COVID-19: How did the pandemic impacted the economic-financial results of the healthcare companies included in B3?

COVID-19: Como a pandemia afetou o desempenho econômico-financeiro das empresas do setor de saúde listadas na B3?

COVID-19: ¿Cómo afectó la pandemia a los resultados económico-financieros de las empresas del sector sanitario incluidas en B3?

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ABSTRACT
This study aims to verify the influence of the pandemic on the economic and financial results of the companies included in the health sub-sectors of B3. The sample consisted of 22 companies with data treated by test Wilcoxon and panel regression. The results indicate that the firms were able to meet their short- and long-term obligations. The medical services subsector (hospitals, analysis, and diagnostics) showing the worst results with significant increase in third-party capital and a reduction in net margin and profitability. This study expands on the scarce literature on the health sector, which is critical to the well-being and economy of Brazilians and evidence to stakeholders that economic-financial results differs between subsectors.
Keywords: pandemic; covid-19; stakeholders; performance indicators; stock exchange.

RESUMO
Este estudo objetiva verificar qual a influência da pandemia no desempenho econômico-financeiro das empresas listadas nos subsetores de saúde da B3. A amostra foi composta por 22 empresas com dados tratados mediante teste de Wilcoxon e regressão em painel. Os resultados demonstraram capacidade das entidades em cumprirem com obrigações em curto e longo prazo. O subsetor de serviços médico (hospitalares, análises e diagnósticos) apresentou o pior desempenho, com crescimento significativo de capital de terceiros e redução da margem líquida e de rentabilidade. Esta pesquisa ampliou a literatura escassa sobre o setor de saúde, que é relevante para o bem-estar dos brasileiros e para a economia, e evidencia aos *stakeholders* que o desempenho econômico-financeiro foi distinto entre os subsetores.
Palavras-chave: pandemia; covid-19; *stakeholders*; indicadores de desempenho; bolsa de valores.

RESUMEN
Este estudio tiene por objetivo verificar la influencia de la pandemia a los resultados económicos y financieros de las empresas incluidas en los subsectores sanitarios de B3. La muestra estaba compuesta por 22 empresas y datos tratados mediante test de Wilcoxon y regresión en panel. Los resultados indican que las sociedades cumplen con sus obligaciones a corto y largo plazo. El subsector de servicios médicos (hospitales, análisis y diagnósticos) mostró los peores resultados, crecimiento el capital de terceros y reduciendo el margen neto y la rentabilidad. Este estudio amplía la escasa literatura sobre el sector sanitario, que es fundamental para el bienestar y la economía de los brasileños y proporciona pruebas a los *stakeholders* de diferencias entre los subsectores.
Palabras clave: pandemia; covid-19; *stakeholders*; indicadores de rendimiento; bolsa de valores.

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1 INTRODUCTION

The Brazilian health sector plays a relevant role in promoting well-being, employment creation, research investments, and development of new products and services, which integrate the complex production chain, responsible for 9.51% of the Gross Domestic Product (GDP) in 2019, (Mendes, 2022). The pandemic declared in March 2020 mainly affected this sector, with social consequences, as well as a strong impact on the financial market and the production sector, including the disruption of global supply chains due to social isolation. However, the companies were affected in different ways depending on their sub-sector (Vasilii, Gao & Anna, 2022).

In Brazil, the health sector is composed of companies operating in the production of medicines and other products, medical services (hospital, analysis, and diagnosis), equipment production, as well as commerce and distribution (B3, 2022). The different specificities and challenges during the pandemic may affect, both nationally and internationally, the economic-financial and operational performance of companies in this sector (Alisyah & Susilowati, 2022; Lima, Beiruth & Martinez, 2021; Piñeiro-Chousa, López-Cabarcos, Quiñoá-Piñeiro & Pérez-Pico, 2022). In the national context, Lima, Beiruth and Martinez (2021) show that the Brazilian health cooperatives have obtained an increase in revenue and a reduction in the level of indebtedness, as well as an increase in the number of users and a reduction in elective procedures due to the priority established for Covid-19 patients.

Internationally, Alisyah and Susilowati (2022) showed a reduction in solvency and profitability for companies in the Indonesian health sector, with no significant difference from the period before the pandemic. In the US, Piñeiro-Chousa et al. (2022) found that there were differences in the performance of companies as a result of size and market experience, even if they engaged in the search for vaccines against the new Coronavirus strain. In turn, Sayed and Eledum (2021) found that the short-term response of the Saudi Arabian capital market to the pandemic was distinct across economic sectors.

Thus, the analysis of the economic and financial performance of listed companies that operate in the health area is important because the prioritization of products and services during the pandemic resulted in excess or low demand, according to the sub-sector of the company (Alisyah & Susilowati, 2022). This study differs from previous ones because it performs a segregated analysis by sub-sector in the period before and during Covid-19, showing if there were significant differences in the economic and financial performance of the companies analyzed.

In this sense, the question was: what is the influence of the pandemic Coronavirus (SARS CoV-2) on the economic-financial performance of publicly traded healthcare companies? Guided by this question, this article aims to verify the influence of the pandemic on the economic-financial performance of companies listed in the healthcare sub-sectors of B3. The difference of the mean of the two dependent samples was performed for the indicators of liquidity, capital structure, profitability, and return, considering the period before the start of the pandemic (2018-2019) and after the start (2020-2021), as well as exploratory analysis of the data by descriptive statistics. These indicators were used to highlight economic sustainability, considering the national and international literature (Andrade, Oliveira, Santos, Oliveira & Silva, 2020; Alisyah & Susilowati, 2022; Guedes, Oliveira, Santos & Ferreira, 2021; Oliveira, Oliveira, Santos, Ferreira & Gonçalves, 2021), without considering market value indicators. These researches used in their studies indexes that show the ability to pay (liquidity), the dependence on third-party capital (capital structure), and the ability to generate returns (profitability and return).

The use of economic indicators can help users to compare entities over the years, as well as make it possible to compare a company's performance with other companies and sectors (Mallin, Farag & Ow-Yong, 2014). Thus, by showing significant differences in economic and financial performance, this study, in the academic sphere, adds to the literature by exploring how the Covid-19 infection influenced the performance of the companies in the Brazilian healthcare sub-sectors, according to the period.

The study also encourages new research, considering the continuing pandemic and the growth of new strains, even if in a smaller proportion, but which continue to demand resources from this sector. As a practical contribution, it can provide information that allows stakeholders to evaluate future scenarios for monitoring the economic and financial situation of companies by sub-sector considering the possibility of new waves of diseases with pandemic capacity. So, these stakeholders can use this information to make decisions about investments in these sub-sectors and gain the know-how to face future scenarios.

In addition to this introduction, this research presents four additional sections. The second section presents the theoretical framework of the study, which discusses: i) the Stakeholder Theory, ii) the economic and financial indicators, iii) the relevance of the health sector, and iv) the presentation of previous studies. The third section is composed of the methodological aspects of the study. The fourth section presents the results found in this study, and the last section describes the final considerations of the study.

2 THEORETICAL FRAMEWORK

The literature review structured in this section is composed of subsections that cover: the Stakeholder Theory; economic-financial performance indicators; the context of the Brazilian health sector in the period under analysis, especially in the context of the pandemic; and the main studies conducted on the area discussed in this research.

2.1 Stakeholder Theory

The socioeconomic and cultural transformations driven by technological innovations pressured companies to new management models. Thus, the shareholder is no longer the exclusive focus of the firm's profit maximization, and other interested parties are also included in the activities and results of organizations (Parmar et al., 2010). Freeman (2010) presents, through their 1984 study Strategic Management: A Stakeholder Approach, the possibility of inserting the interests of people or groups in the company's strategic planning to achieve better performance.

The concept of the Stakeholder Theory includes the systems theory, disclosure theory, corporate social responsibility, and organizational theory, and has become the theoretical basis for research in business and society. This occurs because it considers that the company should take advantage of the contributions provided by external groups, that it maintains relationships with, for the definition of its performance strategies with a focus on sustainability and legitimization before society (Donaldson & Preston, 1995; Freeman, 2010; Laplume, Sonpar & Litz, 2008).

Donaldson and Preston (1995) identify three interrelated approaches in the literature on Stakeholder Theory, also known as the Theory of Stakeholders, which are: descriptive, instrumental, and normative. The descriptive approach is based on the profiling of cooperative and competitive interests and their intrinsic value, showing that each of the stakeholders must be considered by the organization. The instrumental approach is related to the operational part of stakeholder identification, identifying the interests, and interactions, and how to insert these parties in the planning based on corporate performance goals. The normative approach, through the discussion of moral, ethical, and philosophical principles, is related to accepting the legitimacy of including the interests of stakeholders in the company's strategic management through processes and activities, with the interests of all stakeholders being of intrinsic value (Donaldson & Preston, 1995).

The Stakeholder Theory, therefore, contributes to managers by broadening the focus of the corporation's interests, the relevance of ethics in business activities, and the company's value creation and its perception by society, which is influenced by the transparency and reliability of the information provided (Greenwood, 2001; Parmar et al., 2010). In this sense, the voluntary disclosure of performance indicators is understood as a mechanism of transparency and minimization of uncertainties and capital costs, among other benefits, which the stakeholders can take advantage of (Klann & Beuren, 2011).

2.2 Economic-Financial Performance Indicators

The use of indicators is used to measure the economic performance of companies, making it possible to compare their performance over time or concerning the market. This study used the indexes of liquidity, indebtedness, profitability, and return because they make it possible to identify the payment capacity, and the financial and economic situation, forming the tripod of the accounting analysis (Assaf & Lima, 2017; Silva, Ramos, Kroenke & Hein, 2019; Umamaheswari, Suresh & Sampathkumar, 2022). As for the capital structure, we opted for the participation of third-party capital, since this is one of the most used by the market, as it shows the indebtedness of the company (Assaf, 2020).

The accounting indicators for economic-financial analysis help economic agents in the market to evaluate the past, diagnose the present, and estimate the future. The standardization of the statements, the reliability, the regularity, and the easy access to the publicly traded companies allow temporal and sectorial comparisons, both nationally and internationally (Oliveira & Lemes, 2011; Takamatsu & Fávero, 2019). This study focused on the economic-financial performance evaluation of companies included on the Brazilian stock exchange, Exchange, and Over-the-Counter (B3) ranked in the health sector, according to Table 1.

Table 1

List of Economic and Financial Indexes

Indexes	Interpretation
General Liquidity Index (LG)	Shows the ability to pay financial commitments in the short and long term. The higher, the better the performance of the institution (Assaf, 2020).
Dry Liquidity Index (LS)	Shows the company's ability to pay off its debts in the short term after the withdrawal of less liquid values. The higher, the better the performance of the institution (Assaf & Lima, 2017).
Current Liquidity Index (LC)	Shows the entity's ability to pay its debts in the short term. The higher, the better the performance of the institution (Assaf, 2020).
Return on Equity (ROE)	Shows the return on equity invested by the partners/shareholders in the year. The higher the return, the better the performance (Assaf, 2020; Oliveira & Lemes, 2011).
Return on Assets (ROA)	Shows the profitability generated on the company's assets, determining the efficiency of the entity to obtain profits from the assets (Silva et al., 2019).
Third-Party Equity Participation (PCT)	Shows the volume of third-party capital invested, in the short or long term, about the company's capital. The lower the third-party capital, the better, because the company shows less dependence on external resources (Oliveira & Lemes, 2011; Silva et al., 2019).
Gross Margin (MB)	This shows the company's ability to turn its net revenue into gross profit (Assaf, 2020; Oliveira & Lemes, 2011).
Ebitda Margin (ME)	Used to measure the profit margin result before interest, taxes, depreciation, and amortization, as well as to measure efficiency and to help identify operational problems in the company (Assaf, 2020; Fraga et al., 2021). And because it does not consider tax and financial aspects, it allows evaluation of the operational quality of the entity (Moreira, Jones, Tavares, Fehr & Silva, 2014).

Source: Elaborated by the authors.

The economic and financial information is significant for the stakeholders because it can affect the decision-making regarding the cost of third-party capital, share prices, fundraising, payment of interest and dividends, and signal the risk of bankruptcy, among others. It is important to highlight that other indicators, such as operational, environmental, social, and corporate governance, complement the economic-financial analysis, enabling the evaluation of the corporate social responsibility actions (Bassen & Kovács, 2008; Klann & Beuren, 2011; Umamaheswari et al., 2022). The market concentration and the high competitiveness among companies intensify the use of indicators to monitor the company's performance and its long-term sustainability, especially in adverse environments, such as those caused by economic and health crises (Alisyah & Susilowati, 2022; Fernandes, Cailleau & Souza, 2019).

2.3 Relevance and Structure of the Health Sector

The Brazilian health sector has a historical relevance for social and economic well-being, guiding the country's development according to human dignity, quality of life, worker productivity, and the complex production chain of goods and services (Pimentel, Gomes, Landim, Pieroni & Plameira, 2012). The health chain, thought from the evolutionary perspective of the Health Economic-Industrial Complex (CEIS), is structured with a strong dependence on the external sector, evidenced by the structural deficit of the health trade balance aggravated in the 21st century (Gadelha & Temporão, 2018).

This is a sector with a demand for high-tech goods and services that tends to grow as the population gets older. In this sense, the country faces the challenge of increasing investments in innovation to reduce foreign dependence and provide the population with the appropriate conditions, whether through the public or private sector (Gadelha & Temporão, 2018; Pimentel et al., 2012).

According to the 1988 Federal Constitution, based on the concept of the Welfare State, health is one of the three pillars of social security, together with social welfare and social assistance. It is structured by its universal character and financed directly or indirectly by the whole society, and the government is responsible for efficient management through public policies related to health and economic aspects. To expand the network of coverage and quality of goods and services offered by the *Sistema Único de Saúde* (SUS), private institutions are allowed to operate in this sector (Constituição da República Federativa do Brasil, 1988; Gadelha & Temporão, 2018).

The morphology of the CEIS is composed of chemical, biotechnological, mechanical, electronic, and materials-based industries and service sectors (Gadelha & Temporão, 2018). The publicly traded companies that operate in this sector are classified into the following sub-sectors: Medicines and Other Products, Medical Services (Hospital, Analysis, and Diagnosis), Equipment, Commerce, and Distribution (Brasil Bolsa e Balcão, 2022).

The healthcare production chain is considered complex and involves high monetary values and technological levels. It also stands out, both for the intense hiring of skilled labor and for the generation of wealth, with a forecast of growing relevance in the coming decades (Reis, Pimentel, Machado & Barbosa, 2018). The vigor of this sector can be seen by the ratio of spending compared to Gross Domestic Product (GDP), which during 2019 was 5.67% for the private sector and 3.91% for the public sector, totaling 9.58% and ranking below the U.S. (16.77%), Germany (11.70%), France (11.06), and Japan (10.74%). This same chain, in 2020, created more than 3.7 million jobs and more than R$10.5 billion in remuneration for its workers, who were responsible for stimulating consumption (Mendes, 2022).

The structure of the Brazilian health sector is undergoing a concentration process by acquisitions and mergers, involving health plans, hospital services, and diagnostic medicine operators, mainly after the entry of foreign capital. This concentration can be observed by the acquisition of companies in the same segment (horizontal concentration) or by the integration of organizations whose services are complementary (health plan operator, hospital, and diagnostic medicine). The concentration process allows for cost reduction, an increase in market participation, and other competitive advantages (Andrade et al., 2012; Conselho Administrativo de Defesa Econômica [CADE], 2018).

In the pandemic period (2020-2022), the processes of acquisitions and mergers intensified, especially with the merger of Hapvida with the health plan operator Notredame. In this sense, Grupo D'or São Luiz conducted 10 acquisitions, including the hospitals Biocor in Belo Horizonte and Nossa Senhora das Neves in Paraíba. The Grupo Dasa also made 10 acquisitions, including a medical services laboratory in Argentina (Associação de Gastroenterologia do Rio de Janeiro [AGRJ], 2022; Tecchio, 2021).

2.4 Related Studies

The studies included in Table 2 aim to contextualize the present investigation with the objectives, main methodological aspects, and results found in the literature, having been used to investigate similar topics. Alisyah e Susilowati (2022) uses a similar methodological proposal by working with a comparison of two dependent samples to determine if there are significant differences between the economic and financial indicators before and during the Covid-19 pandemic.

Although the research of Fernandes et al. (2019) e Lima et al. (2021) having as the object of study the cooperatives not listed on the stock exchange, they evidenced the relationship of economic-financial indicators in a troubled socioeconomic context, either by the

worsening of the 2014/2015 recession or by the health and economic crisis due to the Covid-19 started in 2020. The cooperatives are organizations strongly interrelated, in terms of demand, with companies in the B3 health sector to offer services to the beneficiaries of health plans. On the other side, Piñeiro-Chousa et al. (2022) analyzed the influence of the production of vaccines for the Sars-Cov-2 virus by two American companies (Pfizer and Moderna) on the volatility of their stock prices. The results suggest that companies that invested in innovative technologies to fight the pandemic were supported by the market, even if differently.

Table 2
Related Studies

Authors	Objective	Methodological aspects	Main results
Alisyah and Susilowati (2022)	Compare the average performance of publicly traded companies in Indonesia to observe the impact of the pandemic caused by the coronavirus.	The sample was composed of 14 companies in the healthcare industry, with data from 2019 and 2020. They applied a normality test and t-test for mean comparisons.	They identified that there were no statistically significant changes in debt, liquidity, activity, and profitability (ROA) indicators before and during the first year of the pandemic. A reduction in solvency and profitability was observed, but not statistically significant.
Lima et al. (2021)	To evaluate the economic and financial performance of Brazilian health plan cooperatives during the period 2018 to 2020.	The sample was composed of the 150 largest cooperatives, considering total assets. A panel-based regression model with fixed effects was used. The dependent variables were continuity (liquidity); revenue; and ROA. The independent and control variables were indebtedness; distribution of investment surpluses; technical provisions; loans; financing, and others.	The variables ROA, surplus distribution, debt composition, and continuity have positive and significant relationships with cooperative continuity. The following were observed in the Covid-19 period: an increase in revenues and capital and a reduction in the degree of indebtedness. In 2020, the number of beneficiaries of the plans increased and the number of elective procedures (surgeries, consultations, exams, etc.) decreased.
Piñeiro-Chousa et al. (2022)	Evaluation of the influence of market volatility and market expectation on the returns of Pfizer and Moderna by comparing the behavior of volatility before and during the Covid-19 pandemic.	They used GARCH econometric model to evaluate the daily returns and volatility behavior of Pfizer and Moderna stocks. The variables: market volatility (VIX), technology market index (NASDAQ), and investor expectation (ISEE) were used with 538 observations in the period before (03/01/2019 to 10/03/2021) and during the pandemic (11/03/2020 to 12/02/2021).	Pfizer stock returns were affected by the technology market and market volatility before Covid-19 and during the pandemic. Market expectations have also become relevant. Moderna's return in the pre-pandemic period, on the other hand, was influenced by the technology market, market volatility, and market expectations. During the pandemic, only the technology market was affected. This difference between the two can be explained by the fact that Pfizer is larger and has been in the market longer.

Source: Elaborated by the authors.

3 METHODOLOGY

The methodological aspects are oriented from the objective of the investigation that, in this case, has the scope of comparing the economic-financial performance between two periods. For this, quantitative, descriptive, and documentary techniques were used to characterize the variables and relate them, using statistical methods. The data relative to the economic-financial indicators (Table) were obtained from the Plataforma Economática®.

According to Table 3, the sample is composed of companies from the Commerce and Distribution (8),

Equipment (2), Medicines and other products (3), and Medical Services (Hospitals, Analyses, and Diagnostics) (11) sub-sectors, for a total of 24 companies. Only the companies Baumer, Lifemed Industrial Equip. e Art. Méd. e Hospitalares, Biomm, and Nortec Química are not classified in the Novo Mercado (NM) segment with the highest level of corporate governance (B3, 2022). By applying the exclusion criterion "absence of data" in the period under analysis, the companies Kora Saúde and Hospital Mater Dei were excluded, resulting in a sample with 22 companies.

Table 3

Companies in the sample (2018-2021)

Company	Sub-sector	Company	Sub-sector
Baumer S.A.	Equipment	Hypera S.A.	Commerce and distribution
Biomm S.A.	Medicines and other products	Instituto Hermes Pardini S.A.	Medical services (hospitals, analyses, and diagnostics)
Blau Farmacêutica S.A.	Commerce and distribution	Lifemed Indústria Equi. e Art. Méd. e Hospit. S.A.	Equipment
Centro de Imagem Diagnósticos S.A.	Medical services (hospitals, analyses, and diagnostics)	Nortec Química S.A.	Medicines and other products
CM Hospitalar S.A.	Commerce and distribution	Odontoprev S.A.	Medical services (hospitals, analyses, and diagnostics)
D1000 Varejo Farma Participações S.A.	Commerce and distribution	Oncoclínicas do Brasil Serviços Médicos S.A.	Medical services (hospitals, analyses, and diagnostics)
Diagnóstico da América S.A.	Medical services (hospitals, analyses, and diagnostics)	Ouro Fino Saúde Animal Participações S.A.	Medicines and other products
Dimed S.A.	Commerce and distribution	Profarma Distribuí. de Produtos Farmacêuticos	Commerce and distribution
Empreendimentos Pague Menos S.A.	Commerce and distribution	Qualicorp Consultoria e Corretora de Seguros S.A.	Medical services (hospitals, analyses, and diagnostics)
Fleury S.A.	Medical services (hospitals, analyses, and diagnostics)	Raia Drogasil S.A.	Commerce and distribution
Hapvida Assistência Médica S.A.	Medical services (hospitals, analyses, and diagnostics)	Rede D'Or São Luiz S.A.	Medical services (hospitals, analyses, and diagnostics)

Source: Own preparation based on B3 data (2022).

The data were initially processed by exploratory analysis (median, mean, standard deviation, coefficient of variation, and minimum and maximum values). The Wilcoxon test was applied since the sample did not show a distribution indicating normality. A total of 88 observations were analyzed, with 44 relating to the period before the pandemic (2018-2019) and 44 after the onset (2020-2021). The use of annual data was due to the lack of observations of some companies in certain quarters, which would not allow the Wilcoxon test to be applied since it requires that the groups be equal (Fávero & Belfiore, 2020). The null hypothesis of the Wilcoxon test is that the medians of the two dependent samples are equal, being rejected when the p-value is below the significance level considered (Fávero & Belfiore, 2020).

A short panel regression was then applied. These data were processed quarterly, resulting in a sample with 191 observations (Fávero & Belfiore, 2020). As mentioned above, some companies did not present quarterly data, which resulted in fewer than 352 observations. In addition, the F-Chow test (compare whether the panel with fixed or POLS effects), Breusch-Pagan Lagrangian test (compare whether the panel with random or Pooled effects), and Hausman test (compare whether the panel with fixed or random effects) were applied. The data showed that in all models random effects were predominant. Also, no multicollinearity problems were found from the Variance Inflation Factor (VIF). The estimation was performed with important clustered standard errors in the firms to mitigate problems regarding heteroscedasticity and serial correlation of the residuals.

The dependent variable in each model was an economic-financial indicator (Table 1), the logarithm of the number of deaths being the explanatory variable, as it represents the worsening of the pandemic. As control variables, the size of the company was used (logarithm of assets and the sub-sector of operation). The model applied was defined as Equation 1.

$$IEF_{i,\,t}= \alpha+ \beta_1 Lnobitos_{\,t}+ \beta_2 Lnativo_{i,\,t} + e_{i,t} \quad (1)$$

Where: IEF = economic-financial indicator of company i in quarter t; Lnobitos = number of deaths per quarter t; and Lnativo is the asset size of entity i in quarter t.

Since healthcare is a sector whose demand for products and services can be positively affected by the worsening of the pandemic, a significant relationship is expected between the number of deaths and the liquidity, profitability, and profit indicators. On the other hand, companies had higher expenses, which may have increased their third-party capital participation; thus, a negative relationship is expected.

4 ANALYSIS AND DISCUSSION OF RESULTS

In the variables presented in Table 4 the terms Before and Pan are used after each variable, where Before refers to the period before the pandemic (2018-2019) and Pan to the time lapse after the onset of the disease (2020-2021). The group of liquidity indicators shows that the companies in this sector were able to pay their short- and long-term obligations before and during Covid-19. This is a sector with high dependence on third-party capital in both periods, whose funds raised may have been directed to finance the operational activities or investments. It is noteworthy that if it is used to pay debts, there is an increased risk of insolvency and bankruptcy, but on the other hand, it may result in a lower cost of capital for the company (Britto, Serrano & Franco, 2018). The net margin and Ebitda margin indices indicate that the industry managed to overcome negative performance in the pandemic period, while the profitability indices showed slightly reduced returns on assets and equity.

Table 4

Descriptive statistics of the sample: before and during the pandemic

Variable	Average	Standard Deviation	Coef. Variation	Minimum	Maximum
LC-BEFORE	1.81	0.73	40.42	0.74	3.69
LC-PAN	2.06	1.11	54.21	0.48	5.81
LG-BEFORE	1.08	0.58	53.98	0.46	3.42
LG-PAN	1.05	0.49	46.46	0.45	2.51
LS-BEFORE	1.36	0.75	55.25	0.36	3.56
LS-PAN	1.58	1.01	64.01	0.44	5.65
PCT-BEFORE	152.40	109.60	71.92	27.69	507.70
PCT-PAN	160.50	91.82	57.21	37.99	475.00
MB-BEFORE	36.69	16.92	46.12	5.83	81.05
MB-PAN	36.85	16.72	45.37	13.93	81.59
ML-BEFORE	-67.57	419.90	-621.43	-2718	35.33
ML-PAN	3.57	24.65	690.86	-120.60	31.67
ME-BEFORE	-45.56	347.50	-762.73	-2231	50.70
ME-PAN	16.00	21.76	136.00	-76.84	52.24
ROA-BEFORE	5.75	7.56	131.36	-14.36	27.12
ROA-PAN	4.91	8.17	166.45	-21.70	22.91
ROE-BEFORE	12.10	18.06	149.26	-40.12	75.35
ROE-PAN	11.47	24.75	215.78	-71.93	114.90

Source: own preparation based on data from Económatica. Number of observations: 44 yearly.
Caption: LC-BEFORE = current liquidity in the period (2018-2019); LC-PAN = current liquidity in the period (2020-2021); LG-BEFORE = general liquidity in the period (2018-2019); LG-PAN = general liquidity in the period (2020-2021); LS-BEFORE = dry liquidity in the period (2018-2019); LS-PAN = dry liquidity in the period (2020-2021); PCT-BEFORE = third-party capital participation in the period (2018-2019); PC-PAN = third-party capital participation in the period (2020-2021); MB-BEFORE = gross margin in the period (2018-2019); MB-PAN = gross margin in the period (2020-2021); ML-BEFORE = net margin in the period (2018-2019); ML-PAN = net margin in the period (2020-2021); ME-BEFORE = Ebitda margin in the period (2018-2019); ME-PAN = Ebitda margin in the period (2020-2021); ROA-BEFORE = return on assets in the period (2018-2019); ROA-PAN = return on assets in the period (2020-2021); ROE-BEFORE = return on equity in the period (2018-2019); ROE-PAN = return on equity in the period (2020-2021).

The Healthcare Sector has a high coefficient of variation within and between the subsectors of B3 that comprise it, mainly in efficiency in profit generation (net margin and EBITDA margin) and profitability (ROA and ROE), as evidenced by Table 5. The Medicines and Other Products sub-sector showed the lowest average profitability and returns and the greatest heterogeneity for the ML and ME indexes within and among the other Sub-sectors. So, there was an improvement in the profitability of this sub-sector during the pandemic period, but not enough to obtain positive values.

Table 5

Mean and coefficient of variation ML, ME, ROA, and ROE before and after the pandemic

Sub-sector	ML-BEFORE	ML-PAN	ME-BEFORE	ME-PAN	ROA-BEFORE	ROA-PAN	ROE-BEFORE	ROE-PAN
				Arithmetic average				
Medicines and Out. Prod.	-550.23	-24.01	-448.69	-8.13	1.24	1.13	-3.57	-6.13
Medical servic. Hosp. Diagn.	10.60	6.69	24.41	22.64	7.49	4.71	15.70	10.43
Equipment	4.49	14.02	12.94	28.36	2.74	11.34	5.63	24.87
Commerce and distribution	7.45	7.79	12.28	14.49	6.25	4.94	15.56	15.88
				Coefficient of variation (%)				
Medicines and Out. Prod.	-181.14	-224.15	-183.28	-492.08	904.66	1283.34	-691.77	-581.3
Medical servic. Hosp. Diagn.	57.33	132.97	42.4	50.45	70.46	137.55	58.11	136.92
Equipment	138.49	52.92	57.5	59.45	129.65	61.75	139.74	67.99
Commerce and distribution	150.16	130.08	99.55	83.09	122.47	103.23	130.03	165.08

Source: Elaborated by the authors. Number of observations: 44 yearly.
Caption: ML-BEFORE = net margin in the period (2018-2019); ML-PAN = net margin in the period (2020-2021); ME-BEFORE = Ebitda margin in the period (2018-2019); ME-PAN = Ebitda margin in the period (2020-2021); ROA-BEFORE = return on assets in the period (2018-2019); ROA-PAN = return on assets in the period (2020-2021); ROE-BEFORE = return on equity in the period (2018-2019); ROE-PAN = return on equity in the period (2020-2021).

As for the other Sub-sectors (Medical services (hospital, analysis, and diagnostics), Equipment, and Commerce and distribution), we observed average positive profitability and return rates before and during the pandemic. However, only the Equipment sub-sector obtained average growth for all profitability and return ratios in the pandemic period, with a reduction of the ML, ROA, and ROE coefficients (Table). As shown by Piñeiro-Chousa et al. (2022) and the results of Table 5, it can be seen that companies in the healthcare sector with products and services for the prevention or treatment of Covid-19 had more favorable conditions for positive performance.

These results suggest uniformity of the companies in the Equipment sub-sector in achieving economic performance, but it should be noted that it is composed of only two companies: Baumer, which provides disinfection and sterilization equipment and services; and Lifemed, which provides ICU-oriented products, especially

pulmonary ventilators, hemodialysis, infusion, disinfection, and remote data monitoring. Therefore, these are companies that produce and market products and services with high demand during the pandemic period, especially in the two years under analysis, as 22,268,574 people were infected and 618,649,000 died as a result of Covid-19, as formally recorded (Conselho Nacional de Secretários de Saúde [Conass], 2021).

The Wilcoxon test was used to compare the median of the indicators between the two groups since there was an absence of normality for most indicators. In this sense, Table 6 shows if there exist statistically significant median differences of the performance indicators, before and during Covid-19, by Sub-sector.

Table 6
Results of Means Tests (Wilcoxon; 5%) (2018-2019; 2020-2021)

Variable	Notes	Means		P-value
		2018-2019	2020-2021	
Sub-sector Medicines and Other Products				
LC	6	2.55	3.00	0.1159
LG	6	1.29	1.42	0.173
LS	6	1.57	2.14	0.2489
PCT	6	81.05	91.38	0.2489
MB	6	29.55	30.70	0.4631
ML	6	8.34	12.44	0.0277**
ME	6	15.97	18.13	0.173
ROA	6	6.72	8.84	0.7532
ROE	6	10.58	16.88	0.3454
Sub-sector Medical services (hospitals, analyses, and diagnostics)				
LC	18	1.50	1.41	0.5862
LG	18	0.75	0.72	0.1570
LS	18	1.43	1.37	0.6165
PCT	18	120.47	166.37	0.0475**
MB	18	30.46	31.01	0.2145
ML	18	10.78	8.35	0.0038***
ME	18	23.36	22.00	0.1446
ROA	18	6.52	3.92	0.0025***
ROE	18	18.35	10.73	0.0176**
Sub-sector Equipment				
LC	4	1.68	2.17	0.0679*
LG	4	1.43	1.67	0.0679*
LS	4	0.93	1.48	0.0679*
PCT	4	100.42	101.2	0.4652
MB	4	49.28	53.01	0.4652
ML	4	2.55	10.95	0.0679*
ME	4	9.91	24.45	0.0679*
ROA	4	1.83	9.00	0.0679*
ROE	4	3.26	20.07	0.0679*
Sub-sector Commerce and distribution				
LC	16	1.49	1.64	0.0879*
LG	16	1.05	0.99	0.8361
LS	16	0.79	1.03	0.0494**
PCT	16	178.23	167.65	0.3011
MB	16	29.98	30.79	0.438
ML	16	2.15	2.47	0.1788
ME	16	6.52	8.51	0.0045***
ROA	16	4.00	2.99	0.2775
ROE	16	11.63	9.00	0.8767

Source: Elaborated by the authors. Number of observations: 44 yearly.
Caption: LC= current liquidity; LG LS = dry liquidity PCT = third-party capital participation MB = gross margin ML = net margin ME = EBITDA margin ROA = return on assets; ROE = return on equity.
* P-value < 0.10; ** < 0.05; *** < 0.001

For the Medicines and Other Products sub-sector, only ML showed a significant median increase between the two periods, suggesting that, over this period, this segment was more efficient in turning sales into net profit. Alisyah and Susilowati (2022), when comparing the performance of Indonesian companies before and during the pandemic, also found no statistical evidence of significant differences in the medians for liquidity and profitability (ROA).

The medical-hospital services, analysis, and diagnostics sub-sector was most negatively affected by the pandemic among the four Sub-sectors, as there was a statistically significant increase in capital dependency, as well as reduced ML and profitability (ROA and ROE). Lima et al. (2021) emphasize that, during the pandemic period, there was a strong retraction in the number of consultations, surgeries and exams, and other elective medical procedures. This occurred so that hospitals would be

focused on preventing contagion and allocating hospital resources, which in many cases became scarce in the market due to the high demand resulting from the pandemic. Therefore, Covid-19 has negatively affected medical-hospital services, analysis, and diagnostics, as they have been reduced in routine care and directed to care for Covid-19 victims.

The Equipment segment, on the other hand, with only two companies, weakens the statistical validity of the test, especially when the growths of the ML, ME, ROA, and ROE indexes of 8.49%, 13.23%, 7.04%, and 16.28%, respectively, are observed. The results show that, with 90% confidence, there is a statistically significant difference in all indicators except for PCT and MB. This suggests that the organizations showed an increase in their ability to pay,

which can be explained by the increased demand for equipment as a result of the growth in sales. The higher demand may also have increased the company's ability to generate net income (ML) and operating income (ME), as well as obtain a higher return on total assets (ROA) and the investment made by the partners (ROE). For the Commerce and Distribution sub-sector, with 8 companies, there is statistical evidence that the dry liquidity ratio and the EBITDA margin increased during the pandemic period, with 95% and 99% confidence, respectively.

Due to the small number of companies per sub-sector, we also performed the test of difference of means for the total sample. Thus, Table 7 shows the Wilcoxon test for the entire sample.

Table 7
Results of Means Tests (Wilcoxon; 5%) (2018-2019; 2020-2021)

Variable	Medians in period		P-value
	2018-2019	2020-2021	
LC	1.55	1.68	0.0635*
LG	0.91	0.94	0.6323
LS	1.22	1.29	0.0619*
PCT	121.23	159.34	0.3505
MB	30.46	31.13	0.8610
ML	4.75	6.96	0.8245
ME	17.57	16.08	0.0635*
ROA	5.73	4.55	0.0951*
ROE	12.56	11.31	0.7002

Source: Survey data, provided by Economática. Prepared by the authors. Number of observations: 44 yearly
Caption: LC= current liquidity; LG LS = dry liquidity PCT = third-party capital participation MB = gross margin ML = net margin ME = EBITDA margin ROA = return on assets; ROE = return on equity.
* P-value < 0.10; ** < 0.05; *** < 0.001

The results suggest that, with 90% confidence, there is a significant median increase for LC, LS, ME, and ROA in the pandemic period. These results are confirmed by Alisyah e Susilowati (2022), even highlighting the non-significant reduction in ROE. Also, Lima et al. (2021) showed that there was statistically significant growth for ROA in the case of Brazilian cooperatives in 2020, and it should be noted that they are not quoted on the stock exchange.

After the median test, panel regression with random effects was applied, and the variables were considered in quarterly periods to evaluate the influence of the pandemic. The proxy used for the pandemic was the logarithm of the number of Covid-19 deaths. This consideration is important since the behavior of the number of deaths over the quarters was statistically different (Kruskal-Wallis, $\chi2= 187.646$, P-value<0.001).

As shown in Table 8, Covid-19 positively and significantly influenced the ROA and Gross Margin of the companies. This result is expected since the increase in the number of deaths raised the demand for pandemic-related medical care, hospital services, and testing. In addition, patients with higher economic resources chose to use the private healthcare network due to the exhaustion of the public healthcare network's capacity. However, sub-sectors, whose entities were not focused on serving patients with

Covid-19, showed reduced performance indices (profitability and returns), as evidenced in Table 6. Company size, on the other hand, positively impacted LC with 90% confidence, indicating that larger organizations had a greater ability to pay in the short term, as observed by Ferraz, Sousa and Novaes (2017) using association with 90% confidence.

The Equipment and Medicines and other products sub-sectors showed positive and significant current and dry liquidity, highlighting that only the Equipment sub-sector showed significant long-term payment capacity with 95% confidence. As a result, the pandemic influenced differently the ability to pay obligations of the companies in the sub-sectors as well as the EBITDA margin, which was significantly lower for the Medical Services sub-sector (hospitals, analysis, and diagnostics).

This shows that the performance of the health sector in Brazil was more affected, considering what was exposed in the study of Alisyah e Susilowati (2022), which makes sense, considering that, according to this study, the population of Indonesia was estimated to be 273.5 million people in 2020 with 158,000 deaths, while Brazil, with an estimated population of 212.6 million (2020), had 685,000 Covid-19 deaths, the position as of September 17, 2022 (University Johns Hopkins, 2022).

Table 8

Results of multivariate analysis by quarter

Variables	Statistical	LC	LS	LG	ROE	ROA	PCT	MB	ME	ML
Constant	Coefficient	-556.828	-450.500	31.007	-252.628	12.407	1.167**	356.598	-331.832	-261.631
	Standard error	369.109	387.310	192.127	629.509	571.119	0.414	350.320	715.759	843.915
Lnobitos	Coefficient	0.437	1.595	1.024	9.015	26.542***	-0.000	15.577**	-9.654	8.943
	Standard error	2.324	2.709	2.247	6.947	7.120	0.004	6.087	7.092	13.077
Lnativo	Coefficient	47.138*	32.802	0.644	27.998	-7.059	-0.042	-13.708	60.699	21.667
	Standard error	24.704	26.381	13.048	38.867	39.148	0.027	23.401	47.673	54.053
Equipment	Coefficient	148.473**	135.482*	68.878**	60.757	98.656	0.005	105.562	-60.303	19.566
	Standard error	69.263	72.649	33.554	145.813	123.929	0.079	80.061	174.622	164.962
Medicines and other products	Coefficient	202.609***	175.344***	54.376	-135.553	-114.797	-0.157	-26.328	-386.564	-60.177
	Standard error	64.258	61.936	49.561	175.236	230.298	0.105	93.561	246.573	220.300
Medical services (hospitals, analyses, and diagnostics)	Coefficient	-33.205	62.226	-27.334	-139.533	-8.136	-0.093	14.211	-262.834**	-5.421
	Standard error	34.248	41.240	24.079	93.186	88.099	0.059	78.190	104.757	85.295
Observations		191	191	191	191	191	191	191	191	191
r^2 overall		0.223	0.226	0.200	0.069	0.055	0.328	0.060	0.238	0.029
r^2 between		0.365	0.330	0.327	0.156	0.059	0.419	0.069	0.340	0.069
r^2 within		0.020	0.005	0.002	0.006	0.049	0.000	0.052	0.035	0.003
$\chi2$	Coefficient	25.460	21.893	25.227	7.190	66.193	32.212	26.031	8.760	2.017

Source: Survey data, provided by Económática. Prepared by the authors. The number of observations: 191 quarterly.
Caption: LC= current liquidity; LG LS = dry liquidity PCT = third-party capital participation MB = gross margin ML = net margin ME = EBITDA margin ROA = return on assets; ROE = return on equity. * P-value < 0.10; ** < 0.05; *** < 0.001

The performance comparison prepared by Lima et al. (2021) shows that the health sector cooperatives, in the first year of the pandemic, registered an increase in the number of beneficiaries and, consequently, in revenue, suggesting that there was a greater demand for health plans as a mechanism for using treatment in private institutions. Thus, the authors' study shows stakeholders that the Equipment sub-sector, which is composed of two companies with products and services in demand during the pandemic period, showed better performance and increased dependence on third-party capital, although not significant (Table 6). Covid-19 significantly increased the short- and long-term liquidity of these entities when compared with those of other sub-sectors, while the Medical Services sub-sector (hospital, analysis, and diagnostics) was the most affected, with a significant reduction in profitability and return indicators (Tables 6 and 8). As evidenced by Piñeiro-Chousa et al. (2022), companies of larger size and products in demand during the pandemic period were able to increase their performance indices as opposed to the other companies.

5 CONCLUSIONS

The health sector involves a complex chain of products and services related to high technology and investments in research and development, having strategic relevance for the economy and for promoting the country's development. In this light, this study aimed to verify the influence of the pandemic on the economic-financial performance of companies in the healthcare sub-sectors of B3.

The exploratory analysis of the data showed that the sector was able to pay its debts in the short and long term and that the companies, on average, have a high dependence on third-party capital. As for profitability and return, a positive gross margin was found, but a negative average for net margin (ML) and Ebitda margin with reduced profitability in the pandemic period from 2018 to 2021. The variability of the mean indicates that this performance is heterogeneous within and between sub-sectors of the healthcare sector, especially regarding third-party capital participation, ML, ROA, and ROE. The Medicines and Other Medical Products and Services (hospital, analytical and diagnostic) sub-Sectors showed increased profitability in the period, considering the median values of ROA and ROE.

When considering the total sample with 88 annual observations, segregated into 44 for the period before the pandemic (2018-2019) and 44 for the period after the onset (2020 and 2021), statistically significant differences (Wilcoxon test) are noticed with growth in LC and LS and a reduction in ME and ROA. The differences in medians by sub-sector showed that the medical services sub-sector (hospitals, analysis, and diagnostics) was the most affected, given the significant reductions in ML, ROA, and ROE concomitantly with the increase in dependence on third-party capital (PTC), while the equipment sub-sector showed the highest increases in profitability. These results suggest that sub-sectors with higher demand for products and services as a result of complications of Covid-19 disease

performed better, as observed for the companies in the Equipment sub-sector that have their products and services related to disinfection, sterilization, and lung ventilators.

The panel regression showed that Covid-19 directly and significantly affected ROA and MB, considering the 191 quarterly observations, while larger firms showed an increase in their ability to pay their debts. This ratifies that the health sector was affected by the disease as also shown by Wilcoxon's test of medians (Table 7). The results made it possible to identify that the pandemic affected the economic-financial performance of the organizations of the healthcare sub-sectors of B3, according to the proposed objective.

This study, therefore, expands the still limited literature on the behavior of the economic and financial performance of healthcare companies, given the specificities of demand due to the pandemic and the priorities established for the care of Covid-19 patients. As a practical implication, this study provides stakeholders with the chance to evaluate future scenarios due to the possibility of new waves of diseases with pandemic capacity by showing different performances of the sub-sectors, generating know-how to make decisions about investments in these contexts.

The analysis of the results of this research highlights the absence of similar studies and the lack of quarterly observations for companies that joined B3 during the period under review, which is why quarterly data were used only for the panel regression. Consequently, further research is suggested, extending the analysis period to the duration of the pandemic, as well as the inclusion of indices related to the market value of these companies.

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