

Psychosocial Risks and the Economic Burden of Work-Related Mental Disorders: Evidence from Brazilian Social Security Data (2008–2023)

Received 08/18/2025
Review began 09/03/2025
Review ended 11/07/2025
Published 12/05/2025

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DOI:

<https://doi.org/10.7759/s44404-025-09704-9>

Carlos Manoel L. Rodrigues ^{1, 2}

¹. Faculty of Health Sciences, University Center of Brasília, Brasília, BRA ². Postgraduate Program in Clinical Psychology and Culture, University of Brasília, Brasília, BRA

Corresponding author: Carlos Manoel L. Rodrigues, prof.carlos.manoel@gmail.com

Abstract

Mental and behavioral disorders are an increasing source of social security expenditures in Brazil, reflecting the burden of psychosocial risks on work and productivity. This study analyzes administrative data from the National Social Security Institute from 2008 to 2023 to estimate the economic impact of benefits granted for disorders classified under ICD-10 Chapter V. Monetary values were adjusted to constant 2023 BRL, and the dataset was aggregated by year, sex, benefit type, and diagnosis. The results reveal a steady rise in costs, averaging BRL 30.6 million annually. Depressive episodes (F32) and anxiety disorders (F41) accounted for the highest incidence of benefits, while schizophrenia (F20-F29), and organic mental disorders (F00-F09) presented higher mean costs per benefit and greater participation of pensions in total expenditures. Gender differences emerged, with women predominating in depressive and anxiety disorders and men in substance-use disorders, associated with higher average benefit values. Interrupted Time Series regressions indicated structural shifts coinciding with eSocial implementation in 2018 and the COVID-19 pandemic in 2020, although coefficients were not statistically significant. Simulations suggested that modest changes in incidence and cost per benefit could markedly affect expenditures, underscoring the relevance of prevention, early intervention, and return-to-work strategies.

Categories: Labor Economics, Social systems (economies, governments, industry), Employee Relations & Labour Legislation

Keywords: psychosocial risks, economic burden, mental health, work-related disorders, social security

JEL Classifications: I18, J28, H55

Introduction

In recent decades, mental and behavioral disorders have emerged as major determinants of prolonged work absences, productivity loss, and increasing social security expenditures across various countries (Hassard et al., 2021). Frequently linked to psychosocial risk factors at work, these conditions include depression, anxiety disorders, post-traumatic stress, and syndromes related to occupational burnout (Kortum et al., 2010). Both the International Labor Organization (ILO) and the World Health Organization (WHO) recognize psychosocial risks as critical determinants of occupational mental health, underscoring the need for systematic monitoring and public policies that address their structural causes (Rugulies et al., 2023) (Kortum et al., 2010).

Previous studies have examined the economic burden of mental disorders and their relationship with psychosocial risk factors at work, usually focusing on specific sectors, occupational groups, or productivity losses (Hassard et al., 2021) (Rugulies et al., 2023). In Brazil, some analyses have discussed the use of social security data to characterize work-related disabilities (Silva-Junior et al., 2012) (Silva and Bonfim, 2021), yet few studies have systematically isolated benefits granted exclusively for International Classification of Diseases-tenth revision (ICD-10) F00-F99 diagnoses linked to work accidents and adjusted to constant prices over a long historical series. Furthermore, research combining economic and epidemiological indicators, disaggregated by sex and benefit type, remains limited. This study fills this gap by providing an integrated assessment of the fiscal impact of psychosocial risks in Brazil, linking administrative and economic evidence to the international debate on sustainable work environments and mental health policies.

In Brazil, the National Social Security Institute (NSSI) grants two main types of accident-related benefits associated with such conditions: temporary disability benefits and permanent disability pensions. The former refers to temporary incapacity to work resulting from an occupational accident or work-related illness, whereas the latter reflects permanent incapacity, serving as an indirect marker of severity and chronicity (Silva and Bonfim, 2021).

The direct causal nexus refers to the relationship between a worker's health condition and exposure to risk factors in the workplace, indicating that the illness or injury is, at least in part, work-related (Ribeiro,

How to cite this article

Rodrigues C L (December 05, 2025) Psychosocial Risks and the Economic Burden of Work-Related Mental Disorders: Evidence from Brazilian Social Security Data (2008–2023). Cureus J Bus Econ 2 : es44404-025-09704-9. DOI <https://doi.org/10.7759/s44404-025-09704-9>

2024). The technical epidemiological nexus, in turn, is based on statistical associations between specific occupational groups and the occurrence of particular diseases, as identified through population data and official records compiled by the Ministry of Health and the Ministry of Labor in the Brazilian Official List of Work-Related Diseases (Ribeiro, 2024).

For mental disorders recognized as occupational diseases, the establishment of one or both nexuses serves as a proxy for exposure to psychosocial risk factors at work. This indicates sufficient evidence - whether through individualized assessment (direct causal nexus) or population-level patterns (technical epidemiological nexus) - that working conditions substantially contributed to the onset or aggravation of the disorder.

From a macroeconomic perspective, the financial burden associated with work-related mental disorders extends beyond the social security system, affecting aggregate productivity, labor market participation, and healthcare expenditures (Abramson et al., 2024). Conversely, prevention and proper management of psychosocial risks can generate substantial savings and enhance economic competitiveness (Hassard et al., 2021) (Hultén et al., 2022) (Rugulies et al., 2023).

Contextual elements such as social inequality, unemployment, and economic crises further shape the incidence and duration of work absences due to mental disorders (Leka et al., 2011) (Rodrigues et al., 2020). These macroeconomic determinants directly influence workers' psychosocial vulnerability, increasing the likelihood of prolonged absences and early retirement (Rodrigues, 2025). Such evidence reinforces the relevance of studies integrating economic and epidemiological analyses to inform prevention and rehabilitation policies (Hassard et al., 2021).

Although the rising costs associated with mental and behavioral disorders are a global concern, Brazil presents a specific institutional and socioeconomic configuration that shapes how these disorders translate into social security expenditures. High levels of informality, structural inequality, and recurrent reforms in the social protection system make the Brazilian case distinct. Therefore, this study focuses on the national context, using international literature primarily as a comparative reference rather than assuming direct generalizability of the observed trends.

In light of these empirical and conceptual gaps, the present study aims to estimate the economic impact of psychosocial risks, measured through the costs of accident-related benefits associated with mental and behavioral disorders classified in the ICD-10, Chapter V: Mental and behavioral disorders of the World Health Organization (WHO, 1992), in Brazil between 2008 and 2023. Specifically, it seeks to: (1) calculate indicators of real cost, cost per benefit, and severity; (2) examine differences by sex and type of benefit, discussing them in light of structural gender inequalities in the Brazilian labor market; (3) identify temporal variations associated with contextual and regulatory milestones; and (4) simulate scenarios of reduced benefit concessions to estimate potential savings.

Research Method

Database

Administrative data from the NSSI were utilized, covering the period from 2008 to 2023. These data originate from official registries of the Brazilian social security system, which document the granting of social benefits nationwide. For the purposes of this study, we selected benefits specifically classified under the categories of work-related sickness benefits and work-related disability pensions, as these represent the primary mechanisms of income replacement associated with occupational health outcomes. The dataset included benefits granted under the categories of work-related sickness benefits and work-related disability pensions. The unit of analysis was aggregated by year, sex, and ICD-10 code (WHO, 1992), restricted to Chapter V - Mental and Behavioral Disorders (F00-F99). Variables included the number of benefits granted and the total monetary value paid in Brazilian reais (BRL) (R\$).

Data selection

From the original National Social Security Institute registry, only records classified in the ICD-10 F00-F99 group and linked to accident-related benefits were extracted (Dataprev, 2024). Records containing inconsistencies, overall totals, or duplicated headers were excluded to ensure data integrity. The final dataset was organized by year, sex, benefit type, and ICD-10 code, including fields for quantity and total cost. Additionally, the historical series of the Brazilian Broad National Consumer Price Index (IPCA), obtained from the Brazilian Institute of Geography and Statistics, was used to deflate monetary values to constant 2023 prices.

Statistical procedures

The analytical process was initiated by structuring and cleaning the database. Total rows and duplicate headers were removed, variable names were standardized, formats were converted into appropriate numerical values, and consistency checks were performed. All monetary values were deflated using the

annual accumulated IPCA index and rescaled to constant 2023 prices.

Although mental and behavioral disorders emerge from individual experiences, the benefits granted under the ICD-10 F00-F99 group express their collective outcome at the population level. In this study, these benefits are treated as aggregate indicators of the materialization of psychosocial risks within Brazil's labor and social security systems. The macrolevel approach makes it possible to capture structural patterns in reporting, regulation, and prevention capacity. The use of Interrupted Time Series (ITS) models has an exploratory and descriptive purpose, aimed at identifying structural changes associated with institutional milestones, such as the implementation of eSocial and the COVID-19 pandemic, without implying causal inference at the individual level.

After preprocessing, key indicators were calculated: real total annual cost, deflated cost per benefit by sex and benefit type, the percentage share of disability pensions in total costs, male-to-female cost ratios, year-over-year variations in cost and quantity, and severity rates (financial, quantitative, and composite).

To assess sex-based differences, several statistical techniques were applied. A two-proportion z-test was used for each ICD category, stratified by benefit type, under the null hypothesis of no difference between male and female proportions. In addition, independent-sample *t*-tests were used to compare mean costs between sexes, and ordinary least squares (OLS) regressions were applied to estimate the association between sex and cost outcomes while controlling for benefit type.

For the time-series analysis, ITS regression was applied using segmented linear models with structural breaks in 2018 and 2020. Newey-West heteroskedasticity and autocorrelation-consistent (HAC) robust standard errors were used to correct for serial correlation and heteroskedasticity (Newey and West, 1987). Breakpoints were selected based on major contextual and regulatory events likely to influence reporting, approval, and cost dynamics of benefits.

2018 (eSocial implementation): Brazil's unified digital platform for reporting tax, labor, and social security information was introduced, standardizing the reporting of Work Accident Communications (in Portuguese: CAT) and occupational health data. It was hypothesized that eSocial may have altered detection, registration, and benefit approval processes, producing changes in both the level and slope of the series (Ortelan and Pinto, 2018). The CAT is an official document in Brazil used to notify social security authorities about occupational accidents or work-related illnesses. Employers are legally required to issue the CAT whenever an accident occurs, even if it does not result in time away from work. The document ensures that the injured worker has access to social security benefits, facilitates occupational health monitoring, and contributes to national statistics on workplace safety.

2020 (COVID-19 pandemic): Official recognition of the pandemic in March 2020 introduced unprecedented psychosocial risks, workforce reorganization, and substantial impacts on mental health. Operational changes included restrictions on in-person assessments, suspension of medical evaluations, and emergency adjustments to social security rules. Accordingly, 2020 was defined as a second breakpoint.

The dependent variable was defined as the annual total real cost, which was transformed using the $\log_{1p}$ function to stabilize variance and accommodate zero values:

$$y_t = \log(1 + \text{TotalRealCost}_t) \quad (1)$$

ITS specification (two interruptions):

$$y_t = \beta_0 + \beta_1 t + \beta_2 D_{2018,t} + \beta_3 (t \times D_{2018,t}) + \beta_4 D_{2020,t} + \beta_5 (t \times D_{2020,t}) + \varepsilon_t \quad (2)$$

where:

y_t $\log_{1p}$ (total real cost) in year t

t : time (in years since the start of the series)

$D_{\{2018,t\}}$: dummy variable for the post-2018 period

$D_{\{2020,t\}}$: dummy variable for the post-2020 period

β_0 : initial intercept

β_1 : pre-interruption trend

β_2 : level change after 2018

β_3 : slope change after 2018

β_4 : level change after 2020

β_5 : slope change after 2020

ε_t : random error term

This analytical framework allows a structural interpretation of aggregate patterns, rather than microlevel causality, consistent with approaches used in occupational epidemiology and health economics.

To estimate the potential fiscal impact of reducing the incidence of work-related mental and behavioral disorder benefits, economic simulations were conducted. Hypothetical reductions of 5%, 10%, and 20% in the annual number of benefits granted were tested. A constant average cost per benefit, based on the deflated values (in 2023 BRL) observed from 2008 to 2023, was assumed.

For each scenario, the projected annual savings (ΔC_t) were calculated as:

$$\Delta C_t = N_t \times r \times \bar{c} \quad (3)$$

where N_t is the number of benefits in year t , r is the reduction rate (0.05, 0.10, or 0.20), and $\bar{c}$ the mean cost per benefit.

This procedure was designed to isolate the effect of incidence reduction by holding mean cost constant, thereby avoiding confounding from cost fluctuations. Conservative estimates were produced, as no adjustments were made for potential structural changes in duration, severity, or long-term cost reductions arising from prevention, early intervention, or reintegration policies.

Software and tools

All analyses were conducted in Python. The pandas library was used for data manipulation and cleaning; numpy was used for mathematical operations; matplotlib was used for descriptive and comparative visualizations; statsmodels was used for ITS regressions, OLS estimations, and HAC-robust corrections; and python-docx was used for exporting tables and results into editable documents.

Results And Discussion

The descriptive analysis of social security benefits related to mental and behavioral disorders revealed distinct patterns in terms of total cost, number of benefits, and the relative share of disability pensions.

When ranked by total cost (deflated to 2023 BRL), mood [affective] disorders (F30-F39) were the largest contributors, totaling BRL 128.9 million for 72,336 benefits (mean cost of BRL 1,806.85) (Figure 1). These were followed by schizophrenia and delusional disorders (F20-F29), with BRL 5.0 million for 3,752 benefits (mean cost of BRL 1,224.04), and organic mental disorders (F00-F09), with BRL 59.99 thousand for 37 benefits (mean cost of BRL 1,757.79). Although not necessarily the most incident categories, these groups exhibited high average costs per benefit, reflecting longer durations of work absences and high rates of disability pensions.

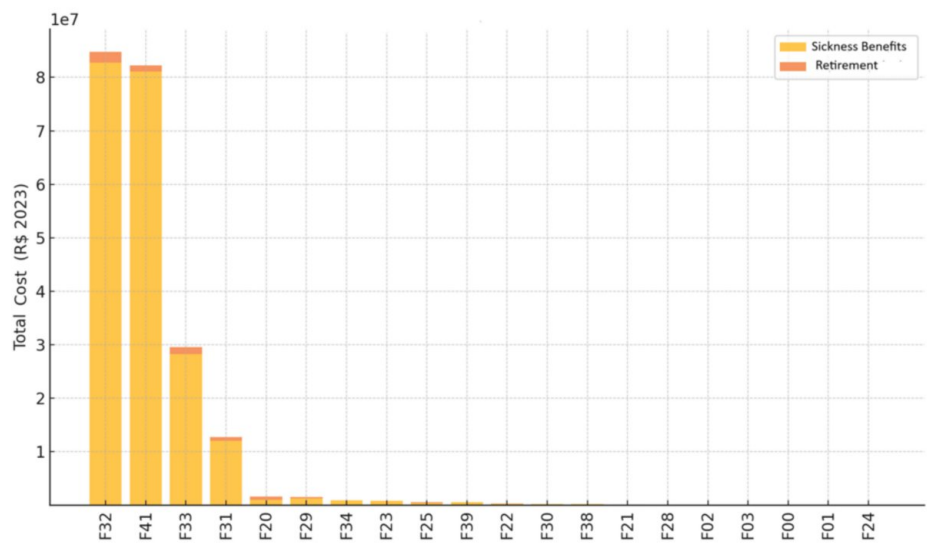


FIGURE 1: Costs of benefits by ICD-10 codes (sickness vs. disability retirement)

Source: Author's own computation/analysis. ICD-10, International Classification of Diseases-tenth revision.

At the level of specific diagnoses, recurrent depressive disorder (F33) generated BRL 29.57 million for 14,913 benefits (mean cost of BRL 1,982.96), depressive episode (F32) accounted for BRL 84.81 million for 49,383 benefits (mean cost of BRL 1,717.49), and anxiety disorders (F41) totaled BRL 82.19 million for 39,843 benefits (mean cost of BRL 2,062.88). Despite presenting lower mean costs than some chronic disorders, their high frequency produced a substantial impact on overall expenditures.

The analysis of real total annual costs showed a marked upward trend between 2008 and 2023, with fluctuations associated with major institutional and contextual events. Aggregate annual expenditures followed an ascending trajectory (Figure 2), particularly from 2015 onward, coinciding with deteriorating macroeconomic conditions and the rising number of work absences due to mental disorders.

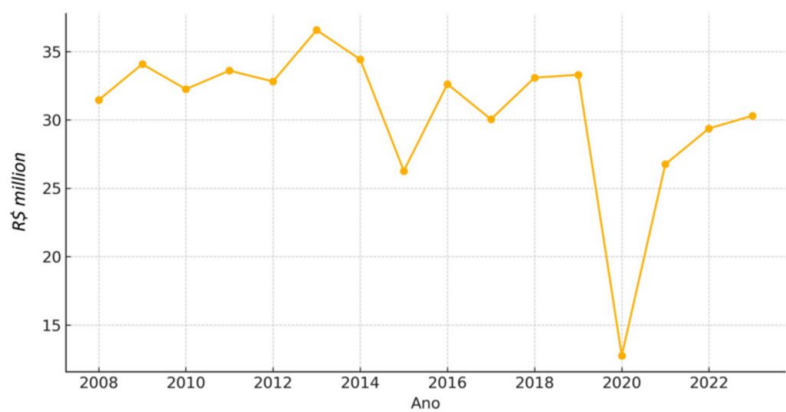


FIGURE 2: Evolution of total real cost of benefits (2008–2023), in millions of 2023 BRL

Source: Author's own computation/analysis. BRL, Brazilian Reais.

Across the study period, mood disorders (F30-F39) accounted for the largest share of total costs (BRL 128.9 million), followed by anxiety disorders (F41; BRL 82.2 million), depressive episodes (F32; BRL 84.8 million), and recurrent depressive disorder (F33; BRL 29.6 million). Although less frequent, schizophrenia and delusional disorders (F20-F29) reached BRL 5.0 million, reflecting their chronicity and high cost per

benefit.

Temporal cost profiles indicated that affective and anxiety disorders were more sensitive to contextual fluctuations, whereas schizophrenia and organic mental disorders showed relatively stable but persistently high costs due to the chronic nature of cases and higher pension rates. These findings suggest that, although some disorders are less frequent, their economic burden may be disproportionate owing to severity and permanence of work incapacity.

Sex differences

Analysis of the 10 most frequent ICD codes revealed consistent sex differences for both sickness benefits and disability pensions (Table 1). Among sickness benefits, depressive episode (F32) registered 32,781 concessions for women and 15,561 for men, a statistically significant difference ($P < 0.001$), with female prevalence approximately 92% higher than male. Severe stress reactions and adjustment disorders (F43) also showed female predominance (23,588 vs. 24,612; $P < 0.001$), while alcohol-related disorders (F10) displayed the opposite pattern, with men representing nearly three times the number of concessions (2,704 vs. 170; $P < 0.001$).

CID	Sickness benefits			Disability pensions		
	Male	Female	P-value	Male	Female	P-value
F32 – Depressive episode	15,561	32,781	<0.001	605	436	<0.001
F43 – Reaction to severe stress and adjustment disorders	24,612	23,588	<0.001	831	282	<0.001
F41 – Other anxiety disorders	15,645	23,714	<0.001	348	136	0.0398
F33 – Recurrent depressive disorder	3,939	10,328	<0.001	311	335	<0.001
F31 – Bipolar affective disorder	2,004	4,677	<0.001	144	196	<0.001
F10 – Mental and behavioral disorders due to use of alcohol	2,704	170	<0.001	109	6	<0.001
F40 – Phobic anxiety disorders	818	1,090	0.3912	35	8	0.0746
F19 – Mental and behavioral disorders due to multiple drug use and use of other psychoactive substances	1,476	71	<0.001	18	0	0.0071
F20 – Schizophrenia	637	187	<0.001	359	90	<0.001
F29 – Unspecified nonorganic psychosis	708	264	<0.001	129	37	0.0061
F06 – Other mental disorders due to brain damage and dysfunction and to physical disease	522	144	<0.001	248	31	<0.001
F23 – Acute and transient psychotic disorders	458	166	<0.001	32	10	0.2999
F14 – Mental and behavioral disorders due to use of cocaine	535	35	<0.001	4	0	0.3935
F34 – Persistent mood [affective] disorders	189	348	0.0019	15	10	0.5548

TABLE 1: Top ICD codes by volume – sex differences in sickness benefits and disability pensions
Source: Author’s own computation/analysis. ICD, International Classification of Diseases-tenth revision.

For disability pensions, the hierarchy of most frequent diagnoses remained similar, but the magnitude of sex differences varied. Bipolar affective disorder (F31) registered 1,402 pensions for women and 1,012 for men ($P < 0.01$), while schizophrenia (F20) showed a more balanced distribution (1,256 vs. 1,194; $P = 0.412$, not significant). Substance-use-related disorders, such as alcohol dependence (F10), however, maintained a clear male predominance (1,178 vs. 346; $P < 0.001$).

Analysis of average benefit values showed significant differences between sexes. For sickness benefits, men received a mean of BRL 1,947.91, compared with BRL 1,782.17 for women, a statistically significant difference ($t(1998) = 7.41$; $P < 0.001$). For disability pensions, men received BRL 2,014.38 on average, compared with BRL 1,777.13 for women ($t(1998) = 8.84$; $P < 0.001$).

Time-series and ITS regression analysis

The time-series analysis of deflated annual costs (2023 BRL) and benefit volumes identified patterns of evolution and shifts associated with institutional and macroeconomic events. A general upward trend was observed, driven both by the number of concessions and by growth in mean benefit values. Sickness benefits showed greater volatility, while pensions were more stable but represented an increasing share of total costs, particularly from 2018.

ITS regressions estimated immediate (level) and gradual (slope) effects on real annual costs. Table 2 presents the OLS regression applied to the log-transformed cost series, incorporating time, structural breakpoints, and interaction terms. The model explained approximately 76.7% of the variance ($R^2 = 0.767$; adjusted $R^2 = 0.650$). The overall model was statistically significant ($F = 6.567$; $P = 0.00588$), and the Durbin-Watson statistic (2.434) indicated no relevant autocorrelation. Normality tests (Omnibus and Jarque-Bera) showed no violations ($P > 0.6$).

Variable	Coefficient	Std error	t	P> t	[0.025]	[0.975]
Intercept	17.3333	0.085	204.293	0.0	17.144	17.522
t	-0.0095	0.016	-0.596	0.565	-0.045	0.026
Post-2018	-0.0805	2.148	-0.037	0.971	-4.866	4.705
t Post-2018	0.0157	0.205	0.077	0.94	-0.441	0.472
Post-2020	-3.9111	2.317	-1.688	0.122	-9.074	1.252
t Post-2020	0.2627	0.214	1.227	0.248	-0.214	0.74

TABLE 2: Ordinary least squares regression results

Intercept, baseline level of the outcome at the start of the series; t, underlying time trend before interruptions; post-2018, immediate change in level after the 2018 interruption; t post-2018, change in trend after the 2018 interruption; post-2020, immediate change in level after the 2020 interruption; t post-2020, change in trend after the 2020 interruption. The table reports estimated coefficients, standard errors, t-statistics, significance levels, and 95% confidence intervals.

Source: Author's own computation/analysis.

The estimated intercept (17.3333; $P < 0.001$) represented the initial mean log of total costs at the reference point. The pre-intervention trend (-0.0095; $P = 0.565$) was negative but not significant.

Pre-2018 trend: Stable, with no significant changes (-0.0095; $P = 0.565$).

2018 (eSocial implementation): Immediate effect was negligible (-0.0805; $P = 0.971$). The slope change post-2018 was small and not significant (0.0157; $P = 0.940$).

2020 (COVID-19 pandemic): An immediate cost reduction was observed (-3.9111; $P = 0.122$), though not statistically significant, possibly due to service disruptions and reduced benefit processing. The slope post-2020 was positive (0.2627; $P = 0.248$), suggesting cost recovery and acceleration, although not statistically significant.

Although the coefficients related to the 2018 and 2020 interruptions were not statistically significant, the ITS models revealed temporal patterns compatible with potential structural effects of these events. The implementation of eSocial in 2018 may have enhanced the accuracy and standardization of reporting, while the COVID-19 pandemic in 2020 coincided with a temporary contraction followed by recovery in benefit expenditures. These patterns should be interpreted as indicative trends consistent with major institutional and health-related disruptions, rather than as causal evidence. The pandemic period, in particular, appears to have amplified preexisting dynamics of mental health-related absences, especially for severe disorders with higher pension rates and for depressive and anxiety disorders, which showed pronounced fluctuations in sickness benefits (Figure 3).



FIGURE 3: Real annual total cost (ICD-F) in Brazil, 2008–2023 (million BRL, 2023 prices)

Source: Author's own computation/analysis. ICD-F, International Classification of Diseases-category F; BRL, Brazilian Reals.

Severity indicators

The share of costs associated with disability pensions, used as a proxy of financial severity, exceeded 40% in diagnoses such as schizophrenia (F20; 41.2%) and Alzheimer's dementia (F00; 43.3%). Among organic mental disorders (F00-F09), pensions accounted for 46.6% of total costs and 48.2% of benefits, while in chronic psychotic disorders (F20-F25) pensions approached half of total costs, reflecting low probability of return to work.

Three severity indicators were calculated for 2008-2023 (Table 3) included (1) Financial Severity Rate (%): Share of total costs attributable to disability pensions; (2) Benefit Severity Rate (%): Share of benefits corresponding to pensions; and (3) Composite Severity Rate: Product of financial and benefit severity rates. Annual severity metrics showed marked variation, with shifts linked to structural changes (eSocial from 2018) and macroeconomic and health shocks (COVID-19 from 2020).

Year	Financial severity rate	Benefit severity rate	Composite severity rate
2008	2.69	1.99	5.36
2009	2.74	2.17	5.95
2010	3.59	2.92	10.49
2011	4.27	3.7	15.8
2012	5.35	4.46	23.91
2013	4.12	3.78	15.59
2014	3.86	3.63	14.01
2015	3.56	3.55	12.63
2016	3.04	2.99	9.07
2017	3.87	3.86	14.91
2018	4.53	4.31	19.54
2019	4.92	4.54	22.32
2020	0.88	0.85	0.74
2021	0.44	0.41	0.18
2022	1.31	1.26	1.66
2023	0.92	0.91	0.84

TABLE 3: Annual severity rates

Source: Author's own computation/analysis

Economic scenarios

Projections based on the average annual cost of BRL 30.61 million (2008–2023, deflated to 2023 BRL) estimated potential impacts under two scenarios. In the optimistic scenario, assuming a 10% reduction in benefit volume and 5% reduction in mean cost (-14.5% combined), projected savings amounted to BRL 4.44 million annually. In the pessimistic scenario, assuming a 10% increase in benefit volume and 5% increase in mean cost (+15.5% combined), expenditures were projected to rise by BRL 4.75 million per year (Table 4).

Scenario	Variation in benefits (%)	Variation in average cost (%)	Composite variation (%)	Estimated annual cost (BRL millions)
Baseline (2008–2023)	0	0	0.00	30.61
Optimistic (-10% benefits, -5% cost)	-10	-5	-14.50	26.17
Pessimistic (+10% benefits, +5% cost)	10	5	15.50	35.35

TABLE 4: Projected economic scenarios – ICD-F benefits

Source: Author's own computation/analysis. ICD-F, International Classification of Diseases-category F.

These projections highlight the sensitivity of social security costs to relatively small variations in benefit volume and average cost, underscoring the importance of preventive and management strategies aimed at both reducing incidence and controlling average benefit expenditures.

Discussion

The economic impact of mental and behavioral disorders on the Brazilian social security system is substantial, both in absolute terms and in the diversity of patterns observed across diagnoses. The highest costs were concentrated in groups such as mood [affective] disorders (F30-F39) and anxiety disorders (F41), reflecting their high prevalence and recurrence. Although their mean cost per benefit was lower than that of chronic conditions, the large number of cases produced considerable aggregate costs. Conversely, diagnoses such as schizophrenia and delusional disorders (F20-F29) and organic mental disorders (F00-F09) were less frequent but associated with substantially higher average costs, driven by prolonged benefit duration and a predominance of permanent disability pensions.

The analysis of real annual costs confirmed that the financial burden of these disorders has remained persistently high throughout the study period. Notable increases were observed in specific years, such as 2014-2015, a period marked by high inflation and macroeconomic instability (Paula and Pires, 2017), and in 2020, with the onset of the COVID-19 pandemic, reinforcing the role of macroeconomic and social factors in workers' mental health (Abramson et al., 2024) (Rodrigues, 2025). The variations observed in 2014-2015 and 2019-2020 should be interpreted as effects of macroeconomic instability and institutional adjustments rather than as representative of the entire period. Economic recession, labor market contraction, and administrative reforms in benefit evaluation likely influenced both the demand for and the processing of claims during these years (Rodrigues, 2025). These fluctuations illustrate the sensitivity of social security expenditures to contextual and regulatory shocks and do not imply a linear or permanent pattern across the full time series.

Beyond these episodic fluctuations, two distinct patterns of social security impact were identified. High-frequency, lower-cost diagnoses (e.g., depressive episode [F32], recurrent depressive disorder [F33], and anxiety disorders [F41]) generated a large number of benefits, whereas low-frequency but high-cost diagnoses (e.g., F00 and F20) reflected greater clinical severity, permanent disability, and high pension prevalence. Cases that combine high pension frequency and elevated financial weight represent a critical challenge for system management, requiring policies aimed at maintaining work capacity and promoting functional readaptation.

The cost per benefit confirmed that disability pensions were consistently more expensive than sickness benefits, across both sexes, with men receiving higher average values, especially for pensions (Silva and Bonfim, 2021). This difference may reflect men's higher concentration in hazardous occupations and longer benefit durations, but it also indicates structural gender inequalities. These include the underreporting and under-recognition of female health conditions, the undervaluation of psychosocial risks - more prevalent in female-dominated occupations - and potential biases in medical assessments that influence both access to and the value of benefits granted.

Although pensions accounted for a smaller number of concessions, they represented more than 40% of total costs in some years, highlighting their role as a proxy for severity and chronicity. Reducing the incidence of severe cases could therefore yield significant economic savings. The male-to-female cost ratio, greater than 1 in most years, suggests men's higher concentration in risk-prone occupations, wage differences that increase benefit values, and possible underreporting of severe cases among women.

Annual variations in cost and number of benefits reflected both macroeconomic changes and administrative adjustments. Periods such as 2014-2015 and 2019-2020 registered sharp increases, while 2016-2017 showed reductions. These fluctuations may be linked to economic crises, reforms in benefit evaluation and granting procedures (Silva-Junior et al., 2012), or external shocks such as the pandemic, which temporarily increased sick leaves due to psychosocial stress and organizational instability (Boucher et al., 2025).

Gender differences were consistent across major diagnoses, confirming the influence of structural determinants on both mental health and access to social protection (Russo et al., 2025) (Garza, 2025). In this sense, gender disparities observed in the data should not be interpreted merely as expected demographic variations but as manifestations of deeper structural inequalities. Occupational segregation, persistent wage gaps, and the unequal distribution of unpaid care work contribute to differentiated exposures to psychosocial risks and to unequal access to social protection mechanisms. These patterns demonstrate how social and economic asymmetries are reproduced within the social security system, reinforcing the need for gender-sensitive approaches in occupational health surveillance and policy design.

Depressive and anxiety disorders (F32 and F33) were significantly more prevalent among women ($P < 0.001$), sometimes tripling male concessions. This pattern may be explained by cumulative burdens from the double workload (paid and unpaid), greater exposure to violence and harassment, and occupational segregation concentrating women in more precarious jobs with lower autonomy (Homan, 2024). Conversely, substance-use-related disorders (F10, F19, F14) were markedly more frequent among men, consistent with cultural norms that normalize risky behavior and discourage preventive care (Garza,

2025). For pensions, although magnitudes were smaller, the same inequalities persisted, including higher prevalence of schizophrenia (F20) and brain-damage-related disorders (F06) among men, likely linked to higher exposure to dangerous occupational settings (Russo et al., 2025). The consistent differences between women and men documented in this study represent structural effects of gender inequality that shape both mental health outcomes and access to protection, highlighting the importance of incorporating gender equity as a guiding principle in occupational and social security policies.

Mean benefit values also exhibited gender disparities, with men receiving higher amounts for both sickness benefits and pensions. This disparity may be explained by men's stronger participation in higher-paying sectors (Alkhabbaz, 2025), longer contribution histories, and greater formal employment stability, which translate into higher base salaries and benefits. Women, by contrast, showed lower averages, reflecting fragmented career paths, greater concentration in low-paying occupations, and higher prevalence of informal or part-time work, all of which reduce social security contributions (Silva and Silva, 2022). Persistent wage gaps and barriers to high-income positions further amplify these long-term disparities.

The magnitude and statistical significance of these differences indicate that gender-sensitive public policies in labor and social security are essential to reduce inequities. Inequalities in benefit access and value are rooted in broader social and economic structures that asymmetrically distribute risks and resources, directly affecting workers' mental health and access to protection (Matysiak et al., 2024). Preventive and rehabilitative strategies must therefore incorporate this structural dimension, promoting safer and more equitable work environments.

ITS analysis highlighted structural changes in 2018 and 2020. The implementation of eSocial in 2018 likely improved detection and reporting of occupational accidents and illnesses, enhancing statistical accuracy (Ortelan and Pinto, 2018). The COVID-19 pandemic in 2020 produced both level and slope changes, reflecting increased case numbers and disruptions in benefit evaluations. Although estimated coefficients did not reach statistical significance - partly due to the small series length ($n = 16$) and multicollinearity - the observed patterns align with literature on the impact of administrative reforms and health crises (Rugulies et al., 2023) (Abramson et al., 2024).

It is important to note that the ITS results should be interpreted with caution. Although the overall model fit was satisfactory, the short length of the annual series ($n = 16$) limits statistical power and the ability to detect small or gradual effects. The purpose of the model is primarily descriptive, identifying points of inflection consistent with major contextual and regulatory events rather than establishing causal relationships. Consequently, the observed coefficients provide exploratory evidence of structural sensitivity in social security expenditures, rather than definitive proof of policy impacts.

Financial severity rates confirmed that disability pensions, while representing less than 20% of benefits, consistently accounted for a disproportionate share of total costs. From 2008 to 2014, rates remained stable, with greater variation from 2018 onward, likely linked to improved reporting under eSocial. During the pandemic, the share of pensions increased further, possibly reflecting clinical deterioration and barriers to rehabilitation under restricted healthcare conditions. The composite severity indicator demonstrated that years with higher pension costs coincided with increased pension frequency, underscoring their disproportionate contribution in severe diagnoses such as schizophrenia (41.2%) and Alzheimer's dementia (43.3%).

Taken together, these findings show that the economic burden of mental and behavioral disorders is sustained by two dynamics: a broad base of high-frequency, moderate-cost diagnoses, and a smaller but highly severe and costly set of chronic cases. While external shocks and regulatory changes may temporarily alter these dynamics, structural costs are primarily determined by the prevalence of disability pensions and case severity. Monitoring severity metrics, alongside preventive and rehabilitative strategies, is therefore essential to mitigate the social and economic consequences of work-related mental illness.

Prospective scenario analysis reinforced the sensitivity of social security costs to relatively small variations in benefit volume and mean benefit values. In the optimistic scenario, projected savings exceeded BRL 4.4 million annually, while in the pessimistic scenario, additional expenditures reached BRL 4.7 million (2023 values). These results underscore that preventive measures, early diagnosis, and return-to-work programs are not only clinically and socially relevant but also critical for containing social security expenditures.

Given the persistent upward trend and cumulative effects of mental disorder-related absences, the findings highlight the urgency of integrated policies across health, labor, and social security. Coordinated strategies are essential to reduce incidence and chronicity, balancing social protection with financial sustainability, consistent with international evidence on psychosocial risk management (Rodrigues, 2025) (Rugulies et al., 2023).

At the organizational level, companies and institutions play a central role in mitigating psychosocial risks and preventing absences due to mental disorders. The observed economic impact-stemming both from frequent diagnoses such as F32 and F41 and from severe cases such as F20 and F00-demonstrates that investing in workplace mental health is not only a matter of social responsibility but also a cost-management and productivity strategy. This requires robust primary prevention programs to improve organizational climate, foster safe and psychologically healthy working conditions, and strengthen leadership capacity for early detection of illness. Complementary reintegration policies - including functional adaptations, multiprofessional follow-up, and return-to-work monitoring - are also essential. Organizations that integrate these strategies into governance tend to reduce prolonged absences and the aggregate costs of work incapacity.

At the macrolevel, the results confirm that the Brazilian social security system is highly sensitive to variations in both benefit volume and average cost. This highlights the need for public policies focused on prevention, treatment, and reintegration, supported by stronger epidemiological surveillance and integrated databases to identify trends and vulnerable groups. The adoption of national guidelines on psychosocial risk management - aligned with recommendations from the ILO and the WHO - could help reduce both new cases and progression to disability pensions. Professional rehabilitation policies, tax incentives for companies investing in mental health programs, and targeted interventions for high-risk sectors could generate relevant economic returns. Moreover, countercyclical economic and social protection policies may indirectly mitigate mental health deterioration during crises. While the findings align with international evidence on the economic burden of work-related mental disorders, their magnitude and evolution must be understood within Brazil's particular regulatory, economic, and social structures. The convergence observed should thus be interpreted as pattern consistency rather than as direct generalization across national contexts.

Conclusions

Brazil between 2008 and 2023 revealed a pattern of rising costs. High-incidence diagnoses, such as depressive episodes (F32) and anxiety disorders (F41), were responsible for substantial volumes of benefits, while chronic conditions, including schizophrenia (F20-F29) and organic mental disorders (F00-F09), were associated with higher mean costs per benefit and significant participation of disability pensions in total expenditures. Temporal trends indicated that structural events, such as the implementation of eSocial, and contextual shocks, such as the COVID-19 pandemic, shaped the trajectory of costs through changes in reporting and monitoring processes as well as through direct impacts on demand for benefits. Prospective analyses demonstrated that even small simultaneous variations in benefit volumes and average benefit costs can significantly affect social security expenditures, underscoring the system's sensitivity and the importance of prevention and management strategies.

Despite the robustness of the analyzed series and the adequate fit of the models, this study presents limitations that must be considered. Administrative data, while comprehensive, are subject to several constraints. Records may contain underreporting of occupational accidents and illnesses, diagnostic or coding errors, and potential biases in the establishment of the causal nexus between work and illness. Such issues can lead both to underestimation and to misclassification of cases. Moreover, the aggregated nature of the data prevents control of individual-level variables such as occupation, sector, comorbidities, or treatment adherence, limiting causal inference, and precluding sectoral or regional analyses. These limitations mean that the estimates reported here should be interpreted as conservative approximations of the economic burden rather than as exhaustive measurements of all direct and indirect costs. The analysis relied on aggregated data without disaggregation by economic sector or occupation, preventing the identification of risks specific to certain groups. Furthermore, the use of administrative data entails limitations such as possible recording errors, underreporting, and the absence of detailed contextual information (e.g., occupation, sector, or geographic region). It was also not possible to obtain specific population denominators for all subgroups analyzed, which precluded the calculation of standardized rates by exposed population. Additionally, the ITS models were constrained by the small number of observations, which reduces statistical power. For this reason, the results of the ITS analysis are interpreted as suggestive patterns consistent with known institutional events, not as statistically confirmed causal effects. In addition, the estimates did not include indirect costs (e.g., productivity losses) or benefits not formally registered in the INSS system.

Another limitation is that administrative data do not allow direct assessment of individual-level factors such as comorbidities, treatment adherence, or social support, which may influence both the duration and severity of absences. The lack of detailed information on the effectiveness of policies and programs implemented during the period further restricts the ability to establish causal relationships between interventions and observed cost variations. Future research directions should include analyses disaggregated by sector, occupation, and region, enabling the identification of contexts of greater vulnerability and the evaluation of sector-specific policies. Incorporating clinical and socioeconomic variables would improve the understanding of determinants of severity and duration of absences. Moreover, the recent update of Regulatory Standard No. 1 (NR-1) in Brazil, which explicitly included psychosocial risks as part of mandatory occupational risk management, opens a promising avenue for

longitudinal studies on regulatory impacts on the incidence and costs of mental health-related absences. Monitoring and evaluating the effects of this regulatory change will be crucial to assess its potential to reduce social security expenditures and promote healthier, more inclusive work environments.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Carlos Manoel L. Rodrigues

Acquisition, analysis, or interpretation of data: Carlos Manoel L. Rodrigues

Drafting of the manuscript: Carlos Manoel L. Rodrigues

Critical review of the manuscript for important intellectual content: Carlos Manoel L. Rodrigues

Supervision: Carlos Manoel L. Rodrigues

Disclosures

Human subjects: All authors have confirmed that this study did not involve human participants or tissue.

Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue.

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgements

We thank the Centro Universitário de Brasília (CEUB) for the institutional support in conducting this research. Data, analytic methods, and study materials are available from the authors upon request.

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