Chapter 3

Heterogeneous Effects of Community-Based Interventions on Mental Health: Evidence from Catalonia

Abstract

This paper evaluates the impact of an intersectoral public health policy implemented in Catalonia, aimed at improving population well-being through enhanced community engagement and the promotion of social activities. Leveraging regional variation in the intensity of policy implementation over time, I examine both the overall and heterogeneous relationship between policy exposure and a validated measure of mental health. The results find no significant association at the population level. However, I find that higher policy intensity is associated with improved mental health outcomes among immigrants and, to a lesser extent, young adults. The results have policy implications that can help increase the efficacy of similar interventions.

3.1 Introduction

Mental health disorders are highly common. Globally, nearly a billion people live with a diagnosable mental disorder (WHO, 2022). Mental health is a fundamental part of individual well-being, influencing how people think, feel, and function in daily life. Poor mental health is associated with lower life satisfaction, reduced physical health, and a higher risk of chronic conditions such as cardiovascular disease (Prince et al., 2007; WHO, 2022). Mental disorders like depression and anxiety are among the leading causes of disability worldwide, contributing significantly to years lived with disability and overall disease burden (GBD, 2022). In many cases, mental health conditions also lead to social isolation and difficulties in personal relationships (Prizeman et al., 2023), as well as lower educational attainment (Breslau et al., 2008; Hysenbegasi et al., 2005). As such, improving mental health is not only critical for reducing suffering but also for enabling individuals to lead fulfilling and productive lives.

Aside from its importance at the individual level, mental health has clear economic consequences. Mental disorders reduce labor supply and worker productivity, and they are a source of long-term social costs. The OECD estimates that mental ill-health accounts for over 4% of GDP in many countries, with more than a third of the cost arising from lower employment and productivity rather than direct healthcare spending (OECD, 2021). In the workplace, depression and anxiety lead to both absenteeism and presenteeism—when workers are present but unable to perform at full capacity. Evans-Lacko and Knapp (2016) find that the annual productivity loss per worker with depression ranges from US$181 to over US$5,500, with presenteeism consistently accounting for a larger share of the total cost, making mental health a significant source of productivity loss and economic inefficiency. The need to strengthen mental health systems has been recognized for decades (WHO, 2001), yet the burden of mental disorders continues to grow. In recent years, this burden has been increased by the COVID-19 pandemic, which disrupted access to care and worsened

mental health outcomes across populations. Looking ahead, global challenges such as climate change, forced migration, and population displacement are likely to intensify existing mental health issues. In this context, mental health policies and plans (MHPPs) are among the policy tools to improve overall mental health. Since 2013, roughly two-thirds of countries in the WHO European Region have adopted or updated MHPPs (WHO, 2018). Despite this trend, empirical evaluations of the effectiveness of such policies remain limited. Aliev et al. (2023) conclude that there is a lack of rigorous evidence on whether these plans produce measurable improvements in mental health outcomes. This paper contributes to filling this gap by evaluating the effect of the PINSAP policy in Catalonia on overall mental health—an intersectoral initiative aimed at promoting social activities and community engagement to support general well-being. Using population-representative survey data, the analysis examines both the overall impact of the policy on mental health and its heterogeneous effects across subgroups, particularly those who may be more vulnerable to social isolation.

There is substantial evidence that participation in social activities improves mental health. Engaging in social activities can buffer stress through increased social support (Cohen and Wills, 1985), strengthen one's sense of belonging and identity (Haslam et al., 2009), and enhance self-efficacy and emotional well-being through meaningful social interaction (Thoits, 2011), all of which contribute to better mental health outcomes. Starting in 2014, the government of Catalonia introduced the PINSAP initiative—a policy designed to strengthen community health through intersectoral collaboration and the mobilization of local social assets. The program aims to promote social connectedness by encouraging community-based activities and partnerships across health, education, and social services. Using the variation in the intensity of the policy's implementation across health sectors and years, this paper examines whether the policy contributed to improvements in mental health as measured by the eight-item Patient Health Questionnaire (PHQ-8)—a validated instrument for

assessing the severity of depressive symptoms in population-level studies (Kroenke et al., 2009). I measure the intensity of PINSAP's implementation using the number of registered social activities in each health sector and year; registering activities on the Assets and Health platform was a central part of how the policy was operationalized locally, so while an imperfect measure, it plausibly captures meaningful variation in the intensity of the policy's local rollout.

The estimation results do not find a clear effect of the policy on average mental health outcomes in the overall population. However, the policy is associated with improved PHQ-8 scores among immigrants, and, to a more modest extent, among young adults aged 18 to 39. These findings have policy implications for improving the effectiveness of the intervention. First, targeting population subgroups that appear to benefit more from the policy—such as immigrants—can enhance the overall impact and efficiency of the intervention. Second, given that one of the stated objectives of the policy was to promote the well-being of older adults, the lack of observable improvements in this group highlights the need for further investigation. It is possible that older individuals face higher informational or behavioral barriers in accessing or engaging with the policy's components. Alternatively, the types of activities promoted may be more appealing or accessible to younger people. Identifying and addressing such limitations could help increase the policy's reach and effectiveness among older adults and other underserved groups.

Ideally, identifying the causal effect of PINSAP on mental health would require data from before the policy's implementation, as well as data from a comparable region that did not adopt the policy, so that pre-existing trends and unrelated shocks could be more credibly ruled out. The data used in this paper are only available after PINSAP's implementation, and only for Catalonia, so this ideal design is not available here. The structure of the data and the way the policy was implemented do, however, offer some useful features that help identify its potential effects. First, the

mental health outcomes are drawn from the Catalan Health Survey (ESCA), a rich and representative dataset covering the entire population of Catalonia. This allows for controlling individual-level characteristics and conducting the analysis across the entire region. Second, there is variation in the intensity of the policy's implementation across health sectors and over time, which helps control for location- and year-specific factors that may influence mental health outcomes through region and year fixed effects. These features do not, on their own, establish a causal relationship. In particular, the estimates could still be biased by reverse causality, if regions with worse mental health outcomes register more social activities in response, or by unobserved factors that vary jointly across regions and years and are correlated with both activity intensity and mental health. Section 3.6 discusses these concerns and the steps taken to address them in more detail. Given the available data, this design represents an attempt to approximate that ideal setup.

The remainder of the paper is structured as follows. Section 3.2 reviews the relevant literature. Section 3.3 provides background on the PINSAP policy. Section 3.4 describes the data sources. Section 3.5 outlines the estimation strategy. Section 3.6 presents the identification strategy. Section 3.7 presents the main results. Section 3.8 discusses the policy implications. Section 3.9 concludes.

3.2 Literature

This paper is first related to a branch of literature examining the relationship between social connectedness, community engagement, and mental health. Although this paper does not directly estimate the effect of individual-level engagement, it evaluates a policy that is designed to operate through enhancing social support and participation within communities. Several empirical studies have found that greater social support and more frequent participation in community or social activities are associated with

improved mental health outcomes (Åhlin et al., 2018; Billedo et al., 2019; Crowe and Butterworth, 2016; Misawa and Kondo, 2019; Scardera et al., 2020; Choi et al., 2021; Wickramaratne et al., 2022). However, much of this literature focuses on specific subpopulations, often using relatively small or non-representative samples. In contrast, this paper draws on a representative sample of the population of Catalonia to examine how the mental health effects of the PINSAP policy—intended to promote social connectedness—vary across different groups. I find that the policy improves mental health outcomes among certain subgroups, particularly immigrants, even though no statistically significant association is detected at the population level.

Second, this paper is also related to a strand of research evaluating the effectiveness of public policies and programs—particularly social prescribing initiatives—aimed at improving mental health through enhanced social connection. Examples of such work include Dayson and Bennett (2016), which examines the early implementation of social prescribing programs in the UK, and Thomson et al. (2020), which provides a broader review of social prescribing models and their potential for improving mental well-being. While these studies have their own merits, many of the interventions evaluated are confined to single settings or pilot programs, often with limited scope or reach (Sonke et al., 2023; Galvez-Hernandez et al., 2022). This raises important questions about the external validity and generalizability of their findings, particularly when applied to broader population-level contexts. In contrast, few studies have assessed the impact of national or region-wide policies explicitly designed to influence social connectedness and mental health at scale. One such example is Li et al. (2024), who evaluate the UK's Campaign to End Loneliness and find modest improvements in loneliness and subjective well-being among older adults. Another closely related study is Galvez-Hernandez et al. (2025), which focuses on the effect of the PINSAP policy in Catalonia on perceived social support among older adults. This paper builds on this line of research by examining the broader mental health effects of the same

policy across the entire population, while also analyzing heterogeneous impacts across different demographic subgroups. In doing so, it contributes new evidence on the population-level efficacy of policies that seek to improve mental health by bolstering social connection and community engagement.

3.3 Policy Background

Catalonia is an autonomous community in northeastern Spain, composed of four provinces: Barcelona, Girona, Lleida, and Tarragona, with a population of around 8 million people. Covering roughly 32,100 km^2, Catalonia is one of Spain's largest regions in terms of area. Economically, it ranks second in gross domestic product, with a total GDP of $307 billion and a per capita GDP of about $38,400—approximately 14% above the national average.

In February 2014, the Government of Catalonia approved the Inter-ministerial Public Health Plan (PINSAP) as a "Health in All Policies" strategy. This plan, embedded in Catalonia's Public Health Law, requires all government departments to collaborate on improving health determinants, making PINSAP a binding cross-sector policy. An Interdepartmental Health Commission with every ministry helped design PINSAP, drawing input from 42 local, social, and scientific organizations. PINSAP set out about 30 intersectoral initiatives targeting the social, economic, and environmental factors of health—with special emphasis on reducing health inequalities and assessing health impacts of policies. In essence, it aimed to leverage each sector's influence on health to create healthier policies and environments for the population (i Serra, 2015).

This initial stage of PINSAP focused on improving population health by acting on the broader determinants of health. More than a thousand initiatives were developed across government departments, municipalities, and community organizations, with

a strong emphasis on community-based health promotion. A key innovation was the development of the "Finder of Assets and Health," an online platform created by Catalonia's Public Health Agency to support local intersectoral committees. This tool mapped community resources—such as seniors' social clubs, physical activity groups, and cultural programs—and helped professionals refer individuals to relevant local supports. For example, a physician could direct an older patient experiencing loneliness to a nearby walking group, integrating social support into public health delivery. Beginning in 2017, the next stage of the plan placed greater emphasis on reducing health inequalities by addressing the broader social and environmental determinants of health. Framed around the idea that health is a fundamental human right, it pushed for the inclusion of health considerations across all areas of government policy—extending this expectation to municipal governments as well. This phase also introduced a more layered governance approach, expanding the intersectoral collaboration to include not only the Catalan government but also regional, municipal, and community levels. It prioritized eight complex health challenges, including social exclusion and mental health, and promoted systematic evaluation to ensure that policy actions translated into measurable health improvements.

Under the PINSAP policy, two major programs were launched to integrate a community perspective into healthcare: the Community Health Program and the Social Prescribing and Health Program. The Community Health Program aimed to reorient primary care toward health promotion, community engagement, and equity by encouraging collaboration across sectors and adjusting health initiatives based on local needs. The Social Prescribing program complemented this by training healthcare professionals to identify social risks—such as isolation or inactivity—and connect individuals to community resources. Both programs were implemented locally through intersectoral committees that brought together primary care providers, municipal officials, civil society organizations, and public health professionals (Galvez-Hernandez

et al., 2025). These committees operated at the neighborhood or municipal level and were supported by a centralized digital platform—the Finder of Assets and Health—which mapped community resources such as walking groups, cultural events, or senior programs. This infrastructure enabled locally adapted, asset-based interventions designed to promote well-being through social connection. The reach and intensity of these initiatives vary across regions, based on region-specific context and the existing collaboration network (Oh et al., 2021).

It is worth clarifying what source of variation this paper exploits. PINSAP was adopted as a single, statewide policy beginning in 2014, rather than rolled out to different health sectors at staggered points in time; there is no sector-by-sector adoption date to exploit. Instead, the empirical strategy relies on variation in the intensity of local implementation—proxied by the number of registered social activities—across health sectors and over time, conditional on region and year fixed effects. This is a design based on continuous policy intensity rather than staggered treatment timing.

3.4 Data

This paper uses three sources of data to evaluate the impact of the PINSAP program on depression levels in the general population as well as among specific subgroups at risk of social exclusion. The primary dataset is the Catalan Health Survey (ESCA) from 2017–2021.[1] ESCA collects detailed information on individuals' health status, health behaviors, socioeconomic characteristics, and healthcare utilization across Catalonia. Each year, a random sample of individuals is drawn, and the survey is representative at both the regional and population levels.

To account for individual-level covariates, I control for age, gender, and education level. Education is reported on a 1–10 scale, where higher values indicate higher levels of educational attainment; scores 1–3 correspond to primary education (from

[1] Enquesta de Salut de Catalunya

illiteracy to completed primary education), scores 4–7 represent secondary education (from early secondary education to higher vocational training), and scores 8–10 denote university-level education (from undergraduate to doctoral degrees).

This paper focuses on three population subgroups for which the effect of PINSAP is separately estimated: immigrants, individuals living in single-person households, and people in different age groups. These groups are selected based on their potential vulnerability to social isolation and exclusion. Age is categorized into three brackets: young adults (18–39), middle-aged adults (40–59), and older adults (60 and above), allowing for an assessment of heterogeneous effects across different life cycles.

This paper uses a validated measure of depressive symptoms to assess mental health status: the Patient Health Questionnaire-8 (PHQ-8). The PHQ-8 is a widely used screening tool for depression and serves as the primary instrument for capturing the presence and severity of depressive symptoms in the ESCA survey. It is derived from the PHQ-9 scale, with the ninth item on self-harm excluded in accordance with ESCA's adaptation. Respondents are asked how frequently they experienced specific depressive symptoms over the past two weeks, with responses scored from 0 ("never") to 3 ("nearly every day"). The total score ranges from 0 to 24, with higher scores indicating more depressive symptoms.

The PHQ-8 has been adopted by the European Health Survey and is recognized as a reliable and comparable indicator of mental health across populations. Beyond its strong psychometric properties, it provides a practical and scalable tool for identifying individuals at risk of depression and tracking mental health trends over time.

Panel A of Table 3.1 presents summary statistics for the individual-level variables used in the analysis, covering the years 2017 to 2021. The dataset contains 16,409 observations, with PHQ-8 scores available for approximately 93% of the sample.

Second, this paper uses data on regional social activities as a proxy for the intensity of the PINSAP policy. These data are obtained from the Assets and Health

platform, which collects information on community-based health initiatives. Specifically, the dataset includes details such as activity descriptions, dates of operation, and geographic location. The information was compiled using web scraping techniques applied to over 50,000 websites within the platform (Galvez-Hernandez et al., 2024). For the purposes of this study, only activities targeting individuals aged 18 and over have been retained.

Panel B of Table 3.1 summarizes the total number of registered social activities and the weather suitability measure (described below) at the region-year level, across the 32 health sectors during the period 2017–2021; each observation in Panel B corresponds to one health sector in one year, so the underlying data are a health-sector-by-year panel rather than a single cross-section. On average, there are 14 activities per sector-year, though there is substantial variation in coverage and intensity. Figure 3.1 illustrates the distribution of activities across region-years: while 30% of health sector-years recorded no activities, others registered over 100. This wide dispersion in exposure to social initiatives is useful to the empirical strategy, as it allows for the identification of differences in mental health outcomes that might be attributable to variation in policy implementation across regions and over time.

Finally, the empirical strategy controls for time-invariant regional factors and region-invariant time shocks through the inclusion of region and year fixed effects, respectively. However, there may remain factors that vary jointly across regions and years and that are correlated with both the number of registered activities and mental health outcomes in a given health sector. One such factor is weather. In years with more favorable weather conditions, outdoor social activities may be both easier to organize and more conducive to improved mental health, independently of the policy itself.

To account for this, I construct a region-year level measure of weather suitability using hourly temperature data from the ERA5 reanalysis dataset, obtained from the

Copernicus Climate Data Store (Copernicus Climate Change Service (C3S), 2017; Hersbach et al., 2020). For each health sector, I match the nearest available grid cell and calculate the daily mean temperature. I then compute the proportion of days in each year for which the average temperature falls between 9°C and 26°C, a range considered suitable for outdoor activity. Panel B of Table 3.1 reports summary statistics for this measure, *propSuitable*, at the region-year level.

Table 3.1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A: Individual-Level Variables (ESCA, 2017–2021)					
Age	16,408	52.647	19.791	18	106
Gender	16,408	0.510	0.500	0	1
Education	16,408	5.640	5.474	1	10
Household Size	16,408	2.808	1.241	1	13
Immigrant	16,409	0.064	0.244	0	1
PHQ-8	15,216	2.898	4.443	0	24
Panel B: Region-Year Variables (32 Health Sectors × 5 Years)					
Activities	160	14.450	22.961	0	153
propSuitable	160	0.773	0.114	0.430	0.967

Notes: Panel A reports individual-level summary statistics from the ESCA survey. Panel B reports region-year level summary statistics (160 = 32 health sectors × 5 years); *propSuitable* is the proportion of days in a given health-sector-year with mean temperature between 9°C and 26°C.

3.5 Estimation

To examine the effect of the PINSAP program on the mental health of residents in Catalonia, this paper estimates a multivariate regression model in which the dependent variable is the PHQ-8 score of individual i in health sector j in year t. The key explanatory variable is the number of social activities registered in health sector j in year t, used as a proxy for the intensity of policy implementation. The regression specification is as follows:

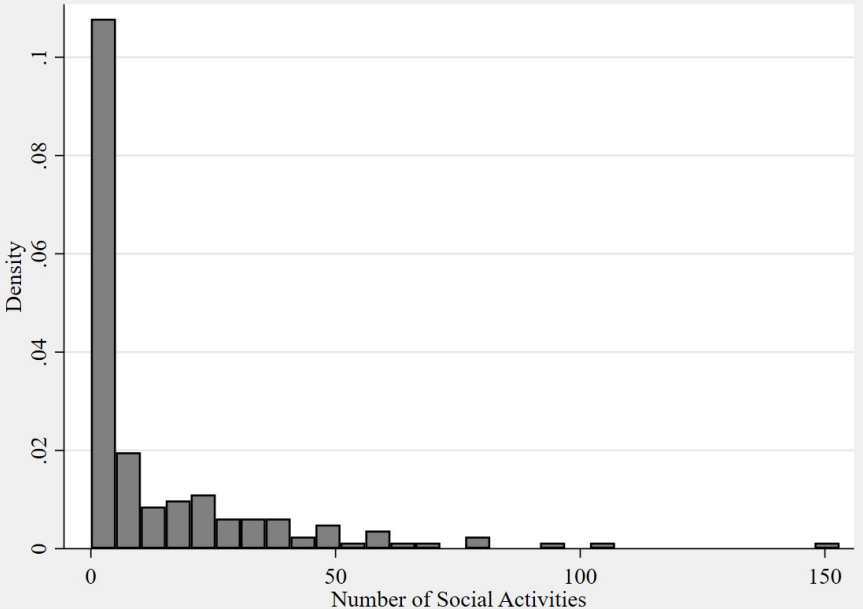


Figure 3.1: Distribution of Registered Activities

$$PHQ8_{ijt} = \alpha_0 + \alpha_1 X_i + \beta \times activities_{jt} + \gamma_t + \gamma_j + \epsilon_{ijt} \tag{3.1}$$

Where $PHQ8_{ijt}$ is the PHQ-8 score, $activities_{jt}$ is the number of activities registered in region j and year t, X_i is a vector of individual characteristics of i, comprising gender, age, and education level, γ_t the time fixed-effect, and γ_j the region fixed-effect.

While estimating the average effect of the PINSAP program on the entire population is informative, it is unlikely that the policy's impact is homogeneous across all individuals. The program is designed to improve mental health by increasing social participation and enhancing individuals' social ties. However, people differ significantly in their baseline levels of social connectedness, their need or willingness to form new social relationships, and their ability to access or learn about the available activities introduced under the policy. As a result, the potential for individuals to benefit from PINSAP may vary substantially across demographic groups.

With these considerations in mind, this paper examines heterogeneous effects of the policy, with particular attention to population subgroups that are more likely

to experience social isolation. One such group is immigrants. Prior research consistently finds that immigrants tend to have weaker or less resource-rich social networks compared to native-born populations, which in turn has implications for their mental health (Brydsten et al., 2019). Beyond this vulnerability, community-based interventions of the kind promoted under PINSAP are also among the specific approaches recommended for this population: the WHO's guidance on refugee and migrant mental health highlights promoting community support and social inclusion—for example, through community forums and peer mentorship—as a core intervention (World Health Organization, 2025), and reviews of community-based interventions among immigrant and resettled populations have associated programs that promote integration and social connection with improvements in depression and anxiety outcomes. This suggests both that immigrants may have more to gain from a policy of this kind, and that this particular type of intervention has some precedent for being effective for this population.

To formally assess whether immigrants benefit more from the policy, I estimate the following specification:

$$PHQ8_{ijt} = \alpha_0 + \alpha_1 X_i + \beta \times activities_{jt} + \beta^{immigrant} \times activities_{jt} \times immigrant_{ijt} + \zeta^{immigrant} \times immigrant_{ijt} + \gamma_t + \gamma_j + \epsilon_{ijt} \tag{3.2}$$

Here, $\beta^{immigrant}$ captures the difference in the effect of regional social activity intensity on the mental health of immigrants compared to the overall population. A stronger negative estimate relative to the baseline specification would suggest that this group benefits disproportionately from the policy—consistent with the idea that enhancing social participation has greater marginal returns for those starting from a more isolated position.

Second, individuals living in single-person households are more likely to experience limited social networks and poorer mental health outcomes. Prior research has documented this pattern across a range of settings: Hughes and Gove (1981) show that unmarried people living alone are more likely to engage in maladaptive behaviors such as drug and alcohol use; Perissinotto et al. (2012) find that older adults living alone face higher rates of functional decline; and Honjo et al. (2018) find that solo living among older adults is associated with increased depressive symptoms, particularly in areas with weaker community ties. Given that the PINSAP program aims to improve mental health through enhanced social participation, its effect may be more pronounced among individuals who live alone, as they are likely to gain more from opportunities to build or restore social connections. To examine this, I estimate the following regression:

$$\begin{aligned} PHQ8_{ijt} = \alpha_0 + \alpha_1 X_i + \beta \times activities_{jt} + \beta^{solo} \times activities_{jt} \times solo_{ijt} \\ + \zeta^{solo} \times solo_{ijt} + \gamma_t + \gamma_j + \epsilon_{ijt} \end{aligned} \tag{3.3}$$

The coefficient β^{solo} captures the difference in the effect of regional social activity intensity on the mental health of individuals who live alone compared to the entire population.

Finally, this paper examines whether the effect of the PINSAP program varies across different age groups. There are several reasons to expect heterogeneity in the policy's impact by age. First, one of the explicit motivations behind the program was to improve the mental well-being of older adults, who are at greater risk of social isolation and depression. Catalonia has a high average age of 43, making the health of older populations a policy concern. Assessing whether the policy has been effective across age groups is therefore directly relevant to its stated goals.

Second, individuals of different ages may differ in their ability to learn about

and engage with new social initiatives. Younger adults, for example, may face fewer informational or logistical barriers when accessing community activities and may thus be more easily reached by the policy. This raises the possibility that the observed effects of the program may vary not only due to differences in baseline mental health, but also because of differences in exposure and responsiveness.

Finally, understanding age-specific effects can be informative on the nature of the registered social activities themselves. If the program is found to be more effective for certain age groups, it may suggest that the content, format, or outreach strategies of the activities are better suited to those populations. Identifying the true mechanism could inform future efforts to tailor social interventions more effectively.

I estimate the following regression separately for each age group $g \in \{young, mid, old\}$, to account for the heterogeneous effect of the intervention across age groups:

$$PHQ8_{ijt} = \alpha_0 + \alpha_1 X_i + \beta^g \times activities_{jt} + \gamma_t + \gamma_j + \epsilon_{ijt}, \quad \text{estimated separately for } g \in \{young, mid, old\} \tag{3.4}$$

Where β^g captures the effect of policy intensity on individuals in age group g, estimated on the subsample of individuals belonging to that group. Each age group is defined identically to Section 3.4, and the coefficient of interest, β^g, is reported separately for each subsample in Tables 3.5–3.7.

3.6 Identification Strategy

To obtain a consistent estimate of β, the usual endogeneity concerns must be addressed. The first concern is the presence of unobserved variables that may be correlated with both the number of registered activities and the error term ϵ_{ijt}. One such source of bias arises from time-specific shocks that affect all individuals but are also

correlated with the rollout of activities. For instance, the COVID-19 pandemic occurred during the study period and likely had a substantial impact on mental health outcomes. Simultaneously, the number of registered social activities generally followed an upward trend over time. If such temporal variation is not accounted for, it prevents a consistent estimation. To address this issue, the model includes year fixed effects γ_t, which absorb any shocks or trends that are common across regions within a given year.

A second potential source of bias stems from unobserved, time-invariant regional characteristics. Different health sectors may vary in their baseline levels of mental health due to factors such as long-standing socioeconomic conditions, cultural attitudes toward mental well-being, or access to healthcare services. Likewise, the number of social activities registered may differ systematically across regions for reasons unrelated to the policy itself. For example, regions with more green space or higher average income may be more likely to host such activities, and these factors may also influence mental health outcomes. To control for these region-specific confounders, the model includes region fixed effects γ_j, which account for any time-invariant differences across health sectors.

The inclusion of both year and region fixed effects, along with controls for individual-level covariates X_i, helps isolate within-region, over-time variation in the intensity of social activities that is plausibly exogenous to other determinants of mental health. This identification strategy enhances the credibility of the estimated effect of the PINSAP program on depressive symptoms, as measured by the PHQ-8 score.

Another concern for identifying β is the possibility of simultaneity. That is, the number of social activities registered in a given region may not be fully exogenous to mental health outcomes in that region. In particular, regions with more severe mental health problems may become a greater focus for local policymakers or community organizations, prompting them to register more social activities in response

to worsening conditions. In this case, the variation in activity intensity would be, at least in part, a reaction to the outcome the policy aims to influence.

This scenario creates a reverse causal link—worse mental health leading to more activities—which can bias the estimated coefficient on activities. Specifically, it would result in a positive correlation between the number of activities and the error term in the regression, causing the estimated effect of activities on mental health to be biased toward zero. Therefore, any estimated negative effect of social activities on PHQ-8 scores should be interpreted as a conservative estimate of the policy's effectiveness.

Nevertheless, the identification strategy employed in this paper is subject to a number of identification concerns. Unobserved factors that vary both over time and across regions may still confound the estimated relationship. For example, while year fixed effects absorb common shocks such as the COVID-19 pandemic, the intensity of such shocks may have differed across regions, potentially affecting mental health outcomes in ways not captured by the model. Moreover, region-specific characteristics may not have remained constant throughout the study period, and the assumption of time-invariant regional confounders may not fully hold. Further, the underlying factors that determine the intensity of PINSAP implementation across regions are not directly observable in the data. These may include pre-existing networks of collaboration between institutions, the strength of local social infrastructure, or the geographic distribution of social and mental health needs. Without information on these factors, it is difficult to fully rule out bias in the analysis.

Notwithstanding, the approach used in this paper reflects the best effort possible given the available data and the complexity of the institutional context surrounding the policy. While some important mechanisms and sources of variation remain unobserved, the analysis aims to make the most of the information at hand, while being transparent about its limitations.

3.7 Results

3.7.1 Main Effect

Table 3.2 presents the estimation results corresponding to Equation 3.1. The coefficient on the number of registered social activities is negative, as expected, suggesting that greater policy intensity is associated with lower PHQ-8 scores. However, the estimate is not statistically significant, and as such, the analysis is unable to confirm an association between the number of social activities and mental health outcomes in the overall population.

The year fixed effects indicate significantly higher PHQ-8 scores in 2020 and 2021 compared to the base year, 2017. This pattern is consistent with the occurrence of the COVID-19 pandemic, which likely contributed to widespread declines in mental health during those years.

The coefficient on the gender variable shows that, on average, females report higher PHQ-8 scores than males. While this result is not the focus of the analysis, it is consistent with the existing literature documenting gender differences in reported levels of psychological distress and depressive symptoms (Salk et al., 2017).

Table 3.2: Main Effect of Policy Intensity on PHQ-8

	(1) PHQ-8
Activities	−0.0017
	(0.0034)
2018	0.288**
	(0.115)
2019	0.305
	(0.194)
2020	0.836***
	(0.282)
2021	0.567***
	(0.202)
Female	1.360***
	(0.082)
Age	0.0194***
	(0.0021)
Education	−0.0492***
	(0.0096)
propSuitable	−0.083
	(2.260)
Constant	1.629
	(1.594)
Region FE	Yes
Year FE	Yes
Observations	15,216

Notes: Standard errors, clustered at the region level, in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Region fixed effects are estimated but not reported.

3.7.2 Immigrant Heterogeneity

Table 3.3 presents the estimation results of Equation 3.2, which includes an interaction between the number of social activities and immigration status. The coefficient on the interaction term is -0.0098 and is statistically significant at the 1% level, considerably larger in magnitude than the (statistically insignificant) base effect for the general population. This suggests that the mental health of immigrants may have responded more strongly to the PINSAP policy relative to non-immigrants.

To illustrate the magnitude, consider that in 2021, the average number of activities registered in a region was 23. Multiplying this by the interaction coefficient implies a PHQ-8 score reduction of approximately 0.22 points among immigrants exposed to average policy intensity. While this is smaller than what is typically observed in clinical settings, it is still meaningful at the population level. For comparison, a study on the responsiveness of the PHQ-9 to antidepressant treatment finds an average score reduction of 1.8 points (Löwe et al., 2006). Of course, any direct comparison must consider the nature and cost of the intervention; while pharmacological treatments are resource-intensive and individualized, PINSAP is a community-level intervention. Unfortunately, detailed cost information for PINSAP implementation is not available, limiting the ability to perform a full cost-effectiveness comparison.

Table 3.3: Immigrant Heterogeneity in Policy Effect on PHQ-8

	(1) PHQ-8
Activities	−0.0014
	(0.0033)
Activities × Immigrant	−0.0098***
	(0.0029)
2018	0.291**
	(0.115)
2019	0.311
	(0.194)
2020	0.845***
	(0.282)
2021	0.580***
	(0.202)
Female	1.366***
	(0.082)
Age	0.0182***
	(0.0022)
Education	−0.0485***
	(0.0097)
Immigrant	−0.353***
	(0.119)
propSuitable	−0.135
	(2.255)
Constant	1.730
	(1.594)
Region FE	Yes
Year FE	Yes
Observations	15,216

Notes: Standard errors, clustered at the region level, in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Region fixed effects are estimated but not reported.

3.7.3 Solo-Household Heterogeneity

Table 3.4 presents the regression results from Equation 3.3, which examines whether the effect of social activity intensity on mental health differs for individuals living in single-person households. The interaction term is negative, but not statistically significant. Therefore, we cannot confirm that the policy had a measurable effect on the mental health of individuals living alone.

To further investigate whether the policy may have had a targeted impact on particularly vulnerable subgroups, the analysis was repeated for individuals aged 60 and above who live alone. This result is included in the appendix (Table 3.8) for reference.

Table 3.4: Solo-Household Heterogeneity in Policy Effect on PHQ-8

	(1) PHQ-8
Activities	−0.0017
	(0.0037)
Activities × Solo	−0.0014
	(0.0072)
2018	0.297**
	(0.115)
2019	0.315
	(0.194)
2020	0.841***
	(0.281)
2021	0.570***
	(0.201)
Female	1.350***
	(0.081)
Age	0.0176***
	(0.0020)
Single-Person Household	0.487***
	(0.142)
Education	−0.0496***
	(0.0096)
propSuitable	−0.110
	(2.248)
Constant	1.685
	(1.580)
Region FE	Yes
Year FE	Yes
Observations	15,216

Notes: Standard errors, clustered at the region level, in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Region fixed effects are estimated but not reported.

3.7.4 Age Heterogeneity

Table 3.5 presents the regression results for the subgroup of young adults (aged 18–39), while the corresponding estimates for middle-aged and older individuals are included in the appendix (Tables 3.6 and 3.7). For the younger group, the coefficient on the number of registered social activities is -0.0090 and is statistically significant at the 10% level ($p = 0.083$), suggesting that increased policy intensity is associated with somewhat lower PHQ-8 scores for this group, though the evidence here is more modest than for the immigrant subgroup. In contrast, the coefficients for the other two age groups are not statistically significant.

This finding is consistent with the possibility that younger individuals may benefit somewhat more from the PINSAP program in terms of improved mental well-being, though the evidence should be read with the appropriate caution given its weaker statistical significance. The underlying reasons are not straightforward to identify, but several potential explanations exist. First, the types of social activities being registered may be more appealing, accessible, or tailored to the interests and needs of younger people. Second, younger individuals may face fewer informational or motivational barriers when it comes to learning about and engaging with new community programs. In contrast, older adults may encounter higher "learning costs," or find such programs less aligned with their preferences or needs.

Table 3.5: Policy Effect on PHQ-8, Young Adults (18–39)

	(1) PHQ-8
Activities	−0.0090*
	(0.0050)
2018	0.470***
	(0.144)
2019	0.613**
	(0.260)
2020	1.352***
	(0.380)
2021	0.802**
	(0.304)
Female	0.965***
	(0.097)
Age	−0.0019
	(0.0071)
Education	−0.0544***
	(0.0126)
propSuitable	−3.864
	(2.888)
Constant	5.352**
	(1.988)
Region FE	Yes
Year FE	Yes
Observations	4,557

Notes: Standard errors, clustered at the region level, in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Region fixed effects are estimated but not reported. Sample restricted to individuals aged 18–39.

3.7.5 Robustness Checks

Throughout, standard errors are clustered at the region level, since the treatment variable $activities_{jt}$ varies only at the region-year level (160 cells) while the regressions above are estimated at the individual level (over 15,000 observations).

Weather. One concern with the specifications above is that unobserved, region-time varying factors—rather than the policy itself—could be driving both the number of registered activities and mental health outcomes. Weather is a plausible candidate: more favorable weather may make outdoor activities both easier to organize and independently beneficial for mental health. Adding the weather-suitability control (*propSuitable*, described in Section 3.4) to every specification reported above leaves all point estimates and significance patterns essentially unchanged; *propSuitable* itself is not statistically significant in any specification (all $p > 0.08$, and typically well above that). This suggests that regional weather variation is not an important confounder for the estimated relationship between policy intensity and mental health in this setting.

3.8 Policy Implications

The PINSAP policy was implemented in part to promote the mental well-being of the Catalan population by improving community engagement through social activities. While the results of this study do not provide evidence of a significant effect on mental health outcomes in the overall population, they suggest some heterogeneity in the policy's impact across subgroups.

In particular, the findings suggest that the policy may have contributed to improved mental health outcomes among immigrants. This result is consistent with the notion that increased opportunities for social inclusion can benefit groups that

may face higher risks of isolation or limited access to informal support networks. From a policy design perspective, this suggests that tailoring interventions toward populations with weaker social ties—such as immigrants—could enhance the overall effectiveness of community-based mental health programs. This might involve customizing the nature of activities, offering language-specific or culturally relevant options, or improving outreach mechanisms within these communities.

In contrast, the analysis does not find a significant association between policy intensity and mental health outcomes among older adults, including those living alone, even though supporting the well-being of this population is one of the stated goals of the PINSAP initiative. Given that Catalonia is a rapidly aging society, this finding calls for further attention. One possible explanation is that older individuals may face higher informational or motivational barriers to engaging with community programs, which might be described as higher "learning costs." Facilitating access for these groups—for example, through home-based options, transportation support, or involvement of trusted intermediaries—may be necessary to increase program efficiency. It is also possible that the design or content of current activities is more naturally aligned with the interests or routines of younger people.

While the current analysis cannot determine the precise mechanisms behind these patterns—due to data limitations and the lack of detailed information on program content and participation—the evidence highlights the importance of accounting for heterogeneity in designing and evaluating community-level mental health interventions. Future policy improvements could benefit from collecting more granular data on participation, activity type, and barriers to engagement. Doing so would enable more responsive and inclusive approaches, helping ensure that the benefits of such programs extend to the populations most in need.

3.9 Conclusion

This paper has examined the relationship between the intensity of a public health policy focused on community engagement and mental health outcomes in Catalonia. Rather than finding broad improvements across the population, the analysis suggests that the effects of the policy, to the extent they are present, are concentrated among specific subgroups. In particular, immigrants—and, more tentatively, young adults—appear to benefit more from increased policy exposure, while no significant association is detected for the general population or other demographic groups.

These findings highlight the importance of accounting for heterogeneity in policy evaluation. A uniform policy may yield uneven effects across populations, particularly when it targets social engagement, which can be more accessible or impactful for certain groups than others. In this context, interventions designed to reduce social isolation may be more effective when adapted to the needs and barriers faced by different subgroups.

While this analysis cannot fully disentangle the underlying mechanisms, the results raise considerations worth further investigation for policy design. Future public health initiatives may improve their efficacy by identifying and addressing the specific constraints that limit participation or impact among less responsive groups, such as older adults or individuals living alone. Further research could also assess the longer-term effects of such interventions and explore their relevance in other settings.

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3.A Appendix

Table 3.6: Policy Effect on PHQ-8, Middle-Aged Adults (40–59)

	(1) PHQ-8
Activities	0.0051
	(0.0050)
2018	0.046
	(0.193)
2019	−0.247
	(0.253)
2020	0.146
	(0.375)
2021	0.055
	(0.344)
Female	1.385***
	(0.115)
Age	0.0450***
	(0.0093)
Education	−0.0491***
	(0.0141)
propSuitable	4.840
	(4.059)
Constant	−2.739
	(2.823)
Region FE	Yes
Year FE	Yes
Observations	5,299

Notes: Standard errors, clustered at the region level, in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Region fixed effects are estimated but not reported. Sample restricted to individuals aged 40–59.

Table 3.7: Policy Effect on PHQ-8, Older Adults (60+)

	(1) PHQ-8
Activities	−0.0017
	(0.0042)
2018	0.351
	(0.224)
2019	0.537*
	(0.315)
2020	0.994**
	(0.399)
2021	0.771**
	(0.279)
Female	1.703***
	(0.151)
Age	0.0488***
	(0.0073)
Education	−0.0327
	(0.0216)
propSuitable	−1.062
	(2.948)
Constant	−0.588
	(1.851)
Region FE	Yes
Year FE	Yes
Observations	5,360

Notes: Standard errors, clustered at the region level, in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Region fixed effects are estimated but not reported. Sample restricted to individuals aged 60 and above.

Table 3.8: Solo-Household Heterogeneity, Older Adults (60+)

	(1) PHQ-8
Activities	−0.0014
	(0.0054)
Activities × Solo	−0.0011
	(0.0082)
2018	0.351
	(0.226)
2019	0.537
	(0.317)
2020	0.994**
	(0.399)
2021	0.771**
	(0.280)
Female	1.702***
	(0.144)
Age	0.0487***
	(0.0079)
Single-Person Household	0.026
	(0.236)
Education	−0.0327
	(0.0217)
propSuitable	−1.066
	(2.946)
Constant	−0.587
	(1.843)
Region FE	Yes
Year FE	Yes
Observations	5,360

Notes: Standard errors, clustered at the region level, in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Region fixed effects are estimated but not reported. Sample restricted to individuals aged 60 and above living alone.