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SERVICES FOR SCIENCE AND EDUCATION

Regional Market Concentration and Its Impact on Health Plan Quality in Brazil: Insights for Regulatory Policy

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ABSTRACT

This study explores the regional concentration of health plan operators in Brazil from 2014 to 2019, analyzing its impacts on the well-being of users. While existing literature addresses health insurance market dynamics, regional-level insights remain scarce. Employing a random-effects panel data model, we assessed variations in service quality—measured through user complaints—in relation to market concentration and income levels across 138 relevant markets. Our findings reveal that increased market concentration correlates with deteriorating service quality, as evidenced by a rise in complaints. Moreover, declining income levels exacerbate this trend, reflecting disparities in access to higher-quality plans. These results underscore the negative implications of market concentration for consumer welfare and raise critical questions about regulatory policies. By emphasizing regional disparities, this study contributes to the ongoing debate on antitrust measures and healthcare regulation, offering actionable insights for policymakers.

Keywords: Health Plans, Antitrust Policy, Market Concentration, Health Economics.

INTRODUCTION

The supplementary health sector in Brazil plays a pivotal role in providing private healthcare alternatives to the Unified Health System (a.k.a. 'SUS'), catering to over 47.6 million users by 2020. Initially driven by corporate health plans and Group Medicine entities, the sector underwent significant regulatory transformations with the enactment of Law 9.656/1998 and the establishment of the National Supplementary Health Agency (a.k.a. 'ANS') in 2000. Despite these developments, challenges persist, particularly in balancing market dynamics with consumer welfare.

The supplementary health sector in Brazil provides private health plans to individuals seeking access to a network of hospitals, clinics, laboratories, and outpatient medical services that complement those offered by the Unified Health System (SUS). Historically, this sector originated with health plans managed by the Human Resources departments of large automakers and corporations, as well as the consolidation of plans within the Group Medicine model. Its significance grew with the enactment of Law 9.656/1998, which laid the initial regulatory framework under the Ministry of Health during the Fernando Henrique Cardoso administration. Further consolidation occurred with Law 9.961/2000, which formally

established the National Supplementary Health Agency (ANS), headquartered in Rio de Janeiro, with the mandate to regulate and oversee health plan operations in Brazil.

The supplementary health sector operates through a value chain that involves multiple stakeholders. On the demand side, there were 47.6 million users as of December 2020 (Figure 1). Companies purchasing health plans for their employees constituted the largest segment (67.6%), followed by collective plans by adhesion and individual or family plans. However, demand for these plans faces significant cost pressures, with price increases consistently outpacing general inflation. Health plans are also among the most expensive benefits on corporate payrolls, as highlighted by several studies [1], [2], [3].

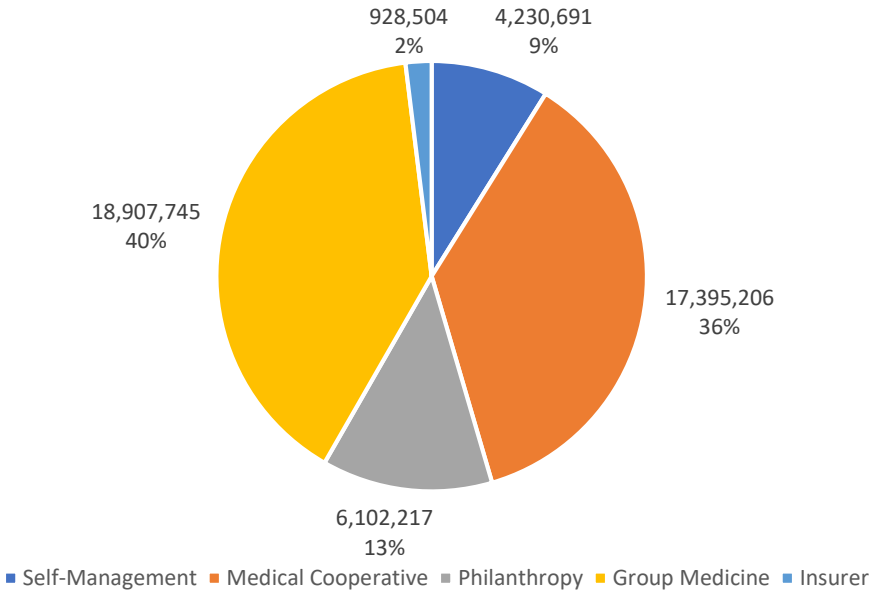

Figure 1: Number of Beneficiaries of Supplementary Health Sector in Brazil
Source: ANS

On the supply side, 711 health plan operators were active in Brazil as of 2020. Notably, market concentration is significant: only 3% of these operators account for approximately 50% of the national market share [1], [4]. This concentration reflects the diverse modalities of health plan providers, each with unique characteristics and market roles.

The health plan market exhibits significant structural and competitive complexities. Of the 711 operators active as of 2020, a mere 3% control approximately 50% of the national market. This consolidation is further shaped by the sector's diverse modalities, such as self-management plans, medical cooperatives, and vertically integrated group medicine operators. For instance, large conglomerates like Amil and Hapvida dominate through vertical integration and acquisitions, creating potential barriers to competition.

Given the geographically localized nature of healthcare services, market concentration necessitates a regional analysis. Previous studies on health plan markets have largely overlooked these nuances, focusing instead on national-level metrics. To address this gap, our research hypothesizes that higher regional concentration levels negatively impact user well-

being, as measured by service quality. Additionally, income disparities may further amplify these effects, limiting access to competitive, high-quality plans.

To test this hypothesis, we employed a random-effects panel data model, analyzing 138 relevant markets from 2014 to 2019. By correlating market concentration indices (HHI), income levels, and user complaints, this study sheds light on the interplay between economic structures and healthcare outcomes. The findings highlight the urgent need for targeted regulatory interventions to mitigate the adverse effects of concentration and ensure equitable access to quality healthcare.

This paper is organized as follows. Section 2 reviews the existing literature on market concentration and its implications for healthcare quality, highlighting both national and international perspectives. Section 3 describes the methodology, including data collection and the econometric modeling approach employed. Section 4 presents the results, detailing the relationship between market concentration, income levels, and user complaints. Section 5 discusses the findings considering theoretical frameworks and regulatory implications, while Section 6 concludes with final remarks and recommendations for future research and policy interventions.

LITERATURE REVIEW

The Brazilian literature review was conducted without restricting the initial year, aiming to identify Brazilian publications that evaluated the regional concentration of health plans and its possible implications and effects on the well-being of the population served by these services. This search identified only three studies that specifically addressed the regional concentration of health plans, [5], [6], [7], with the latter deepening and updating the approach proposed by the earlier works.

Although these studies discussed models for defining the relevant market based on geographic distribution, they primarily proposed a gravitational model approach. This model defined the relevant market as the area attracting a combination of supply and demand for private health services, considering both the proximity of users to healthcare services and the uneven distribution of hospital infrastructure across municipalities. For demand, the number of health plan beneficiaries was assessed, while for supply, the availability of hospital beds was considered, leading to the creation of clusters of municipalities that served as the basis for defining relevant markets [5], [6].

Following the methodology proposed by [5] and [6], 89 relevant markets were identified, covering approximately 81% of health plan beneficiaries in Brazil at the time of the survey. Building on this approach, Ferreira (2020) revisited the definition of relevant markets used by ANS and CADE, employing a flow model. This updated approach identified 148 relevant markets across Brazil, encompassing 2,717 municipalities. Ferreira's work also estimated concentration indices, such as the Herfindahl-Hirschman Index (HHI), based on cross-sectional data for specific months. Notably, the HHI analysis included both medical-hospital plans and exclusively dental plans, which, according to [8], do not directly compete due to differences in product characteristics and market structures.

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CADE (Administrative Council for Economic Defense) [i] uses the HHI to measure market concentration, considering the relative market share and the number of firms in a relevant market. The index ranges from 0 to 10,000 points, with markets classified as non-concentrated (HHI below 1,500), moderately concentrated (HHI between 1,500 and 2,500), or highly concentrated (HHI above 2,500). This metric is integral to assessing the potential anti-competitive effects of mergers, acquisitions, or agreements that may reduce competitiveness [9].

In the supplementary health sector, CADE has published extensive analyses of the market's structural aspects and provided guidelines for evaluating mergers within the sector. The supplementary health market, according to CADE, exhibits several characteristics of market failures, including information asymmetry, principal-agent problems, and moral hazard. Additionally, structural barriers to entry, such as switching costs and grace periods for consumers and the need for economies of scale among providers, exacerbate these issues [10]. To define relevant markets in the supplementary health sector, CADE considers both the product dimension and the geographic dimension.

Under the product dimension, health plans are segmented into four main categories [8]:

- Individual/family medical-hospital plans (with or without dental coverage).
- Collective medical-hospital plans (with or without dental coverage).
- Exclusively individual/family dental plans.
- Exclusively collective dental plans.

This study excluded dental plans from the analysis, as they operate under different market dynamics compared to medical-hospital plans, with distinct value chains, supplier relationships, and competitive structures. Moreover, individual/family and collective medical-hospital markets were combined for analytical purposes, as data availability and statistical robustness supported this integration.

Regarding geographic dimensions, CADE adopts a municipal approach, considering the willingness of health plan users to travel for healthcare services. In cases where a single operator controls over 20% of a market, CADE identifies 89 relevant markets [5], [6]. These definitions highlight the need for a regionalized evaluation of market concentration, a perspective largely absent in existing studies.

While [5] and [6] provided critical HHI measures, no prior study evaluated the evolution of concentration over time or its broader effects on population well-being. This study addresses these gaps by considering both temporal dynamics and regionalized impacts of market concentration.

International literature also informed the empirical approach of this research. Studies commonly rely on the HHI to estimate market concentration and assess its effects across three primary areas:

1. Quality of care: The relationship between concentration and service quality.
2. Price: The impact of concentration on health plan pricing.

3. Clinical outcomes: Broader health effects, such as mortality rates and quality of life metrics.

A foundational theoretical model informing this research is the work of [11], which analyzed the relationship between market concentration and quality of care in the United States. Their findings identified a potential trade-off between price and quality, indicating that as market concentration increases, users' perceptions of service quality may decline. This framework provides the conceptual basis for the hypotheses and methodologies employed in this study.
Building upon this theoretical foundation, the present research proposes the following theoretical equation, adapted from the approach developed by [11]:

$$QUAL_{i,t} = \beta_0 + \beta_1 * HHI_{i,t} + \beta_2 * INCOME_{i,t}$$

Where:

- $QUAL_{i,t}$: Represents the quality of care in municipality i during month t.
- $HHI_{i,t}$: Denotes the Herfindahl-Hirschman Index, a measure of market concentration, in municipality i during month t.
- $INCOME_{i,t}$: Refers to the average income in municipality i during month t.

This model captures the relationship between market concentration, income levels, and the quality of care, enabling a deeper analysis of how these factors interact at a municipal and temporal level.

METHODOLOGY

Data Collection

To operationalize the proposed equation, publicly available data were gathered to construct the econometric model. Table 1 outlines the primary data sources used, which are attributed to each of the 138 relevant markets as defined by [7], analyzed on a monthly basis from 2014 to 2019. The datasets were processed using the R programming language to organize health plan beneficiaries by relevant market for each month of analysis. Methodological procedures were applied to calculate the Herfindahl-Hirschman Index (HHI). These procedures included excluding beneficiaries of exclusively dental health plans, following the relevant market definition from the product perspective, and grouping health plan operators in the "Medical Cooperative" modality, such as UNIMEDs, into a single economic group, consistent with approaches adopted by [6], [7] and [10].

Additionally, the estimation of the number of complaints involved converting the total absolute volume of complaints registered with the ANS into a relative metric, the number of complaints per 100,000 users. This adjustment ensured comparability across relevant markets of varying sizes (see Box 1).

Box 1: Summary of Data Sources Used

	IHH	Quality of Service	Wage
Source	ANS: Consolidated beneficiary information	ANS: Complaints registered by 100,000 users	RAIS Municipal PNAD

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Frequency	Monthly	Monthly	Annual (extrapolated to monthly)
Relevant Market Detail	Adequate	Adequate	Adequate
Considerations	Only 2 months lag (allows analysis updates)	More adequate than other indexes evaluated (e.g., IDSS, NIPs).[ii]	Best source at the municipal level to compose each MR.

IDSS: Supplementary Health Performance Index; MR: relevant market; NIP: Notification of Preliminary Investigation; PNAD: National Household Sample Survey; RAIS: Annual Report on Social Information

Another important consideration is that the historical data provided by ANS, particularly for the evaluation of the HHI, begins in May 2014. This established the starting point for the quantitative analyses. Additionally, as a methodological precaution, data from periods after 2019 were excluded to avoid potential distortions caused by the pandemic, which could have impacted the dynamics of health plan demand and supply.

Consequently, the analysis covers a total of 68 months, from May 2014 to December 2019, across 138 relevant markets (following methodological exclusions). This dataset includes 9,384 observations encompassing the HHI, quality of care (measured by the number of complaints registered with ANS), and the wage bill for each relevant market.

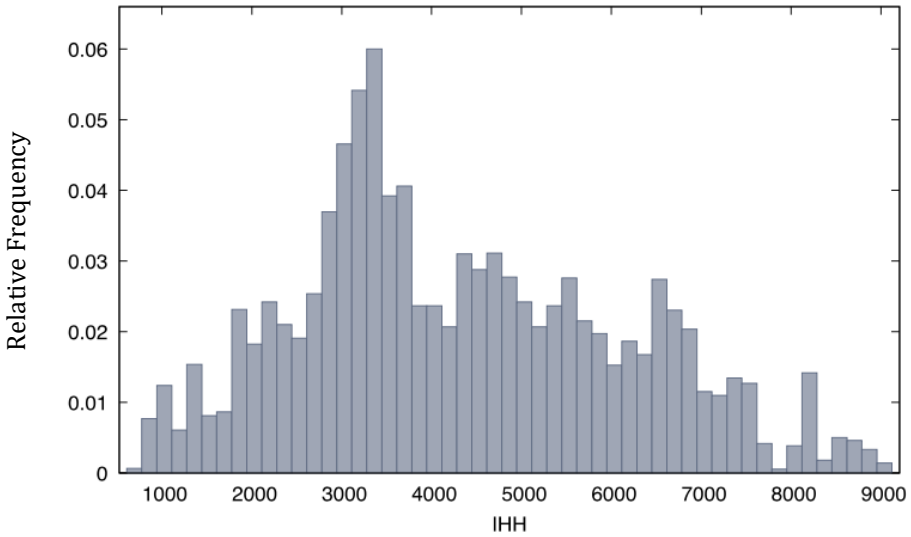

Figure 2: Histogram of the Distribution of the IHH between May 2014 and December 2019
Source: Prepared by the authors, Gretl Software.

Figure 2 illustrates the concentration pattern of health plan operators in the Brazilian market during the analyzed period (May 2014 to December 2019), based on the regionalization criteria of the relevant markets.

The average HHI for this time series was 4,316 points across the 9,384 HHI estimates. Notably, only about 2% of the estimated HHIs for the relevant markets fell below 1,500 points, the threshold used by [9] to classify a market as non-concentrated.

Table 1 provides the key descriptive statistical measures for the variables analyzed, including the HHI, quality of care, and wage bill.

Table 1: Descriptive Statistics of the variables analyzed

	IHH	**Number of Complaints per 100k Users**	**Annual Wage Bill (in R$)**
Average	4,315.7	6.9108	20,725
Median	4,026.0	3.0654	20,682
Minimum	692.00	0.0000	14,564
Maximum	9,038.0	854.58	50,222
Standard deviation	1,806.9	22.229	3,532
C. V.	0.41867	3.2165	0.17042
Bias	0.36219	21.894	2.2642
kurtosis ex.	-0.56983	692.53	13.806
5% percentile	1598.5	0.0000	15970
95% percentile	7489.0	23.068	26177
Interquartile range	2580.5	6.7086	3915.2
Note. Missing	0	0	0

Source: Prepared by the authors, Gretl Software

Modelling

Building on the theoretical framework established through a review of national literature, including studies such as [5], [6], [7], and international contributions like [11], combined with the data discussed in the "Data Collection" section, the final theoretical model was defined as follows:

$$COMP_{i,t} = \beta_0 + \beta_1 * HHI_{i,t} + \beta_2 * WAGE_{i,t} + u_{i,t}$$

Where:

- $COMP_{i,t}$: Complaint rate per 100,000 health plan beneficiaries in relevant market i at time t.
- $HHI_{i,t}$: Herfindahl-Hirschman Index, a measure of market concentration, for relevant market i at time t.
- $WAGE_{i,t}$: Annual wage bill in relevant market i at time t.
- $u_{i,t}$: Error term.

The econometric model employs panel data to analyze the relationship between the quality of care provided by health plans (measured through user complaints), market concentration, and income levels across relevant markets over time.

Panel data methodology was chosen as it reconciles the advantages of cross-sectional models (analyzing data across multiple entities at a specific point in time) with those of time series models (tracking data over time) [12]. This approach allows for greater statistical power,

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leveraging the dataset, which spans 68 months (from May 2014 to December 2019) across 138 relevant markets.

The model incorporates rigorous econometric techniques, including unit root tests to ensure stationarity, functional form selection, and the choice between fixed or random effects for the panel data. It also addresses potential issues such as heteroscedasticity and autocorrelation, which are discussed in detail in the following section.

RESULTS

To ensure the stationarity of the time series in the panel data model, a unit root test was conducted as one of the primary diagnostic tools. Stationarity ensures that the variable under study maintains consistent statistical properties, such as mean and covariance, over time, preventing issues associated with trends or varying levels that could bias the analysis. The Dickey-Fuller test was applied to evaluate stationarity. If the null hypothesis of the test is rejected, it indicates that the time series does not have a unit root, meaning it is stationary. This allows the use of Student's t-values in regression analysis with confidence. The principle can be summarized by the equation:

$$\Delta Y_t = \delta Y_{t-1} + u_t \delta = 0$$

[12], [13].

In this study, the variables HHI (Herfindahl-Hirschman Index) and WAGE (wage bill) exhibited evidence of a unit root in their level and logarithmic forms, as indicated by the augmented Dickey-Fuller test. To address this, these variables were transformed into their first differences to achieve stationarity. The variable COMP (complaint rate) did not present signs of a unit root in its level form; however, it was transformed into a logarithmic form to facilitate the interpretation of the regression coefficients while maintaining stationarity.

Thus, the functional form adopted in the econometric model of panel data is presented below, combining (i) adjustments that eliminate the existence of a unit root in the time series and (ii) interpretation of the estimated coefficients:

$$lnCOMP_{i,t} = \beta_0 + \beta_1 * dHHI_{i,t} + \beta_2 * dWAGE_{i,t} + u_{i,t}$$

In panel data models, two primary approaches determine how regression should be conducted: fixed effects and random effects. Fixed-effects models minimize the sum of squared errors for each of the 128 cross-sectional units individually, ensuring that each unit is analyzed independently. However, the error terms from these regressions are not shared across units. In contrast, random-effects models treat the errors as part of a shared distribution across all cross-sectional units, allowing for the estimation of coefficients that jointly explain the behavior of the variables under study in a more integrated and synergistic manner [12].

To determine the most appropriate model, tools like the Hausman test are employed. According to [12], "the null hypothesis underlying the [Hausman] test is that the estimators of the fixed-effects model and the error components model [random effects] do not differ substantially." If

the null hypothesis is rejected, it implies that the random-effects model is not appropriate, and the fixed-effects model should be used instead [12], [14]. The Hausman test applied to the random-effects model yielded a test statistic value of 2.53471 with a p-value of 0.281575. Since this does not provide sufficient evidence to reject the null hypothesis, it confirms that the generalized least squares (GLS) estimates from the random-effects model are consistent. Consequently, the random-effects model was deemed appropriate and adopted for this analysis.

Table 2 presents the results of the random-effects panel data econometric model, where the dependent variable is log(COMP), and the explanatory variables are the differences in HHI and WAGE.

Table 2: Results of the Data Model in Random Effects Panel

Random-effects model (GLS), using 9246 observations Included 138 crosscut units Time Series Length = 67 Dependent variable: logCOMP				
Variable	Coefficient	Standard Error	T-Test	P-value
Constant	1.18249	0.0734009	16.11	2.17e-58***
d_HHI	0.000188982	8.67309e-05	2.179	0.0293 **
d_WAGE	-0.000100089	3.39097e-05	-2.952	0.0032 ***

Average var. dependent	1.183343	D.P. var. dependent	1.100296
Sum resid. Square	11179.89	Regression P.E.	1.099737
Likelihood log	-13997.53	Akaike Criterion	28001.07
Schwarz's criterion	28022.46	Hannan-Quinn Criterion	28008.34
rho	0.214283	Durbin-Watson	1.542719
Joint testing on designated regressors – Test Statistic: F(2, 9106) = 6.62453 with p-value = P(F(2, 9106) > 6.62453 = 0.00133381 Test to differentiate intercepts from groups – Null hypothesis: Groups have a common intercept Test Statistic: F(137, 9106) = 105.156 with p-value = P(F(137, 9106) > 105.156) = 0			

Source: Prepared by the authors (Gretl Software).

The regression results (Table 2) reveal a statistically significant positive relationship between market concentration (HHI) and user complaints. Specifically, for every 500-point increase in the HHI —a measure of market concentration—the complaint rate is estimated to rise by approximately 9.4%. This finding underscores the negative impact of highly concentrated markets on service quality, aligning with the theoretical literature that associates reduced competition with lower consumer satisfaction and limited provider accountability.

Conversely, income levels (WAGE) show a statistically significant negative relationship with complaints. A hypothetical reduction of R$1,000 per capita in the annual wage bill of a relevant market, representing a 5% decrease from the average wage, would lead to an estimated 10% increase in user complaints. This result highlights the role of economic constraints in shaping

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access to higher-quality health plans, particularly in low-income regions where options for premium services are limited. The robustness of the regression model depends on ensuring homoscedasticity and addressing potential autocorrelation. Heteroscedasticity was assessed through informal methods, such as analyzing residuals for patterns, and formal tests, including the Breusch-Pagan test. Results from the Breusch-Pagan test (p = 0.3144) indicated no evidence of heteroscedasticity, supporting the assumption of constant variance in error terms [15].

Autocorrelation, defined as the correlation between error terms across observations in time or space, was evaluated using the Durbin-Watson test and the Breusch-Godfrey/Wooldridge test. The Durbin-Watson test (d = 1.5576, p < 2.2e-16) and the Breusch-Godfrey/Wooldridge test (chi^2 = 834.44, p < 2.2e-16) both rejected the null hypothesis, confirming the presence of autocorrelation in the model [16], [17], [18]. The identified autocorrelation may stem from factors such as omitted explanatory variables, functional form biases, or external socio-political influences on complaint reporting. While non-stationarity and functional form errors were addressed earlier, the absence of theoretical models fully capturing quality of care dynamics suggests that additional variables may be necessary. Possible remedies include clustering standard errors and refining theoretical models to incorporate broader explanatory variables.

Based on the results of the random-effects panel data regression presented in Table 2, the equation describing the behavior of the number of complaints can be reformulated by incorporating the significant coefficients estimated from the model:

$$lnCOMP_{i,t} = 1{,}18249 + 0{,}000188982 * dHHI_{i,t} - 0.000100089 * dWAGE_{i,t} + u_{i,t}$$

Trends in Market Concentration

A secondary analysis of market concentration trends, as measured by the HHI, reveals a gradual increase in concentration levels during the study period. Figure 3 shows the mean and median HHI values across the 138 relevant markets, demonstrating a consistent upward trend. This concentration is likely driven by mergers and acquisitions among operators, as well as the bankruptcy of smaller health plans, which have consolidated market power in the hands of a few large players.

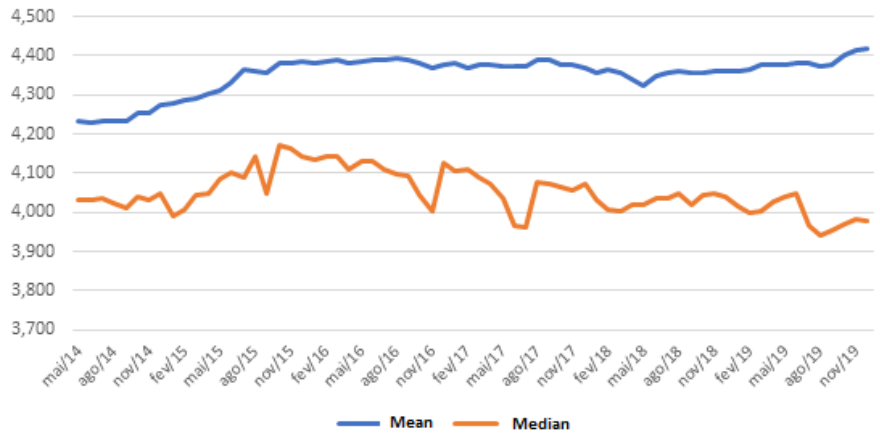

Figure 3: Mean and median of the HHI between May 2014 and December 2019

Source: Prepared by the authors (Microsoft Excel®).

The average *HHI* ranged from 4,231 to 4,439 points over the analyzed period, well above the threshold of 2,500 points defined by [9], [19] to classify markets as highly concentrated. This consistent level of high concentration suggests structural barriers to competition that require regulatory attention to mitigate their adverse effects on consumer welfare.

DISCUSSIONS

The findings of this study reveal critical insights into the interplay between market concentration and user well-being in the Brazilian health plan market. The econometric analysis demonstrated that increased market concentration, as measured by the Herfindahl-Hirschman Index (HHI), significantly correlates with a rise in user complaints. This aligns with the theoretical frameworks discussed in the literature, such as the works of [11], which highlight the trade-offs between market efficiency and consumer satisfaction in highly concentrated markets.

Regional disparities emerged as a key theme in our analysis. Markets with lower income levels exhibited a stronger association between concentration and user dissatisfaction. This corroborates findings from [6], who emphasize the role of socioeconomic factors in exacerbating healthcare inequities. In line with theories of market failure discussed by [10], these results suggest that economic constraints limit access to competitive, high-quality plans, further entrenching disparities in healthcare outcomes.

An additional concern is the observed trend of increasing market concentration over the study period. Consolidation through mergers and acquisitions, coupled with the exit of smaller operators, has heightened the dominance of a few large players. While vertical integration strategies adopted by major operators may lead to cost efficiencies, they also risk reducing consumer choice and driving up prices. These dynamics echo the regulatory challenges outlined by [8], emphasizing the need for a nuanced approach that balances efficiency gains with the preservation of market competitiveness.

Furthermore, the reliance on user complaints as a proxy for service quality offers valuable but incomplete insights. Complaints capture immediate consumer dissatisfaction but may not fully reflect broader clinical outcomes or systemic issues. Future research should incorporate additional metrics, such as patient health outcomes and plan affordability, to provide a more comprehensive assessment of market dynamics.

Considering these findings, policymakers must prioritize interventions that promote competition and address regional inequities. Enhancing transparency in pricing and service quality, fostering entry of new operators, and imposing stricter scrutiny on mergers are potential avenues for action. Additionally, tailored policies that account for regional socioeconomic disparities can help mitigate the disproportionate burden on low-income markets.

FINAL REMARKS

This study contributes to the growing body of evidence on the implications of market concentration in the health insurance sector. By adopting a regionalized approach, it highlights how concentration trends negatively impact service quality and exacerbate existing inequities.

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These findings resonate with theoretical perspectives, such as those discussed by [10] and [11], which underscore the interplay between competition, quality, and accessibility in healthcare markets.

The results call for a reevaluation of current regulatory frameworks. Policymakers should adopt proactive measures to address market imbalances, ensuring that consolidation does not come at the expense of consumer welfare. Strengthening antitrust enforcement, promoting transparency, and fostering competition are critical steps toward achieving a more equitable and efficient health insurance market.

As the healthcare sector continues to evolve, future research should explore the long-term impacts of concentration on clinical outcomes, pricing, and access to care. Incorporating diverse data sources and methodologies will enhance our understanding of these dynamics, informing more effective policy interventions.

In conclusion, this study underscores the need for a balanced approach to regulation that safeguards consumer interests while fostering innovation and efficiency in the health insurance market. By addressing the challenges identified herein, Brazil can advance toward a more inclusive and resilient healthcare system.

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[i] The Brazilian equivalent to the DG COMP in the European Union, the Competition and Markets Authority (CMA) in the United Kingdom, and the Federal Trade Commission (FTC) in the United States is the Conselho Administrativo de Defesa Econômica (CADE), or the Administrative Council for Economic Defense.

[ii] It was considered that quality sources of health plan operators such as the IDSS (Supplementary Health Performance Index) would be more complete because it considers four different performance domains of a health plan operator, but this index is calculated once a year by the ANS and assigned horizontally and nationally, and there is no possibility of distinguishing the quality of care of the same health plan operator in different regions of the country, as the work proposes. The NIPs, on the other hand, include information at the municipal level, but these are more serious complaints made by users to the ANS, in a smaller absolute number.