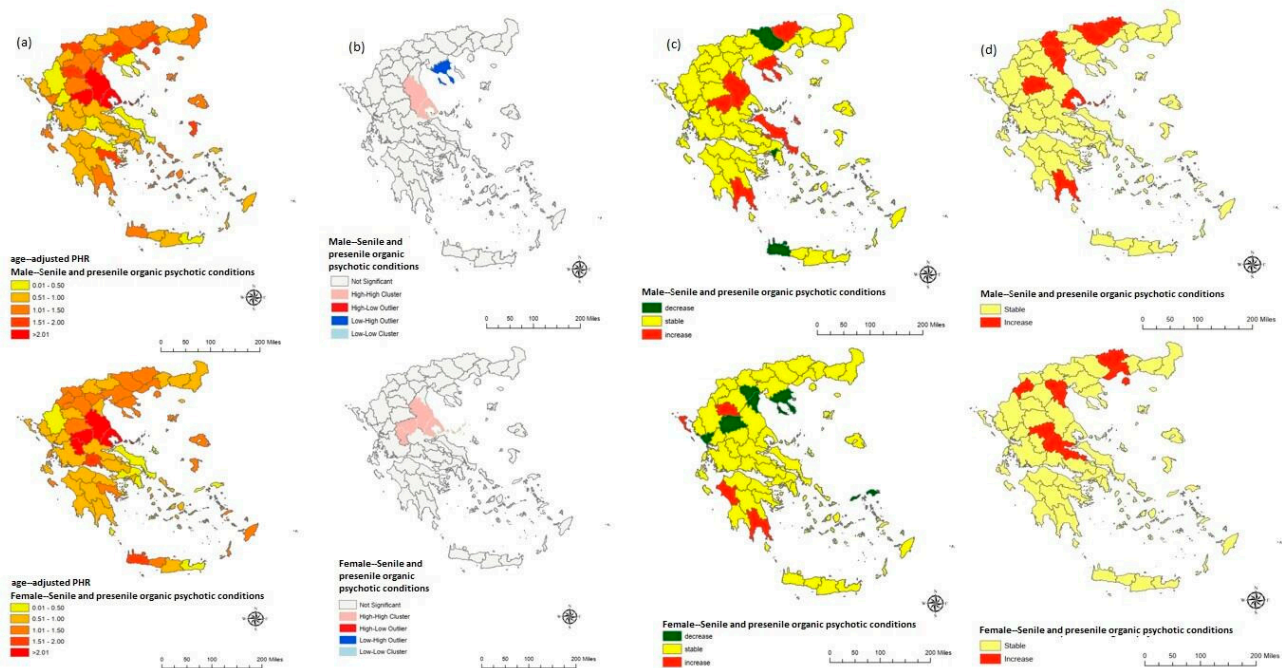

Figure 3. Descriptive (**a**), LISA (**b**) time series of annual PHR values (**c**) and hospitalization-days (**d**) maps per sex for hospitalizations of patients with senile and presenile organic psychotic conditions from 1999 to 2012 in Greece.

3.4. Alcohol Dependence Syndrome

From 1999 to 2012, a total of 24,570 hospitalizations due to alcohol dependence syndrome were reported in Greece, with an annual average of 1755, showing no significant difference between 1999–2006 and 2006–2012 (Table 2). The majority of hospitalizations (88.2%) concerned men, and the male to female ratio was 7.5:1. A similar average number of days of treatment per year for both sexes were seen (Table 2). Male patients aged 46–64 years comprised approximately 51.6% of male hospital admissions, and female patients aged 25–44 years old made up 54.8% of female hospital admissions. The average admission rate was 35.1/100,000 for males and 3.6/100,000 for females.

The age-adjusted PHR in males represented higher values in central Greece, with the age-adjusted PHR showing small variations across the country (Figure 4a). The age-adjusted PHR in females represents some high values in northern Greece and lower values in central and western Greece (Figure 4a). A significant positive global correlation existed in age-adjusted PHR in males (I = 0.1806, *p* = 0.005) but not in age-adjusted PHR in females (I = −0.0424, *p* = 0.738) (Table 3). According to the LISA cluster maps (Figure 4b), the local spatial autocorrelation analysis detected HH clusters for males in central and northern Greece and one HL outlier for females in western Greece. The HH clusters for males are the prefectures of Larisa, Magnesia, Karditsa, Trikala, Pieria, Grevena, Kozani and Florina; the high-low outlier for females is the prefecture of Lefkada (Figure 3b). Among the HH cluster prefectures in males, Magnesia had statistically significantly decreased annual hospitalization days from 1999 to 2012 (Figure 4c,d). Finally, among the other HH cluster prefectures in both sexes, none of the prefectures presented a statistically significant increase or decrease in age-adjusted PHR values from 1999 to 2012; however, there were prefectures north and south of the HH clusters of males with increased statistically significantly age-adjusted PHR values and decreased annual hospitalization-days (Figure 4c,d).
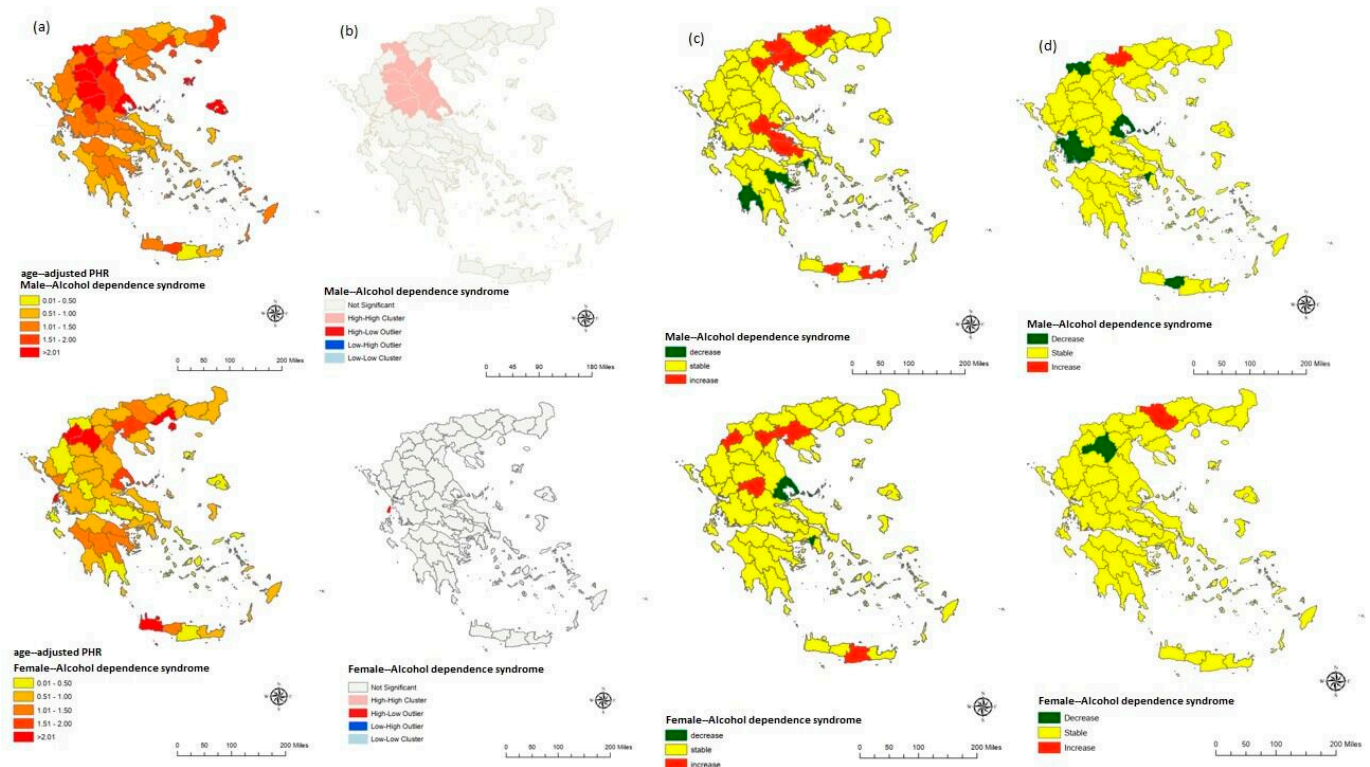

Figure 4. Descriptive (**a**), LISA (**b**) time series of annual PHR values (**c**) and hospitalization days (**d**) maps per sex for hospitalizations of patients with alcohol dependence syndrome from 1999 to 2012 in Greece.

3.5. Drug Dependence

A total of 23,454 hospitalizations were recorded due to drug dependence syndrome for the period from 1999 to 2012, with an annual average of 1675. This is similar to hospital discharges due to alcohol dependence syndrome (Table 2), with a slight increase during the period 2006–2012 when 12,945 (55.2%) hospitalizations occurred (Table 2). Male patients comprised 20,192 (86.1%) hospitalizations and the male to female ratio was 6.2:1. The average number of days of treatment per year was 36.3 and 19.2 for male and female patients, respectively. The majority of hospitalizations due to drug dependence occurred in young people of both sexes between the ages of 25–44, represented as percentages for this age group as 72.3% of male and 56.5% of female hospital discharges. The second most

vulnerable group of each sex were those aged 0–24. Patients up to 24 years of age accounted for 4846 (20.7%) of hospitalizations, with 99.5% of these attributed to patients between 15 to 24 years of age. The average admission rate was 19.6/100,000 for males and 3.4/100,000 for females.

The age-adjusted PHR in males represented higher values in northern Greece, lower values in western Greece, and the age-adjusted PHR had small variations across the country (Figure 5a). The age-adjusted PHR in females represents some high values in northern and central Greece (Figure 5a). A significant positive global correlation existed in age-adjusted PHR in males (I = 0.1728, *p* = 0.003) but not in age-adjusted PHR in females (I = 0.0403, *p* = 0.381) (Table 3). According to the LISA cluster maps (Figure 5b), the local spatial autocorrelation analysis detected HH clusters and one LH outlier for males in northern Greece and one HH cluster for females also in northern Greece. The HH clusters for males were the prefectures of Thessaloniki, Pieria, Chalkidiki and Serres, while the LH outlier was the prefecture of Agio Oros (Figure 3b). The HH cluster for females was the prefecture of Thessaloniki. Finally, among the HH cluster prefectures in both sexes, none of the prefectures presented statistically significant increased or decreased age-adjusted PHR values from 1999 to 2012. However, there were prefectures north of the HH clusters of males with statistically significantly increased age-adjusted PHR values (Figure 5c).
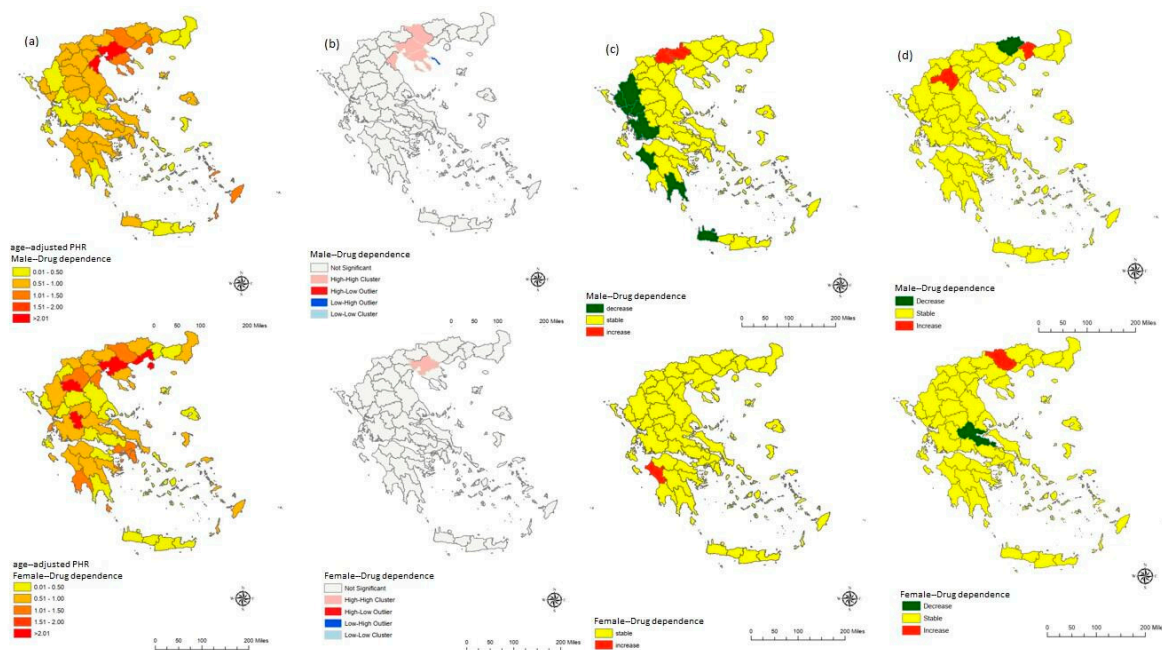

Figure 5. Descriptive (**a**), LISA (**b**) time series of annual PHR values (**c**) and hospitalization days (**d**) maps per sex for hospitalizations of patients with drug dependence syndrome from 1999 to 2012 in Greece.

3.6. Correlation between Sex- and Age-Adjusted PHR and Sociodemographic Characteristics of Each Prefecture

We first studied the correlation of mental disorders with diseases of the nervous system as well as alcohol and drug dependence syndromes. Data from the 51 prefectures in Greece show that, unlike drug dependence, sex-and age-adjusted PHR values of mental disorders show a large positive correlation with alcohol dependence syndrome (*p* < 0.001, R ≈ 0.5, Table 4). From mental disorders, sex- and age-adjusted PHR values of senile and presenile organic psychotic conditions and affective psychoses are medium positively correlated with sex-and age-adjusted PHR values of diseases of the nervous system (Table 4).

Table 4. Pearson's correlation between sex- and age-adjusted PHR of mental disorders and diseases of the nervous system (*p*-value, R: Pearson's correlation coefficient).

	Alcohol Dependence Syndrome	Drug Dependence	Diseases of the Nervous System
Diseases of the nervous system	0.316	0.906	-
Schizophrenic and other psychoses	<0.001 R = 0.492	0.062 R = 0.260	0.859
Affective psychoses	<0.001 R = 0.534	0.129	0.043 R = 0.282
Senile and presenile organic psychotic conditions	<0.001 R = 0.543	0.266	0.019 R = 0.323
Alcohol dependence syndrome	-	0.078	0.316
Drug dependence	0.078 R = 0.247	-	0.906

We then assessed the correlation of sex-and age-adjusted PHR values of mental disorders and education level (Table 5), occupation (Table 6) marital status (Table 7) and number of psychiatrists per 10,000 inhabitants (Table S1 Supplementary Material).

Table 5. Pearson's correlation between sex- and age-adjusted PHR of mental disorders and education level (*p*-value, R: Pearson's correlation coefficient).

	Tertiary Education	Secondary Education	Lower Secondary Education	Primary Education	<6th Grade of Primary Education
Schizophrenia psychoses	0.525	0.010 R = −0.356	0.007 R = −0.370	0.212	0.002 R = 0.423
Affective psychoses	0.283	0.503	0.040 R = −0.286	0.386	0.212
Senile and presenile organic psychosis	0.965	0.194	0.162	0.845	0.370
Alcohol dependence syndrome	0.514	0.026 R = −0.308	0.045 R = −0.279	0.482	0.015 R = 0.336
Drug dependence	0.171	0.752	0.882	0.020 R = −0.323	0.450

Table 6. Distribution of occupation among discharged patients with mental disorders.

	Schizophrenia and Other Psychoses	Affective Psychoses	Senile and Presenile Organic Psychotic Conditions	Alcohol Dependence Syndrome	Drug Dependence
Armed forces occupations	0.1%	0.4%	0.0%	0.0%	0.9%
Managers	1.0%	2.2%	0.1%	3.8%	2.0%
Professional	2.0%	4.7%	0.1%	3.9%	1.1%
Technicians and associate professionals	0.1%	0.4%	0.0%	0.2%	0.3%
Clerical support workers	3.8%	7.9%	0.1%	8.0%	4.3%
Service and sales workers	1.0%	1.5%	0.0%	1.7%	2.4%
Skilled agricultural, forestry and fishery workers	6.3%	5.5%	0.2%	11.5%	2.7%
Craft and related trades workers	1.2%	1.4%	0.0%	3.9%	5.5%
Plant and machine operators, and assemblers	0.4%	0.6%	0.0%	1.2%	1.4%
Elementary occupations	1.9%	2.8%	0.1%	5.2%	3.5%
Retirees, Housewives, Students	78.6%	70.1%	99.2%	51.4%	64.0%
Unemployment	3.5%	2.5%	0.1%	9.2%	11.9%

Table 7. Distribution of marital status among discharged patients with mental disorders.

	Schizophrenic and Other Psychoses	Affective Psychoses	Senile and Presenile Organic Psychotic Conditions	Alcohol Dependence Syndrome	Drug Dependence
Widow	6.4%	6.4%	44.3%	2.5%	0.6%
Married	28.3%	53.6%	46.6%	56.3%	16.9%
Unmarried	55.9%	29.8%	6.2%	28.4%	74.5%
Divorced	4.5%	5.6%	1.1%	7.2%	4.2%
Non-responders	4.9%	4.7%	1.9%	5.6%	3.9%

Specifically, sex- and age-adjusted PHR values of either schizophrenia psychoses or alcohol dependence syndrome show a medium positive correlation with the percentage of individuals in each prefecture who did not graduate primary education and a small negative correlation with the percentage of individuals having secondary education. Conversely, PHR values of affective psychoses show a small negative correlation with the percentage of individuals who graduated from lower secondary education and of drug dependence with the percentage of individuals who graduated from primary education, while senile and presenile organic psychotic conditions show no correlation with education level (Table 5).

The majority of admissions for all mental diseases were attributed to patients who are out of the workforce (retirees, housewives and students) (Table 6). However, it is interesting that the second-highest percentage for hospitalization of patients with schizophrenia and other psychoses concerns skilled agricultural, forestry and fishery workers (6.3%) similarly to alcohol dependence syndrome (11.5%), with affective psychoses clerical support workers (7.9%), and with drug dependence unemployment (11.9%). Furthermore, the percentage of individuals who were hospitalized for alcohol dependence syndrome and were unemployed is relatively high (9.2%). In terms of per capita GDP, only a weak negative correlation was found between GDP and sex- and age-adjusted PHR's values of alcohol dependence syndrome ($p = 0.042$, R = -0.283).

While the majority of individuals hospitalized with affective psychosis, senile and presenile organic psychotic conditions or alcoholic dependent syndrome were married, the majority of individuals hospitalized with schizophrenic and other psychoses as well as drug dependence were mainly unmarried (55.9% and 74.5% respectively, Table 7).

4. Discussion

This study covering a 14-year period revealed seven main findings. First, a regional variation in PHR values was shown, with higher PHRs seen in the northern part of Greece, primarily in western Macedonia and Thessaly. Second, more male (55%) than female patients were hospitalized in psychiatric units. Third, schizophrenia and other psychoses were the primary diagnoses recorded as the reason for hospital admission. Fourth, schizophrenic and other psychoses were the disorders contributing to the highest mean number of occupied bed-days per year for male and female patients. Fifth, the statistically significant correlation of PHR values of alcohol consumption with each mental disorder. Sixth, most patients were not in the workforce. Seventh, most patients with schizophrenia and drug dependence remain unmarried.

The northern area of Greece largely in western Macedonia and Thessaly showed the highest rates of mental hospital discharges across all Greek prefectures. This stark discrepancy is either caused by a true spike in local psychopathology or is an artifact. In the case of the former, a presumed local biological or genetic detrimental factor is a possible, albeit unlikely culprit. It is far more likely that several factors (such as alcohol, local social constructs, psychosocial adversity, etc.) synergize to yield the detrimental effect. If, on the other hand, this is an artifact, it could be accounted for by a presumed low local threshold for admission, or by the confirmed abundance of private beds in the area, compared to other areas in Greece. Acting together, these two factors would increase admissions and consequently, discharges.

An expected finding was that the vast majority of hospital discharges for each mental disorder corresponded to individuals who were not in the workforce, such as retirees (including those receiving a disability pension), housewives, students and the unemployed. It is well recognized that poor mental health correlates with absence from the workforce [28] due to low productivity, poor communication with coworkers, low physical capability and daily functioning. Some of the patients who have been admitted to hospitals occupy with farming, livestock, and fishing. These activities are the third most frequent occupation in Greece (11.2%), and very frequent in areas with high PHR values [29].

Similar to Madianos et al., we did not detect high levels of treated psychiatric morbidity in prefectures where large urban cities are located [16]. A possible explanation is the higher allocation of public health resources in urban areas. In urban and semi-urban areas, health facilities are highly accessible with a good rate of availability, affordability and accommodation [30]. Furthermore, the majority of mental health facilities, professionals, research studies with innovative interventions and highly specialized mental health consultants/centers which may improve the outcome of illness are primarily located in larger cities [31]. An additional potential explanation is that both large urban centers in Greece (Athens and Thessaloniki) are located by the sea, and urban green-blue spaces positively impact mental health outcomes among exposed citizens [32].

The statistically significant correlation between the PHR of alcohol dependence syndrome and mental disorders is not an unexpected finding. Prevalence rates of alcohol use disorder among patients with affective psychoses (bipolar disorder and major depressive disorder) range from 30% to 60% [33–35]. The comorbidity between alcohol use disorder in bipolar disorder has been known to be associated with an earlier onset of mood symptoms [33] and more hospitalizations [35]. Similarly, the prevalence of alcohol use disorder among patients with schizophrenia is estimated to be 24.3% [36]. Finally, alcohol use disorders seem to be the strongest risk factor for onset of all types of dementia, mainly early-onset dementia (hazard ratio for women 3.34 (95% CI 3.28–3.41) and for men 3.36 (3.31–3.41)) [37]. About 38.9% of early-onset dementia cases are alcohol-related [37].

Unmarried patients accounted for the majority of total hospital admissions due to schizophrenia and other psychoses, drug dependence and a large part of total hospital admissions due to affective psychoses and alcohol dependence syndrome. Unmarried, divorced, or widowed status is associated with loneliness as well as a lack of emotional and practical support in daily life [38]. However, married individuals accounted for the majority of admissions due to affective psychoses and alcohol dependence syndrome. This finding is in accordance with a finding of one other study, where it was shown that there were a greater number of episodes in married subjects (41.8%) as compared to never married subjects (20%) [39]. A possible explanation is that marital function among bipolar patients who are married is often impaired [40]. More precisely, bipolar persons record lower scores on scales of marital adjustment [41], have more extramarital sexual experiences [42], and have higher divorce rates [43]. Support of spouses and family are crucial for improved mental health and better outcomes in individuals with mental disorders [4,44,45]; however, a poor marriage may induce more stress.

5. Conclusions

This 14-year period study shows that schizophrenia and other psychoses were the primary diagnoses recorded as the reason for hospital admission and contributing to the highest mean number of occupied bed days per year. The study also provides evidence of geographical variation of discharges due to mental disorders, with higher PHRs seen in the northern part of Greece. Finally, a significant association between mental disorders and alcohol consumption, marriage status and absence of the workforce were found.

6. Limitations

The present study was conducted in a relatively constant and uniform population over a 14-year period. Data from 1999 to 2015 were available; however, a change in the

classification system from ICD9 to ICD10 was introduced in 2013; Due to lack of uniformity, only discharge notes for 1999 to 2012 were analyzed. Concerning occupational classification, ELSTAT merged the categories "Retirees, Housewives, Students, Unemployment" together so further analysis cannot be conducted. We were also unable to remove duplicates or estimate first discharge notes and involuntary admissions, due to the existing organization of the statistical registration system. Our data may imply more severe rather than more prevalent mental disorders in Greece, hence more hospitalizations. However, we assume that the same bias could be found in all the prefectures of Greece, making the comparison among the different prefectures somehow reliable. Finally, individual-based studies are needed to describe the epidemiology of mental disorders in Greece. Studies related to the geographical variation of mental disorders in a range of populations could help uncover new environmental clues about mental disorders. Our study formed the basis for future work.

Abbreviations

PHR: proportional hospitalization ratio; ELSTAT: Hellenic Statistical Authority; ICD-9: International Classification of Diseases, Ninth Revision; LISA: local indicators of spatial autocorrelation; HH: high–high cluster; HL: high–low outlier; LL: low–low cluster; LH: low–high outlier; ISCO-8: International Labor Organization; GDP: gross domestic product.

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