



Mental health disparities across regions: Exploring the roles of inequality, socioeconomic factors and regional public health service

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ABSTRACT

The main objective of this study is to analyze whether inequality in income distribution together with other determinants influences Risk of poor mental health and non-specific psychological distress, Prevalence of registered mental disorders, and Mortality in mental disorders, and how the public health system mitigates these effects. The study also aims to contribute to the existing empirical evidence focusing on a regional basis considering that mental disorders are not only seen as an individual problem, but also as a social issue, emerging the need for regional strategies. To this end, the case of seventeen Spanish regions is used, indexes by principal component analysis are obtained and panel data models are estimated. The results obtained allow us to conclude that regions with a higher level of income inequality generate a higher Risk of poor mental health and a higher rate of Registered mental disorders, but do not increase Mortality, highlighting the importance of the Spanish regions public Health Service, which does not distinguish by income level. Similarly, factors such as access to healthcare services, the perceived quality of medical institutions and patient's satisfaction, unemployment and socioeconomic deprivation, as well as population density, play a critical role in the prevention, early detection, and effective treatment of mental illness. These results show that mental health status is no exception to the social pattern, as disparities in regional income and deprivation translate into unequal mental health outcomes. This relationship underscores the importance of addressing socioeconomic determinants as a central component of mental health policies, emphasizing prevention and equity as fundamental strategies to reduce the burden of mental illness in vulnerable populations. Effective policies should combine: (i) the reduction of regional inequalities and the strengthening of local capacities and health systems, (ii) strategic planning of medical services, particularly those aimed at addressing deficiencies in mental health care, and (iii) investment in health and reduction of direct costs for individuals.

1. Introduction

Mental illness is nowadays one of the causes of major health problems worldwide. In parallel, although the dominance of medical, psychiatric and psychological perspectives on mental health has distracted from socioeconomic factors (Macintyre et al., 2018), there is a growing body of evidence in the literature showing that economic inequalities and austerity policies affect general health but can be specifically associated with worsening mental health and increasing mental health inequalities, particularly for those who are already vulnerable to poor health. Furthermore, as the problem grows, mental disorders are increasingly seen not only as individual issues but also as societal concerns, highlighting the need to adopt regional strategies for the prevention and treatment of these conditions.

The paper addresses these issues and examines the uneven

geography of Risk of poor mental health and non-specific psychological distress, Prevalence of registered mental disorders, and Mortality in mental disorders -that is wellbeing, illness and mortality-, evaluating the factors behind the regional differences in impact and disentangling whether regional inequality in income distribution influences these mental health indicators, and how the public health system mitigates these effects. Most previous studies related to mental disorders were conducted within a specific age group or geographical area but to date there are only a few studies related to mental health outcomes according to regions. However, the health level of the population group becomes increasingly relevant, and it is possible to be more effective at managing the cause of the differences in the distribution of health status when accessed at the community level.

Therefore, the main hypothesis of the paper to be tested is that Risk of poor mental health, Prevalence of registered mental disorders, and

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Mortality in mental disorders can be attributed to regional differences in socioeconomic factors, and mental health inequalities tend to be more pronounced in regions with higher income inequality. However, regions with greater accessibility to endowed and reputable health centers mitigate the negative impact of economic inequalities as it means better access to medications, better coordination of care levels, improvements in patient care or more effectiveness of psychiatric readmissions for instance. The empirical analysis will be grounded in the framework of social and environmental determinants of health, while also drawing on insights from regional science, particularly in areas such as urban hierarchy (Capello et al., 2022) and location theory (Murray, 2024).

To this end, the analysis is applied to seventeen Spanish regions for the period 2011–2022 using econometric techniques such as principal component analysis and panel data. Studying whether inequalities affect mental health in Spain is important because, first, Spain has exacerbated unemployment, job insecurity, and poverty more than other countries in Europe due to the 2008 economic crisis, the COVID-19 pandemic and the economic consequences of the geopolitical context. As these factors can be closely associated with stress, anxiety, depression or other mental health problems, understanding this relationship is crucial for developing targeted interventions and reduce the overall social and economic burden of mental illness. And second, Spain's regional healthcare system is based on the principles of universality and equity. If social and economic inequalities are contributing to unequal mental health outcomes, this could indicate gaps in the system that need to be addressed to ensure fair access to care.

Among the main novelties of the paper, we can highlight, first, the analysis of not only diagnosed mental illnesses but also the analysis of the Risk of poor mental health and serious psychological distress not indicative of a specific mental illness but associated with anxiety and mood disorders (Leary et al., 2022); second the use of Principal Component Analysis (PCA) for modeling indexes at regional level that measure the relevant socio-economic dimension, the accessibility to patient care or the patients' perceptions of the quality of care at medical centers; and third, the use of a regional perspective in the study of mental disorders, not well elucidated in the literature.

The results obtained allow us to conclude that regional differences in income inequality led to a higher rate of mental illness but not suicides, emphasizing the importance and quality of the public Health Service that ensures access to healthcare for the treatment of the most severe cases. In this vein, the availability of health centers that allow access to medical care and their reputation are fundamental variables for the prevention and treatment of this illness.

The paper is structured as follows: after this introduction, Section 2 presents a review of the literature and discusses the main hypotheses analyzing the studies that have been recently published about the relationship between the proposed independent variables and mental disorders, making special emphasis on socioeconomic inequality. Section 3 describes the data used and the methodology. In Section 4, the paper presents the empirical analysis applied to the Spanish regions during the period 2011–2022 and the results are discussed. Finally, the main conclusions are presented in Section 5.

2. Literature review and main hypotheses

Understanding the determinants of mental illness is crucial for improving public health, enhancing quality of life, and guiding policies that promote the well-being of the population. As Herman-Stahl et al. (2007) highlighted there is a significant public health burden posed by mental illness that emphasizes the need to recognize depressive disorders as a public health priority, noting that major depressive disorder contributes significantly to suicide-related burden (Ferrari et al., 2013). Besides, these findings underscore the importance of implementing cost-effective strategies to mitigate the impact of mental illnesses.

Most prior research on mental disorders has focused on specific age groups or individual characteristics. Authors like Dallo et al. (2013),

Olfson et al. (2019), or Weissman et al. (2020) have examined psychological distress across sex, age, race, ethnicity, and demographic characteristics, such as education. More recently, however, Jeste et al. (2025) or Das (2025) suggest that social and environmental determinants of mental health may have a greater impact than traditionally considered medical risk factors. As the problem increases, mental disorders are not only seen as an individual problem, but also as a social issue, which must be recognized and taken seriously. Therefore, acknowledging regional differences can enhance efforts to effectively address mental health disparities and emphasize the importance of regional strategies for preventing and managing these conditions. However, few studies have explored regional differences in mental health outcomes, and variations in serious psychological distress and mental health have not been well elucidated from this point of view. Studying the determinants of mental health from a regional perspective is therefore essential, as geographic variations in environmental, socioeconomic, and service-related factors can significantly influence mental health outcomes.

2.1. The environment

When considering regional differences in mental disorders, most studies compare rural–urban differences of mental disease and their results indicate that mental illness tends to be more prevalent in urban areas than in rural ones, even when adjustments for sociodemographic characteristics are considered (Dhingra et al., 2009). Also, Kovess et al. (1987), Philo (2005), Martino et al. (2019) Wang et al. (2020) and Werneck and Silva (2020) have suggested that geographic areas with stressful environments are associated with mental illness or suicides. The increased prevalence of the disease in urban areas compared to rural regions is primarily attributed to several factors. First, the fast-paced and competitive city lifestyle contributes to chronic stress, while social isolation remains prevalent despite high population density. Second, environmental factors, including air pollution, noise, and limited access to green spaces, further harm mental health. Additionally, urban environments expose individuals to higher levels of violence and substance abuse, increasing the risk of mental disorders. Besides, although cities offer more mental health services, high demand often results in long waiting times. In contrast, rural areas, despite having fewer healthcare resources, often benefit from stronger social networks and a slower, less stressful lifestyle, which can serve as protective factors against mental illness. In this line, the study of Qin (2005) demonstrates that individuals residing in highly urbanized areas face a greater risk of suicide compared to those in more rural or less urbanized settings although urban environments appear to lower suicide risk among men, but they are more associated with an increased risk for women. However, during specific periods such as the Covid pandemic, Wang et al. (2022) highlight the opposite trend, showing that public's mental health indicators in capital cities were better than those in regional areas. Also, Vitiello et al. (2022) challenge the mainstream perspective by reporting that in Italy lower population density was associated with higher rates of suicide among males, while no consistent relationship was observed for females. This finding suggests that males may be more vulnerable to the negative effects of risk factors present in areas with lower population density. With all these premises we arrive at the first hypothesis to test:

H1(DENSITY): Denser regions with larger urban areas are more likely to experience higher rates of mental health disorders compared to more rural regions.

2.2. Socioeconomic disadvantages: Inequality and deprivation

The literature also offers examples where socioeconomic disparities, income inequality and the high cost of living further contribute to anxiety, depression and mental illness, whereby perceptions of lower socioeconomic status measured by education, occupation, and income are associated with a higher risk of depression (Hoebel et al., 2017) or

more psychological and somatic symptoms (Dierckens et al., 2020). For instance, Weinberg et al. (2021) find that adolescents with higher socioeconomic status report better mental health while Barr et al. (2015) and Fleming et al. (2023) highlight that mental illness may have increased because the past 2008 financial crisis impacted health systems in many countries, with mental health services being particularly affected by funding reductions following fiscal austerity in Europe. Henking (2022) confirms that socioeconomic inequalities manifest as disparities in mental health outcomes when states that individuals with higher incomes are more likely to seek professional mental health services and to perceive such treatments as highly effective. In contrast, income level does not appear to influence perceptions of the effectiveness of prescribed medication for common mental disorders. In the same line, Lago-Peñas et al. (2022) also state that in OECD countries low socioeconomic status appears to have a consistently significant impact on mortality and morbidity caused by non-communicable diseases, including mental disorders, because social and economic disadvantages are linked to health inequalities in terms of access to care, increased risk of these illnesses, and early death. And Shan et al. (2025) support that mental health disorders impose a substantial social and economic burden. Thus, countries with higher income levels are more likely to have greater mental health resources necessary to reduce the epidemic of mental disorders.

There are different arguments that explain this relationship between socioeconomic status and mental illness present in the literature. One of the explanations is that limited knowledge of healthy behaviors and exposure to inadequate social models often lead individuals in disadvantaged economic circumstances to adopt behaviors detrimental to their overall health, including mental well-being. Consequently, socioeconomically disadvantaged individuals are more likely to develop mental health problems. Moreover, when low socioeconomic status persists over time, it is strongly related to higher rates of mental health problems (Reiss, 2013) and even authors like Stringhini et al. (2017) warn that poverty and socioeconomic inequality shorten lives. More explanations are offered by Stuckler et al. (2017) when affirm that austerity policies tend to disproportionately affect the most disadvantaged groups and influences health outcomes through a 'social risk effect', driven by rising unemployment, poverty, homelessness, and other socioeconomic stressors; and a direct 'healthcare effect', resulting from reduced healthcare funding, decreased coverage, and limited access to medical services. These effects are empirically supported by several researchers: on the one side, Wang and Fattore (2020) who find significant impact of higher unemployment rates on admissions for severe mental disorders after controlling for relevant economic factors and highlight that the effects are concentrated on the most economically disadvantaged areas and, on the other side, McManus and Schaur (2019) and Adda and Fawaz (2020) who link greater exposure to import competition and deterioration in mental, physical, and overall health, due to job displacement or transitions to lower-paying jobs, which often result in the loss of employer-sponsored health insurance and higher out-of-pocket medical expenses.

Likewise, from a socio-spatial perspective, the unequal distribution of health and education resources reflects what Marmot and Wilkinson (2005) call a "geography of inequality," where the most advantaged territories sustain cumulative trajectories of well-being as they possess infrastructure, services, and human capital that continuously reinforce their development conditions and allows them to allocate resources to support their mental health services, while the most disadvantaged depend on exogenous interventions to improve their mental health indicators. In other words, territorial asymmetries in socioeconomic factors not only determine the positioning of different populations, but also the capacity of regions to sustain or improve their psychological well-being. Similarly, Capello et al. (2022) show that regional differences in socioeconomic factors shape the dynamics of geographical areas. In regions with higher productive density, human capital, and infrastructure, changes occur gradually and cumulatively. In contrast,

more fragile regions rely on the occasional introduction of advanced functions, such as universities, administrative or research centers, national-level services, or key infrastructure. This perspective is also useful for understanding mental health inequalities, as the territorial distribution of resources—employment, education, infrastructure, and access to specialized services—determines differentiated trajectories in psychological well-being. Consequently, in socioeconomically established contexts, mental health is maintained through preventive and cumulative mechanisms, whereas in disadvantaged areas, improvements depend largely on targeted interventions, reproducing a pattern analogous to that observed in urban hierarchies.

Building on these insights, it can be inferred that well-being, and particularly mental health, is shaped by regional inequalities and the availability of material resources, educational opportunities, and employment conditions within a given region. However, despite the importance of these theories, the relationship between socioeconomic status and mental health disorders is not very well elucidated in literature. For this reason, the following hypotheses allow us to analyze this relationship on a regional basis:

H2 (DEPRIVATION): Mental illnesses are more prevalent in regions experiencing economic difficulties and deprivation.

H3 (INEQUALITY): Greater economic inequality in a region is associated with higher rates of mental health disorders

Although all the variables considered in this analysis—risk of poor mental health and non-specific psychological distress, prevalence of registered mental disorders, and mortality due to mental disorders—are generally expected to be positively associated with inequality and adverse socioeconomic conditions, it is important to note that the risk of developing a mental disorder and the prevalence of mental disorders could also behave differently in relation to these conditions. Risk refers to the likelihood of developing a mental disorder in the future, whereas prevalence describes the proportion of individuals within a specific population who are currently affected by a mental disorder. While both dimensions are influenced by socioeconomic factors, prevalence is also shaped by elements such as case detection, diagnostic practices, and access to treatment, which are often more limited in disadvantaged communities. Consequently, a group may exhibit high risk but low prevalence if cases remain undiagnosed, or high prevalence when multiple risk factors are combined with inadequate access to care.

2.3. Regional health service: Access, quality and expenditure

According to the literature, regional differences in mental health are influenced by multiple factors, including not only low household income and socioeconomic conditions but also a broader set of regional characteristics such as variations in medical funding, service availability, medical quality and accessibility. A territorial planning that ensures equitable access to healthcare services and reduces existing disparities is essential for improving health outcomes and mental disorders. The reason is that limited access to psychological and psychiatric care can impede timely diagnosis and treatment, exacerbating mental health disparities (Bhavsar et al., 2019). At the same time, healthcare costs such as out-of-pocket expenses, co-pays, or costs of treatments is a crucial factor that affects overall health outcomes, regardless of insurance status or geographic region (Leary et al., 2022). Together, these factors mean that restricted service availability and high healthcare costs can increase stress, anxiety, and vulnerability to mental disorders, highlighting the critical role of both accessibility and affordability in shaping mental health outcomes (Das, 2025).

These facts are clearly evidenced in papers such as Brown et al. (2024) who show a decline in mental health for those living in regions with the largest reductions in funding, highlighting at the same time, the need to consider factors such as deprivation, infrastructure, and existing assets in the area, when distributing funding to avoid exacerbating regional inequalities in mental health. Similarly, Murray (2024) underscores the role of accessibility, inequities in service distribution, and

gaps in territorial coverage as key social determinants of mental health while [Santana and dos Santos \(2024\)](#) also supports that areas with limited access to healthcare services and socioeconomic resources tend to experience poorer health outcomes and higher rates of mental disorders. In the same vein, [Alotaibi et al., \(2025\)](#) emphasize the importance of investing, planning, and strategically locating efficient healthcare facilities as valuable tools for improving public health, particularly mental health. Similarly, the study by [Rahman et al. \(2025\)](#) demonstrates that investment in healthcare, along with access to knowledge, technologies, and best practices, has a significant impact on physical and mental health outcomes. As a result, increasing the allocation of resources to public health services would ensure equitable access to mental health care while enhancing the availability and quality of psychological and psychiatric services. This, in turn, would help alleviate stress, anxiety, feelings of insecurity and other issues that affect psychological well-being. Thus, collectively, these studies highlight the urgent need to invest and integrate territorial planning into public health policies, particularly in regions marked by pronounced inequalities. Such planning can serve as a preventive tool for mental health by ensuring equitable access to healthcare services, which is essential for improving mental health outcomes and reducing existing disparities.

Finally, other studies emphasize how environmental and organizational factors promote both physical safety and psychological well-being. For example, a hospital's reputation can influence not only the quality of care delivered but also a patient's motivation to participate actively in their recovery and enhance their mental health. Studies like [Stokes et al. \(2021\)](#) indicate that patient satisfaction with mental healthcare and hospital reputation is correlated with both treatment outcomes and quality of life of the patient. Trust in the place where care is received is crucial, as a positive environment can reduce stress and anxiety for patients, helping them focus better on their treatment and overall well-being. On the other hand, hospitals with a poor reputation may create distrust, which could discourage patients from seeking help or continuing necessary treatment. Recently, this argument has been corroborated by other researchers such as [Domenico and Giuseppe \(2025\)](#) who examine the importance of both the capacity and appeal of each healthcare service. Thus, mental health outcomes can vary depending on who has access and who is left underserved when psychological or psychiatric services are insufficient or have limited attractiveness. Similarly, [Carnazza et al. \(2025\)](#) highlight the same fact when affirm that regions with higher-quality healthcare and the presence of licensed private hospitals tend to attract more patients, reflecting a persistent duality compared to other areas.

Building upon the above range of theoretical frameworks and empirical findings, the paper proposes to test empirically the following hypothesis:

H4 (EXPENDITURE): Regions with higher resource endowments or greater health expenditures tend to have better mental health outcomes

H5 (QUALITY): Regions with more effective medical institutions generally experience better mental health outcomes

H6 (ACCES): Better accessibility to mental health services is associated with improved mental health outcomes in a region.

Testing all these hypotheses will help identify the underlying factors driving spatial disparities in mental health outcomes, deepening our understanding of how these issues emerge and spread across regions, with particular attention to the socioeconomic characteristics that shape these variations.

3. Empirical analysis: Data and methodology

3.1. The data

The paper analyzes the case of seventeen Spanish regions during the period 2011–2022. As dependent variables, the study identifies and uses different variables related to mental health representing different

aspects or levels of disease: wellbeing, illness and mortality. The variables are first, *Percentage of risk of mental disorders*; second, *Prevalence of registered mental disorders*; and third, *Suicide mortality* rate per 100,000 inhabitants. They are provided by the Spanish Ministry of Health. More precisely, according to the technical report, the calculation of the Risk indicator is based on data from the Spanish National Health Survey on mental health and reflects whether the threshold above which an individual is considered at risk of poor mental health has been exceeded. On the other hand, the calculation of Prevalence is derived from the number of individuals whose medical records indicate a diagnosis of common mental health disorders in clinical practice.

To measure regional Income Inequality (INEQUALITY) the paper uses two different indicators provided by the National Institute of Statistics:

GINI coefficient: measures the cumulative proportion of the population ordered by equivalent income compared to the cumulative proportion of the income received by them. It is a measure of inequality that takes a value of 0 in the case of perfect equity and a value of 100 in the case of perfect inequality.

Income Quintile Ratio (IQR): Relationship between the total disposable income of the top 20 % of the population with the highest income and that of the bottom 20 % with the lowest income. It measures the disparity between the income of the richest 20 % of the population and the poorest 20 %. A higher ratio indicates greater income inequality, as it shows how much more income the top 20 % earns compared to the bottom 20 %.

Also, the *density of population* (DENSITY) is provided by the National Institute of Statistics and measured by the Inhabitants per km².

Additionally, for each region, the following key indicators, many of them related to the public health system, are used. They are provided by the Spanish Ministry of Health. In Spain, the way health services are funded and managed is closely tied to the country's decentralized political structure. Each region has full autonomy to manage and decide how to spend its health budget. They manage hospitals and primary care centers, can prioritize certain services according to their policy (e.g., mental health, elderly care) or decide salary scales for doctors.

LOWEDU	Proportion of the population aged 25–64 with lower secondary education or below
UNEMP	Unemployment rate
TIMESP	Average waiting time for a first consultation in Specialized Care
PAESPAP	Patients awaiting a first consultation in Specialized Care per 1000 inhabitants
POORRISK	Percentage of people at risk of poverty or social exclusion
IDEP	Percentage of dependent people
INAC	Self-reported inability to access prescribed medications for economic reasons (in the last 12 months)
SATPUB	Degree of citizen satisfaction with the functioning of the public healthcare system
SATIS	Average citizen satisfaction with the information received during a consultation with their family doctor regarding their health condition
VALPOS	Average satisfaction among citizens regarding the quality of care received during consultations with public healthcare specialists
EXPENDITURE	Public healthcare expenditure per inhabitant managed by each region.

These indicators will be used to build indexes to measure the regional socioeconomic position, effectiveness of the regional health system, patient experience, accessibility to the system, resource use and healthcare system costs as it is explained right now in the methodology.

3.2. The model and methodology

Most of the independent variables introduced in the last section are not used in the regression model in their raw state. Instead, principal component analyses (PCA) are performed to create regional indicators or index variables. With PCA the main components are expressed as a

linear combination of the original variables. Therefore, the index avoids problems of correlation by respecting the independence between the explanatory variables. In other words, by applying the principal component method, the researchers reduce the dimension of the number of original variables considered in the analysis and deal with the problem of multicollinearity among the initial variables.

The first index created by PCA measures the difficulty in the “Access” to health services in each region. To this end the variables used are Patients awaiting a first consultation in Specialized Care per 1000 inhabitants (PAESPAC) and Average waiting time for a first consultation in Specialized Care (TIMESP).

The second index “Deprivation” measures the socio-economic dimension of each region. This term refers to the lack or absence of something necessary to live in a healthy or adequate way, such as food, housing, education, personal care, or economic resources. Each nation measures deprivation in a slightly different way but the broad themes include unemployment, low education, index of dependence, access to medicines, and risk of poverty. To this end the variables used are Unemployment rate (UNEMP), Proportion of the population aged 25–64 with lower secondary education or below (LOWEDU), Proportion of people at risk of poverty or social exclusion (POORRISK), Percentage of dependent people (IDEP) and Self-reported inability to access prescribed medications for economic reasons in the last 12 months (INAC).

The third index assesses the “Quality” of health care centers measuring the satisfaction with public health system by means of the variables Degree of citizen satisfaction with the functioning of the public healthcare system (SATPUB), Average citizen satisfaction with the information received during a consultation with their family doctor regarding their health condition and (SATIS) and Average satisfaction among citizens regarding the quality of care received during consultations with public healthcare specialists (VALPOS).

Tables 1 through 3 present the indicators or indexes related to Access, Deprivation and Quality obtained by PCA. In each of these tables, Eigenvalues indicate how much variance or information is explained by each of the principal components in the analysis. The component with the highest eigenvalue explains the greatest amount of variation in the data. The proportion shows what percentage of the total information in the data is explained by that specific component, while the cumulative variance shows how much total information from the dataset is explained as more components are included.

The Table 1 presents the “Access” index to health services in each region. It shows that the first component accounts for 81,58 % of the total variance while the following component explains 18,42 % of the total variance. Thus, most of the variance is contained in the first principal component while the second component is relevant, but it does not capture as much variation as the first one. Both variables contribute equally to the variability explained in the first component and are inversely correlated in the second.

Table 2 presents the PCA corresponding to the “Deprivation” index. The first and second components explain the biggest part of the variance with 63,8 % and 16,38 % of the total variance respectively, while the remaining components are less crucial in explaining the variation in the data as they explain together around 5 % of the cumulative variance of data. PC1 is the dominant component and represents a general

socioeconomic disadvantage factor, where higher unemployment, low education, poverty risk, and inactivity are associated with lower independence. Finally, Table 3 presents the PCA corresponding to the “Quality” index. The PCA has successfully reduced the dimensionality of the data without losing a significant amount of information, and PC1 is the dominant component and primarily responsible for the underlying structure of the data. Specifically, the first component accounts for 66.58 % of the data’s variability, while the second and third account for 20.48 % and 12.95 %, respectively, and therefore also explain a significant proportion of the system’s total variability.

These three indicators derived from the PCA (ACCESS, DEPRIVATION and QUALITY) are incorporated, along with the other determinants, into the complete model, which is represented by the following equation:

$$\text{Mental illness}_i = \beta_1 \text{ACCESS}_i + \beta_2 \text{DEPRIVATION}_i + \beta_3 \text{INEQUALITY}_i + \beta_4 \text{QUALITY}_i + \beta_5 \text{EXPENDITURE}_i + \beta_6 \text{DENSITY}_i + \mu_i$$

where i represent individual regions. This is the main equation to be tested econometrically in the next section, and it will help us determine whether the previously stated hypotheses are satisfied.

4. Results

This section presents the results of the econometric approach. The analysis is conducted by means of a set of panel data regressions with standard errors robust-clustered at regional level to account for potential error correlation within regions. Robust standard errors are especially beneficial in the presence of heteroskedasticity, a condition in which the error term’s variability differs across observations. To identify the most suitable model for panel data analysis, the Hausman test was performed to compare fixed effects and random effects models. The null hypothesis asserts that the random effects model is both consistent and efficient, whereas the alternative hypothesis suggests that the fixed effects model better accounts for individual heterogeneity within the panel data. If the p-value falls below the 0.05 significance threshold, the null hypothesis is rejected, indicating correlation between individual effects and regressors, necessitating the use of the fixed effects model to prevent biased estimates. Conversely, if the p-value exceeds 0.05, the null hypothesis is not rejected, and the random effects model is presented in the results table. In these cases, it can be said that there is not enough evidence to say that the unobserved regional effects are correlated with the explanatory variables. Table 4 presents the impact of regional inequality on mental health by means of the panel data estimation while Table 5 suggests the possibility that mental health conditions themselves may affect socioeconomic outcomes. To avoid this potential endogeneity problem and reinforce the results of Table 4, an estimator based on the Generalized Method of Moments (GMM) is used, in which lagged variables and differences act as instruments, addressing issues of simultaneity and reverse causality. Sargan test assesses the validity of the instruments and serial correlation is checked. In this way, the robustness of the results is demonstrated.

Both the panel data estimations and the GMM model provide valuable and complementary insights into the determinants of the dependent variables. The static panel model provides a solid reference point for the analysis while the GMM estimation, in turn, extends the analysis by addressing potential endogeneity and dynamic relationships that may not be fully accounted for in the static panel framework. The overall findings are broadly consistent across models, reinforcing the robustness of the results. Therefore, both the traditional panel data estimations and the GMM approach are accepted as valid and complementary methods for analyzing the relationship under study, providing a more comprehensive understanding of the underlying dynamics.

In these regressions, the indexes just obtained from the PCA (Access, Deprivation and Quality) are included as independent variables, along with the rest of the relevant variables. The first two columns in both Table 4 and Table 5 correspond to the Risk of mental disorders; columns 3 and 4 refer to Prevalence of registered mental disorders, and the last

Table 1
Principal component analysis: “Access” index.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.6315	1.2630	0.8158	0.8158
Comp2	0.36849	.	0.1842	1.0000
PAESPAC	PC1	PC2		
TIMESP	0.7071	0.7071		
	0.7071	−0.7071		

Table 2
Principal component analysis: “Deprivation” Index.

Component	Eigenvalue	Difference	Proportion	Cumulative	
Comp1	3.18912	2.3700	0.6378	0.6378	
Comp2	0.81906	0.34007	0.1638	0.8016	
Comp3	0.47898	0.19101	0.0958	0.8974	
Comp4	0.28797	0.06312	0.0576	0.9550	
Comp5	0.22485	.	0.0450	1.0000	
UNEMP	PC1	PC2	PC3	PC4	PC5
LOWEDU	0.5075	0.0489	0.0953	−0.3542	0.7781
POORRISK	0.4330	0.5902	−0.0145	−0.4415	−0.5187
IDEP	0.4760	0.2968	−0.2049	0.7998	0.0601
INAC	−0.3903	0.6039	0.6436	0.1574	0.2095
	0.4195	−0.4432	0.7311	0.1231	−0.2793

Table 3
Principal component analysis: “Quality” index.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.9972	1.3829	0.6658	0.6658
Comp2	0.6143	0.2259	0.2048	0.8752
Comp3	0.3883	.	0.1295	1.0000
SATPUB	PC1	PC2	PC3	
SATIS	0.6130	−0.1759	−0.7702	
VALPOS	0.5371	0.8077	0.2431	
	0.5794	−0.5627	0.5896	

two refer to Mortality due to mental illness. Each of these pairs of columns use, respectively, the Gini index (GINI) and the Income quintile ratio (IQR) as measures of income inequality. The analysis applied to 17 regions of Spain reveals many important regional differences.

First, the results show that easy “Access” to health services is determinant to reduce Risk of illness and Mortality rates but is not significant to explain the Prevalence or burden of disease. Besides, the results show minor differences in the significance levels of this variable, *Access*, when the panel data in Table 4 is compared with the GMM results in Table 5; both yield qualitatively similar results that support the same conclusions. So, the longer the waiting time to access healthcare services and the number of patients awaiting a first consultation in specialized care, the higher the Risk of mental disorders and the higher the

Mortality. That is, early detection and, overall, easy access for the treatment of the most severe cases avoids bigger problems. By contrast, regions with limited access to mental health resources can delay diagnosis and intervention aggravating the problem. This means, as highlighted by [Santana and dos Santos \(2024\)](#) and [Domenico and Giuseppe \(2025\)](#), that the illness may vary depending on who has access and who is left unattended. Thus, it would be important to identify areas where psychological or psychiatric care services are insufficient, or to design interventions that distribute resources more equitably, for example, through the creation of new centers, the expansion of capacity in existing ones, the reorganization of patient allocation or the cooperation with other institutions such as schools or social services. It is also noteworthy, as expected, that the risk of developing a mental disorder is negatively associated with access to medical services, given that the availability of preventive care, psychosocial support, and early detection can reduce a person’s likelihood of developing a mental disorder in the future. In contrast, the prevalence of the disorder is not directly related to access to medical services. This may reflect the fact that even in contexts with good access to healthcare, prevalence can remain high if the burden of social and economic factors that contribute to the development of mental disorders is substantial. Consequently, while better accessibility to mental health services is generally expected to improve regional mental health outcomes, this hypothesis is only partially supported, since other factors may offset its effect on disease prevalence.

Focusing now on the fundamental objective of this work, socioeconomic conditions measured by the *Deprivation* and *Inequality* indexes are both positive and significant in the Spanish regions to explain the Risk

Table 4
Impact of regional inequality and other determinants on mental health. Panel data estimation.

	1	2	3	4	5	6
	Wellbeing		Prevalence		Mortality	
	GINI	IQR	GINI	IQR	GINI	IQR
Access	0.032** (2.05)	0.035** (2.14)	0.039 (0.36)	0.023 (0.21)	0.025* (1.94)	0.023** (1.99)
Deprivation	0.051** (2.24)	0.060** (2.45)	0.501*** (4.70)	0.510*** (4.83)	−0.005 (−0.04)	−0.002 (−0.17)
Inequality	0.013** (1.98)	0.012** (2.06)	0.126** (2.15)	0.175** (2.22)	0.005 (0.80)	0.109 (1.12)
Quality	−0.051*** (−3.34)	−0.052*** (−3.31)	−0.182* (−1.76)	−0.176* (−1.73)	0.010 (0.81)	0.009 (0.77)
Expenditure	−0.002** (−2.00)	−0.002* (−1.87)	−0.246* (−1.80)	−0.248* (−1.82)	0.013 (0.80)	0.012 (0.73)
Density	0.009 (0.17)	0.033 (0.41)	0.001 (0.68)	−0.001 (−0.56)	0.006*** (3.00)	0.006*** (3.06)
Constant	2.436 (6.78)	1.089 (0.29)	6.598 (3.48)	7.481 (4.96)	0.813 (1.87)	0.779 (1.91)
R ²	0.611	0.68	0.53	0.59	0.82	0.85
N.obs	204	204	204	204	204	204
P-value	0.69	0.74	0.23	0.56	0.00	0.00

t-student in parenthesis. P-value of the robust Hausman test [Ho: FE vs. RE]. The *, **, *** correspond to 10, 5, and 1 % significance levels respectively

Table 5
Impact of regional inequality and other determinants on mental health. GMM estimation.

	1	2	3	4	5	6
	Wellbeing		Prevalence		Mortality	
	GINI	IQR	GINI	IQR	GINI	IQR
Acces	0.034** (2.12)	0.033** (2.03)	0.132 (0.11)	−0.017 (−0.14)	0.017* (1.92)	0.074*** (2.62)
Deprivation	0.043* (1.94)	0.042* (1.93)	0.506*** (4.33)	0.524*** (4.41)	0.001 (0.13)	0.014 (1.17)
Inequality	0.011** (2.40)	0.130** (2.06)	0.118** (1.98)	0.180** (2.08)	0.003 (0.42)	−0.19 (−0.97)
Quality	−0.043*** (−2.76)	−0.04*** (−2.89)	−0.165 (−1.55)	−0.016* (−1.94)	0.007 (0.60)	−0.009 (−1.06)
Expenditure	−0.001* (−1.93)	−0.002** (−2.13)	−0.151* (−1.93)	−0.17** (−1.99)	−0.001 (−0.08)	0.321 (1.07)
Density	0.003 (1.31)	0.083 (0.10)	0.016 (0.92)	0.017 (1.03)	0.004** (2.22)	.0040*** (3.41)
Constant	3.024 (5.81)	2.319 (0.60)	3.872 (1.06)	4.131 (1.18)	1.175 (2.68)	1.647 (0.83)
Sargan test (p value)	1.00	1.00	1.00	1.00	1.00	1.00
AR1(p value)	0.04	0.02	0.01	0.01	0.03	0.02
AR2 (p-value)	0.07	0.09	0.39	0.36	0.32	0.36

t-student in parenthesis. The *, **, *** correspond to 10, 5, and 1 % significance levels respectively

of mental health and the Prevalence of the illness but not to explain the Mortality. The significance levels are very similar in the panel data and in the GMM for the case of variable *Inequality*, however, the panel data in Table 4 demonstrates significance at the 1 % level for the variable *Deprivation*, while the GMM of Table 5 achieves significance at the 5 % level. Despite this discrepancy, these outcomes are robust showing that more deprived regions are associated with higher Risk and Prevalence of mental disorders. The result also allows us to conclude that a higher level of deprivation and income inequality between regions generates a higher rate of cases but not deaths, highlighting the importance of the Spanish regional Health Service, which does not distinguish by income level. The results are robust, as both measures of inequality, the Gini index and the Income quintile ratio (IQR), lead to similar results. Research such as that conducted by Santana and dos Santos (2024) and Carnazza et al. (2025) aligns with these findings and links socioeconomic disparities to higher levels of stress, anxiety, and mental disorders. Therefore, it is crucial for mental health policies to incorporate a territorial approach that addresses socioeconomic inequalities as an intermediate objective aimed at reducing mental illnesses. The findings of Rahman et al. (2025) also support these results by suggesting the need for policies that reduce the direct financial burden on individuals for essential services, such as mental health prevention or universal coverage schemes that minimize or eliminate the costs that individuals must pay at the point of service. Overall, the findings support the hypothesis that mental illnesses are more common in regions facing economic stress and deprivation, and that greater economic inequality correlates with higher rates of mental health disorders.

Institutional factors also play an important role. The hospital quality measured by the experience and satisfaction perceived by patients and the amount expended in health by regions are both significative to avoid Risk of illness and reduce the Prevalence of the disease. The significance levels for the variables *Quality* and *Expenditure* are similar in the panel data model (Table 4) and the GMM model (Table 5). However, the comparison of the two t-statistics in Tables 4 and 5 of the variable *Expenditure*, when explaining the risk of mental illness in the case of the Income quintile ratio, indicates a difference in the strength of statistical significance that does not affect the robustness of the results. As both variables are negative, the higher the satisfaction with the Public Health system, the lower the spread of disease. Consequently, more formal and qualitative institutions, as well as less fragile or informal systems, are crucial for disease prognosis. Furthermore, regions with better-equipped health systems and greater endowments per capita have a lower risk and a lower burden of disease. As for the values obtained, they are those expected a priori as explained before in the review of literature (see

Bhavsar et al., 2019 and Stokes et al., 2021) and are in line with the theories of Carnazza et al. (2025), who indicate that in regions with higher healthcare quality, patients are more easily attracted or in line with Asensio et al. (2021) who show that Spanish hospitals with higher quality outcomes and research productivity had lower readmission rates for common and severe mental disorders. However, none of these two variables are significative to explain Mortality. The most likely explanation is that many mental illnesses significantly affect quality of life, but they are not always immediately life-threatening, and in some cases, they may not even be recorded as the primary cause of death on medical certificates. Additionally, individuals with serious mental illnesses can live for many years if they receive appropriate treatment (such as medication, psychotherapy, and social support) and have unrestricted access to public healthcare, as is the case in the Spanish regions. Consequently, direct mortality from mental illness tends to be relatively low, even though prolonged suffering may occur. Considering that mortality is a complex outcome explained by numerous factors, many of which are beyond the hospital's control, observed differences in mortality in this context are likely more influenced by lifestyle behaviors or the prevalence of chronic diseases. In summary, the hypotheses that higher medical spending and better quality of medical institutions are associated with higher rates of mental health disorders are generally supported, except in the case of Mortality and suicides, which is a more complex outcome and sometimes beyond the control of hospitals themselves.

Finally, the results obtained show that *Density* of population does not affect Percentage of risk of mental disorders or the Prevalence of registered mental disorders but affects positively the Suicide mortality rate per 100,000 inhabitants. The reason can be that in urban areas, despite having more resources to ask for help than in rural areas, factors such as perceived social isolation, chronic stress and socioeconomic pressure can increase the risk of death. Also, environmental pollution, easier access to substances of abuse, reduced physical activity and sunlight exposure, and greater genetic risk have all been proposed as possible mediators.

Overall, these results suggest that mental health is determined by a combination of territorial, socioeconomic, and organizational factors. Effective policies should combine: (i) the reduction of regional inequalities and the strengthening of local capacities, (ii) strategic planning of medical services, particularly those aimed at addressing deficiencies in mental health care, and (iii) investment in health and reduction of direct costs for individuals. This integrated approach allows mental health to be addressed as a multidimensional phenomenon, promoting both equity and efficiency in service provision and in the

creation of environments that support psychological well-being. In other words, it involves designing mental health policies that tackle regional disparities, improve equitable access to necessary services, and minimize the financial burden of psychological or psychiatric care.

5. Conclusions

The main objective of this work has been to analyze whether inequality in income distribution together with socioeconomic factors and other determinants influences Risk of poor mental health, Prevalence in Registered mental disorders, and Mortality in mental disorders, that is, wellbeing, illness and mortality rates, and how the regional public health system mitigates these effects in the context of the Spanish regions. The topic has been analyzed at a regional level, as few investigations have addressed regional disparities in mental health outcomes or fully explained variations in serious psychological distress. As mental disorders become increasingly prevalent, they are recognized not only as individual challenges but also as pressing social issues. Therefore, understanding regional differences is essential for improving efforts to reduce mental health disparities and for developing targeted, region-specific strategies for prevention and care.

Among the main novelties of the paper, we can highlight, first, the analysis of not only diagnosed mental illnesses but also the analysis of the risk of mental health and serious psychological distress; second the use of Principal Component Analysis for modeling indexes at regional level to measure the relevant socio-economic dimension, the accessibility to patient care or the perceived quality of the medical system; and third, the use of a regional perspective in the study of mental disorders, not well elucidated in the literature.

The main results show that regions with a higher level of income inequality generate a higher Risk of poor mental health and a higher rate of Registered mental disorders, but do not increase suicides, highlighting the importance of the Spanish regional Health Service, which does not distinguish by income level. Hence, deprivation, unemployment and poverty levels are closely linked to increased psychological distress and illnesses and income inequalities between regions are associated with higher levels of mental disorders. Access to health services is determinant to reduce Risk of illness and Mortality rates but are not significative to explain the prevalence or burden of disease. That is early detection reduces risk and suicides while limited access to mental health resources in underserved areas can delay diagnosis and intervention. By contrast, regions with better valued health institutions and higher health endowments have a lower risk and a lower prevalence of disease. And furthermore, urban environments in particular present unique challenges that can hinder mental health outcomes, highlighting the need for regionally tailored strategies within public health systems. These results show that mental health status is not an exception to the social pattern, as disparities in regional income and deprivation translate into unequal mental health outcomes.

In view of the results, the increasing prevalence of mental disorders presents a significant public health challenge. Mental health outcomes are not evenly distributed across regions, and they are deeply influenced by regional socioeconomic conditions, access to care, and urbanization levels. Therefore, a good approach to mental health policies must strengthen economic support, promote healthy connections and address the specific needs and vulnerabilities of different regions requiring interventions that account for local disparities in income, education, employment, and healthcare infrastructure. Concretely, they should be more active in the most deprived areas. These targeted strategies are essential to reduce the burden of mental disorders, promote equity in mental health services, and ultimately improve population well-being across diverse geographic areas.

More precisely, the paper suggests that effective policies should combine several measures. First, sharper focus on improving socioeconomic factors, reducing regional inequalities and strengthening local capacities to develop their economies. Second, strategic planning of

medical services, particularly those aimed at addressing deficiencies in mental health care by allocating equitable funding to underserved areas to ensure access to basic mental health services, expanding community-based mental health programs such as local support networks or enhancing partnerships between health authorities, social services, schools, and non-governmental organizations to coordinate care. A good point would be prioritizing integration of mental health into primary care, ensuring that general practitioners are trained to detect and manage common disorders or develop specialized regional centers for severe or complex cases, reducing waiting times and travel barriers. And third, increase investment in health, reducing at the same time the direct costs for individuals.

This integrated approach suggests that mental health must be seen from the regional point of view as a complex, multifaceted issue that needs to be addressed developing policies that reduce regional gaps, ensure fair access to essential services, and reduce the economic strain associated with mental health treatment.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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