ISSN: 1984-3704
RC UFBA Revista de Contabilidade da UFBA
Ciências Contábeis UNIVERSIDADE FEDERAL DA BAHIA

DOI: https://doi.org/10.9771/rcufba.v19i2.69463

How to Evaluate the Efficiency of Medical Cooperatives? An Application of DEA in Supplementary Healthcare

Como Avaliar a Eficiência de Cooperativas Médicas? Uma Aplicação da DEA na Saúde Suplementar

Clécia Aparecida Garcia Pereira
Universidade de São Paulo
cleciagarcia88913@gmail.com

Thiago Rios Sena
Universidade Estadual de Feira de Santana
thiagoriossena@gmail.com

Anna Beatriz Vieira Palmeira
IFAL / FUCAPE
anna.palmeira@ifal.edu.br

Hellen Bomfim Gomes Dias
Universidade Federal de Pernambuco
hellen.bomfim@ufpe.br

ABSTRACT
Medical cooperatives play a significant role but lack effective instruments to assess their efficiency. ANS Resolution No. 518 defines indicators; however, integrated tools for evaluating economic-financial efficiency are still lacking. In this context, this study proposes the application of Data Envelopment Analysis (DEA) to assess efficiency and support strategic decision-making in healthcare operators. A total of 31 large medical cooperatives belonging to the Unimed System, operating continuously between 2017 and 2024, were analyzed. These operators, regulated by the ANS, serve a large number of beneficiaries and manage billions of Brazilian reais. The results revealed that few operators achieved full efficiency throughout the period. Unimed Blumenau demonstrated continuous maximum performance, standing out as a benchmark. Units previously used in practice as a reference, such as Belo Horizonte, showed lower performance in the DEA model, despite strong absolute results. This study presents a replicable methodology for evaluating the efficiency of healthcare plan operators (OPS), aligned with ANS regulatory guidelines. By applying DEA on a national scale, it provides technical support for management, enabling the identification of waste and the optimization of resources. The methodology can be applied periodically or regionally, serving managers, regulators, and investors. The proposal contributes to a more transparent and sustainable supplementary healthcare model, guided by evidence and focused on performance.
Keywords: Data Envelopment Analysis. Economic-Financial Efficiency. Medical Cooperatives. Supplementary Healthcare.

RESUMO
As cooperativas médicas têm papel relevante, mas carecem de instrumentos eficazes para avaliar sua eficiência. A Resolução nº 518 da ANS define indicadores, porém faltam ferramentas integradas para avaliar a eficiência econômico- financeira. Diante disso, este estudo propõe a aplicação da Análise Envoltória de Dados (DEA) para avaliar a eficiência e apoiar decisões estratégicas nas operadoras. Foram analisadas 31 cooperativas médicas de grande porte pertencentes ao Sistema Unimed, com atuação contínua entre 2017 e 2024. Essas operadoras, reguladas pela ANS, concentram grande número de beneficiários e movimentam bilhões de reais. Os resultados revelaram que poucas operadoras atingiram eficiência plena durante o período. A Unimed Blumenau apresentou desempenho máximo contínuo, destacando-se como referência. Unidades anteriormente utilizadas na prática como referência, como Belo Horizonte, apresentaram desempenho inferior no modelo DEA, apesar de bons resultados absolutos. Este trabalho apresenta uma metodologia replicável para avaliação da eficiência de OPS, com aderência às diretrizes regulatórias da ANS. Ao aplicar a DEA em escala nacional, oferece suporte técnico à gestão, permitindo identificar desperdícios e otimizar recursos. A metodologia pode ser aplicada periodicamente ou regionalmente, servindo a gestores, reguladores e investidores. A proposta contribui para um modelo mais transparente e sustentável na saúde suplementar, pautado por evidências e foco em desempenho.
Palavras-chave: Análise Envoltória de Dados. Eficiência Econômico-Financeira. Cooperativas Médicas. Saúde Suplementar.

Recebido em: 14/08/2025. Aceito em: 12/02/2026. Publicado em: 18/02/2026. Editor: José Luiz Borsatto Junior

1 INTRODUCTION

Since 1988, with the creation of the Unified Health System (SUS), the country has guaranteed universal healthcare coverage; however, the complementary services provided by private operators have been fundamental in expanding access and improving the quality of care. The supplementary health sector in Brazil has faced increasing economic and regulatory challenges, intensified by population aging, the judicialization of healthcare, the incorporation of high-cost technologies, and rising healthcare expenditures (Araújo & Silva, 2018; Agência Nacional de Saúde Suplementar - ANS, 2025).

Health Plan Operators (OPS), particularly medical cooperatives such as those within the Unimed System, are regulated by the Agência Nacional de Saúde Suplementar (ANS) and play an essential role in covering approximately 20% of the population (Xavier & Souza, 2020). Among the various types of operators, medical cooperatives stand out due to their organizational model based on the self-management of healthcare professionals, as exemplified by the units that comprise the Unimed System. These cooperatives, especially large-scale ones, serve millions of beneficiaries and generate billions of reais annually.

However, their economic and financial performance does not always reflect the efficient use of available resources. Through Normative Resolution No. 518, the ANS established minimum governance practices, emphasizing internal controls and risk management, including the monitoring of economic and financial indicators as a preventive mechanism against insolvency (ANS, 2022). Although regulatory indicators have been defined, the market still lacks effective mechanisms to assess how OPS convert their resources into sustainable outcomes, which hinders the identification of best practices and informed decision-making by managers and investors (Reis et al., 2021; Deungaro, 2024). Identifying the degree of operational efficiency of cooperatives, particularly in contexts of increasing claims ratios and judicialization, may contribute to more precise managerial decisions.

In the field of organizational performance analysis, efficiency can be understood through different conceptual approaches, each with distinct managerial implications. Technical efficiency refers to an organization's ability to produce the maximum possible outputs from a given set of inputs or, alternatively, to minimize resource usage to achieve a certain level of results. Allocative efficiency concerns the optimal choice of input combinations, considering their respective prices, in order to minimize costs or maximize economic outcomes. Economic efficiency, in turn, results from the simultaneous achievement of technical and allocative

efficiency, reflecting the organization's capacity to operate in both a technically efficient and economically rational manner (Charnes, Cooper, & Rhodes, 1978).

From a managerial perspective, these distinctions are particularly relevant in the supplementary health sector. Technical efficiency is associated with operators' ability to control healthcare and administrative expenses, reduce waste, and improve internal processes, regardless of price structure. Allocative efficiency relates to strategic resource allocation decisions, such as investments in technology, accredited provider networks, and administrative structure, taking into account their relative costs. Economic efficiency reflects the balance between cost control and the generation of sustainable long-term results. In this context, Data Envelopment Analysis (DEA) stands out as an appropriate tool for measuring relative technical efficiency among operators, enabling the identification of internal benchmarks and managerial improvement opportunities, especially in regulated and heterogeneous environments such as supplementary healthcare.

This article proposes the use of Data Envelopment Analysis (DEA), specifically the VRS-in model, as a managerial tool to identify opportunities for improving the economic and financial efficiency of medical cooperatives. Based on the indicators defined by ANS Normative Resolution No. 518, the proposal aims to provide a practical diagnostic framework that enables managers to make more strategic resource allocation decisions and enhance the financial and operational performance of their institutions, allowing them to identify inefficiencies, recognize internal sector benchmarks, and implement evidence-based corrective actions.

2 INVESTIGATED CONTEXT

Health Plan Operators (OPS) are entities responsible for offering and managing health insurance plans, acting as intermediaries between service providers and beneficiaries. These operators exhibit distinct legal structures and operational modalities, including medical cooperatives, self-managed entities, and group medicine companies, all subject to regulation and supervision by the Agência Nacional de Saúde Suplementar (ANS). Within the regulatory framework, Normative Resolution No. 518/2022 established minimum corporate governance practices, with emphasis on internal controls, risk management, and economic-financial monitoring, defining mandatory indicators for assessing operators' sustainability and preventing insolvency situations.

In the scientific field, academia has employed Data Envelopment Analysis (DEA) to

examine the economic and financial condition of OPS as a central element of their sustainability. Through the application of DEA, Xavier and Souza (2020) concluded that aspects such as operational structure and legal nature directly affect economic performance. Similarly, Deungaro (2024) conducted a comparative analysis of large-scale operators within the medical cooperative and group medicine modalities from 2018 to 2021. Using economic-financial indicators disclosed by the ANS, the author identified significant variations in the average indicator patterns between the biennia 2018–2019 and 2020–2021. These findings reinforce the need for a more systematic approach to evaluating OPS efficiency, particularly during periods of instability.

Using the same empirical strategy, Reis et al. (2021) demonstrated that economic-financial indicators were decisive factors in the establishment of special regulatory regimes by the ANS between 2017 and 2019, with particular emphasis on liquidity and indebtedness. These results highlight a direct relationship between operators' financial performance and critical regulatory decisions, strengthening the argument that managers require more precise and accessible tools for performance monitoring and risk prevention. Given their importance to public health, it is essential to examine the economic and financial efficiency of these organizations, especially in a market that has been contracting over the past 15 years. To assess the financial condition of OPS, economic-financial indicators were calculated, and statistical tests and Data Envelopment Analysis (DEA) were performed. The results indicated that the OPS modality may influence its efficiency.

More recently, the increase in claims ratios among OPS has become a prominent issue. Araújo and Silva (2018) noted that in recent years, health operators have faced alarming data related to rising claims ratios, signaling potential risks to the sector's sustainability.

In April 2025, the ANS released the 8th edition of Panorama Saúde Suplementar (2025). Among the topics addressed, the report highlighted the growth in the number of beneficiaries of medical-hospital plans, reaching 52.2 million in January 2025, representing a 1.96% increase compared to the previous year. From an economic-financial perspective, the sector recorded a net profit exceeding R$10 billion, the highest since the pandemic, marking seven consecutive quarters of positive performance. In addition, the average claims ratio declined to the lowest level in the historical series in the fourth quarter of 2024.

Consistent with this scenario, the Agência Nacional de Saúde Suplementar (ANS), through the Supplementary Health Economic-Financial Panel, released data for the fourth quarter of 2024, highlighting the sector's economic and social relevance. Considering the entire

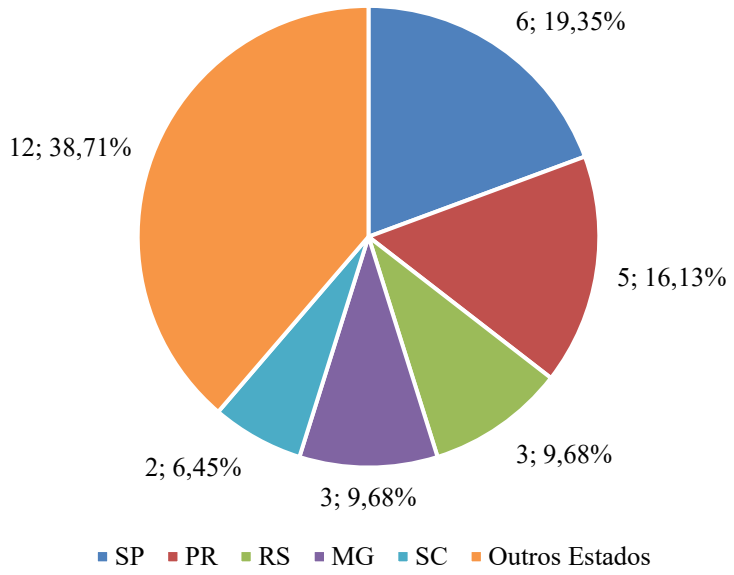
sector, R$312.1 billion in premium revenues and R$256.8 billion in healthcare expenses were recorded. Focusing exclusively on medical assistance and medical cooperatives, approximately 19 million beneficiaries were identified, with 268 operators in activity and 262 active operators with beneficiaries. Revenues totaled R$96.8 billion, representing 31.0% of the total, while net reimbursable events amounted to R$80.7 billion (31.4%). These figures reinforce that supplementary healthcare plays a fundamental role in Brazil, complementing the SUS and serving a significant portion of the population. Given the economic and social relevance of supplementary healthcare, understanding the efficiency of economic-financial indicators becomes essential for ensuring the sustainability of OPS in the face of growing economic and demographic challenges.

3 DIAGNOSIS OF THE PROBLEM SITUATION

Data processing followed systematic procedures aimed at ensuring consistency, comparability, and adherence to current regulatory guidelines. Initially, the cumulative quarterly trial balances of the operators were collected directly from the Financial Statements database of the Agência Nacional de Saúde Suplementar (ANS), considering the closing of the fourth quarter of each fiscal year in order to capture the annual economic-financial position of each cooperative. Subsequently, accounting information was standardized in accordance with the chart of accounts established by Normative Resolution No. 528/2022, and the economic-financial indicators set forth in Annex IV of Normative Resolution No. 518/2022 were calculated, ensuring uniform measurement of variables throughout the analyzed period.

The exclusion criteria for operators were defined based on methodological and comparability assumptions. Only medical cooperatives classified as large-scale (above 100,000 beneficiaries) and exhibiting continuous operation between 2017 and 2024 were considered, ensuring complete historical series and avoiding distortions associated with market entry or exit during the period. Of the 47 cooperatives initially identified, 16 were excluded for failing to maintain large-scale classification or due to operational discontinuity, resulting in a final sample of 31 medical cooperatives belonging to the Unimed System. The state of São Paulo concentrated the largest number of Unimed operators (6 operators; 19.35%), followed by Paraná (5; 16.13%), Rio Grande do Sul and Minas Gerais (3 each; 9.68%), Santa Catarina (2; 6.45%), and the remaining states (38.71%) with one Unimed each (see Figure 1).

Figure 1
Distribution of the Number of Unimed Operators by State



Source: Research Data (2025)

The selection of input and output variables used in the DEA model was grounded in normative, conceptual, and managerial criteria. The selected inputs (number of beneficiaries, General Complaint Index (IGR), healthcare expenses, and administrative expenses) reflect the primary resources and operational pressure factors monitored by the ANS within the scope of economic-financial governance of operators. These elements represent, respectively, operational scale, perceived service quality, healthcare costs, and administrative costs—central aspects for evaluating the technical efficiency of OPS. The outputs consisted of economic-financial indicators required by Normative Resolution No. 518/2022, such as profitability, liquidity, claims ratio, capital structure, and operational timeframes, as they represent the expected outcomes of the appropriate use of available resources. Thus, the adopted modeling approach ensures direct alignment between the efficiency analysis and the regulatory parameters employed by the regulatory agency itself.

Data were obtained from the institutional website of the ANS (Financial Statements, 2023). Cumulative quarterly trial balances were used, considering the closing of the fourth quarter of each year for each operator. The databases were compiled using Power BI (Microsoft Corporation, 2025), and the indicators provided in Annex IV of Normative Resolution No. 518 (ANS, 2022) were calculated: Net Profit Margin (NPM), Return on Equity (ROE), Claims Ratio (CR), Administrative Expense Ratio (AE), Commercial Expense Ratio (CE), Operating

Expense Ratio (OER), Financial Result Ratio (FRR), Current Liquidity Ratio (CL), Third-Party Capital Guarantee Ratio (TC/CP), Average Premium Collection Period (APCP), and Average Claims Payment Period (ACPP).

The Healthcare Cost Variation Index (VC) was excluded from the analysis, as the absence of 2016 data rendered its calculation unfeasible, given that it depends on comparisons between consecutive 12-month periods. In addition to the indicators, data on administrative and healthcare expenses (Net Reimbursable Events) were collected. Indicator calculations were performed in accordance with the chart of accounts established by Normative Resolution No. 528 (ANS, 2022).

Additionally, the General Complaint Index (IGR) was collected from the ANS Complaints Data and Index database (ANS, 2021), an index that reflects the monthly average number of complaints per 100,000 beneficiaries. The absence of complaints is considered ideal, as complaints may result in fines and negatively impact operators' financial performance.

An exploratory data analysis was initially conducted. Subsequently, Data Envelopment Analysis (DEA) was applied to assess the relative efficiency of Health Plan Operators (OPS). The Variable Returns to Scale model with input orientation (VRS-in) was adopted, as it is recommended for contexts in which decision-making units operate at different efficiency scales.

Data Envelopment Analysis was originally proposed by Charnes et al. (1978) and constitutes a non-parametric method for measuring the relative efficiency of units that use multiple inputs to produce multiple outputs. In the present study, the efficiency of 31 large-scale cooperatives belonging to the Unimed System was evaluated. The analyses were performed using the R software. Table 1 presents the variables assessed in the model.

Table 1
Input and Output Variables

	Variables	Source
Input	Number of Beneficiaries	ANS
	General Complaint Index [IGR]	ANS
	Healthcare Expenses	ANS
	Administrative Expenses	ANS
Output	Net Profit Margin [NPM]	Net Income / Earned Premiums
	Return on Equity [ROE]	Net Income / Shareholders' Equity
	Claims Ratio [IS]	(Net Reimbursable Events + |CCT|) / (Earned Premiums + |CCT|)
	Administrative Expense Ratio [DA]	Administrative Expenses / (Earned Premiums + |CCT|)

Commercial Expense Ratio [DC]	(Commercialization Expenses) / (Earned Premiums + |CCT| + Other Operating Revenues)
Operating Expense Ratio [DOP]	(Administrative Expenses + Other Operating Expenses) / (Earned Premiums + |CCT| + Other Operating Revenues)
Financial Result Ratio [IRF]	Net Financial Result / (Earned Premiums + |CCT|)
Current Liquidity Ratio [LC]	Current Assets / Current Liabilities
Third-Party Capital Guarantee Ratio [CT/CP]	(Current Liabilities + Non-Current Liabilities) / Shareholders' Equity
Average Premium Collection Period [PMCR]	(Healthcare Operations Receivables / Earned Premiums) × 360
Average Claims Payment Period [PMPE]	(Outstanding Claims Provision / Reimbursable Events) × 360

Source: Research Data (2025)

Initially, a descriptive analysis of the input and output variables was conducted, followed by the application of the Variable Returns to Scale (VRS) model with input orientation (input minimization). Table 2 presents the average of each input over the years.

Table 2
Input Indicators Over the Years for the 31 Operators

Year	Beneficiaries	IGR	Healthcare Expenses	Administrative Expenses
2017	306776,65	7,92	R$ 883.687.908,00	R$ 101.718.859,50
2018	306473,00	8,55	R$ 932.519.198,69	R$ 109.369.392,80
2019	308666,94	11,21	R$ 1.042.158.245,16	R$ 119.675.234,52
2020	312344,16	12,01	R$ 1.013.970.621,41	R$ 122.083.606,74
2021	324747,90	16,49	R$ 1.256.407.774,89	R$ 135.325.944,28
2022	338547,26	19,79	R$ 1.283.646.204,12	R$ 147.586.489,90
2023	348908,84	30,20	R$ 1.446.685.851,95	R$ 161.314.887,56
2024	350248,48	35,63	R$ 1.591.543.055,21	R$ 190.073.701,64

Source: Research Data (2025)

It is possible to identify growth in the average number of beneficiaries over the analyzed period. However, it is important to emphasize the high dispersion in the data, as evidenced by the range of values. The observed median was 186,498 beneficiaries, with Unimed Central Nacional and Unimed Belo Horizonte standing out due to their high number of beneficiaries per year. In contrast, Unimed Blumenau recorded the lowest number of beneficiaries in 2018 (102,032), presenting growth of 27.20% by 2024, reaching 129,782 beneficiaries. When analyzing the aggregate of Unimed cooperatives nationwide, a total of 2,072,120 beneficiaries was recorded in 2023; however, a decline of 5.80% was observed in 2024.

The analysis of the monthly average of the General Complaint Index (IGR) over the years shows a substantial increase throughout the period, rising from 7.92 to 35.63 complaints per 100,000 beneficiaries, representing growth of 349.81% between 2017 and 2024. This

increase resulted from the growth in the number of complaints registered with the ANS. In addition to the rise in complaints in recent years, the judicialization of healthcare has emerged as a major challenge, with patients seeking judicial access to treatments not covered by health plans, thereby increasing the need for clear and balanced regulation (ANS, 2025). Aguiar (2025) demonstrates that judicialization increased by 60% between 2020 and 2023, generating costs of approximately R$17.5 billion and financially impacting both public and private healthcare systems.

When analyzing healthcare expenses per year, an increase of 80.10% was observed between 2017 (R$884 million) and 2024 (R$1.6 billion). Health plans in Brazil faced an increasingly complex scenario over the analyzed period. Among the main factors of concern were population aging (Goya, 2023), the accelerated incorporation of new technologies (Agência Nacional de Vigilância Sanitária - ANVISA, 2020; ANVISA, 2022; Johnson & Johnson, 2023), the continuous updating of legal norms and ANS regulations (IESS, 2023; ANS, 2023), in addition to medical inflation and the ongoing rise in healthcare costs.

The evolution of the monthly average of administrative expenses over the years also showed significant growth of 86.86% between 2017 and 2024. This increase may be associated with various structural and contextual factors. Among the main drivers were investments in digital transformation, including the acquisition and maintenance of management systems, digital service platforms, and data intelligence tools, which are essential for improving governance and information transparency (Silva & Dias, 2022; Magalhães, 2017). Another relevant factor was the salary adjustment applied to nursing professionals, regulated by Law No. 14,434/2022, which established a national minimum wage for the category. The increase in salaries for nurses, nursing technicians, and nursing assistants exerted pressure on healthcare costs across the entire health sector, including the supplementary segment.

Additionally, rising costs associated with specialized human resources, particularly in the areas of information technology, compliance, data management, and regulation, significantly contributed to the increase in administrative expenses among health plan operators. The current regulatory context, particularly the requirements of ANS Normative Resolution No. 518/2022, imposed on operators the need to structure internal controls, periodically disclose economic-financial data, and develop performance indicators, demanding greater administrative robustness.

Table 3 presents the evolution of the economic-financial indicators (outputs) over the years, considering the 31 large-scale operators included in the sample.

Table 3
Economic-Financial Indicators Over the Years for the 31 Operators

Year	MLL	ROE	IS	DA	DC	DOP	IRF	LC	CT/CP	PMCR	PMPE
2017	0,04	0,20	0,86	0,10	0,01	0,97	0,02	1,47	1,58	18,81	32,20
2018	0,05	0,19	0,83	0,10	0,01	0,97	0,01	1,59	1,32	22,89	33,33
2019	0,04	0,15	0,87	0,08	0,01	0,98	0,01	1,62	1,23	23,48	32,00
2020	0,08	0,26	0,79	0,08	0,01	0,93	0,00	1,86	0,96	23,19	36,29
2021	0,01	0,03	0,88	0,08	0,01	1,00	0,01	1,71	1,10	19,48	30,04
2022	0,01	0,03	0,88	0,10	0,02	1,02	0,03	1,56	1,26	21,68	25,93
2023	0,01	0,03	0,86	0,09	0,02	1,01	0,02	1,43	1,38	24,41	27,38
2024	0,02	0,08	0,85	0,10	0,02	1,00	0,01	1,38	1,45	22,08	27,32

Source: Research Data (2025)

When analyzing the results between 2017 and 2024, a downward trend in profitability (NPM and ROE) was observed, possibly associated with rising healthcare costs and limitations on revenue adjustments. Marques et al. (2023) indicated that during the pandemic there was a statistically significant decrease in profitability indicators of health plan operators, such as Net Profit Margin (NPM) and Return on Equity (ROE).

Conversely, operational indicators, such as commercial and operating expenses, showed growth, reflecting challenges in cost management and operational efficiency. The current liquidity ratio remained relatively stable, although with a slight decline in recent years, which may indicate a reduced capacity to meet short-term obligations. Regarding the average payment period, a decrease was observed, possibly reflecting renegotiation efforts with providers or improvements in internal processes.

In light of this scenario, the need for operators to develop more sustainable healthcare and cost management models becomes evident, capable of reconciling access to innovation with the financial equilibrium of operations.

4 PROPOSED INTERVENTION

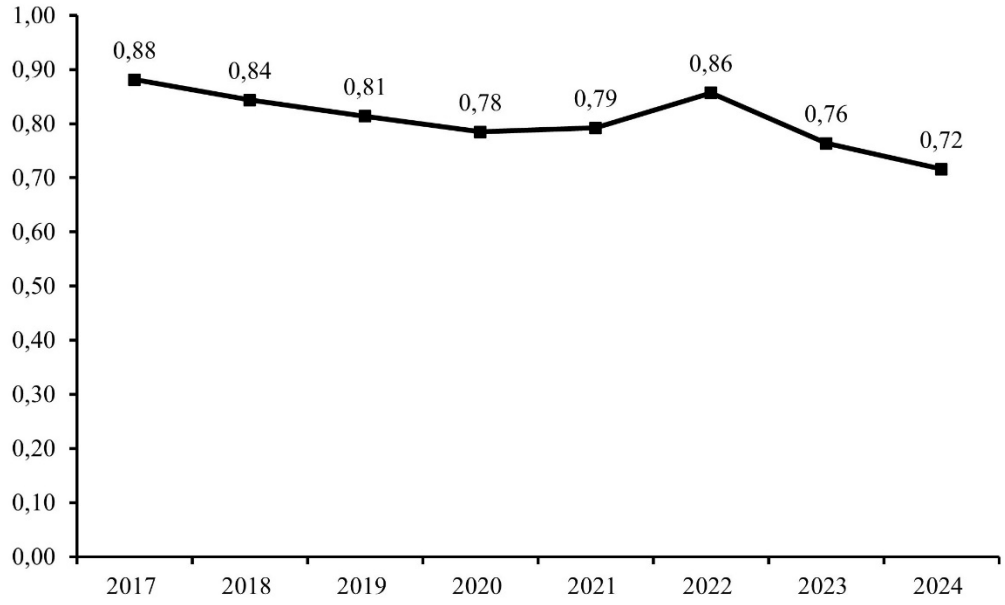
In order to assess the efficiency of the operators, the Variable Returns to Scale model with input orientation (VRS-in) was applied. This model was considered more realistic because it allows for variable returns to scale, thereby highlighting operators that made effective use of their resources even under distinct operational contexts.

Figure 2 presents the evolution of average efficiency scores by year. A progressive downward trend was observed, with the exception of 2022. The average efficiency declined

from 0.88 in 2017 to 0.72 in 2024. The year 2022 showed a temporary increase to 0.86, possibly reflecting adjustment strategies adopted by some operators following the most severe impacts of the pandemic. However, this recovery was not sustained in subsequent years.

This pattern reinforces the notion that, despite advances in technology, digitalization, and management practices, operators have faced increasing challenges in maintaining high levels of operational efficiency.

Figure 2
Evolution of Average Efficiency Scores Using the VRS-in Model



Source: Research Data (2025)

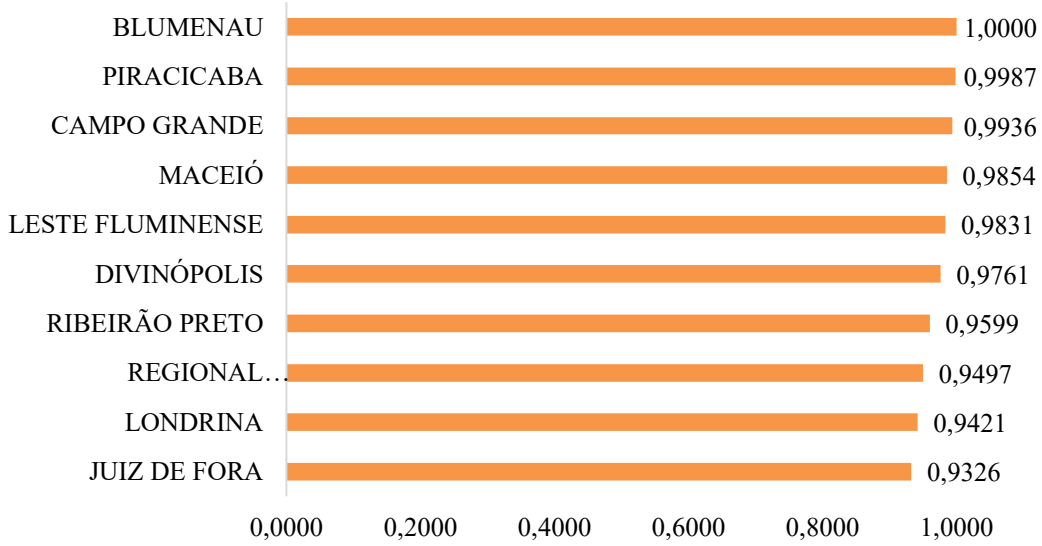
Figure 3 presents, in Panels A and B respectively, the ten operators with the highest and lowest average efficiency between 2017 and 2024. In Panel A, Unimed Blumenau, Unimed Piracicaba, and Unimed Campo Grande stood out, all with average performance exceeding 0.99. These operators demonstrated consistent and proportional use of available resources over the years.

Conversely, in Panel B, Unimed Belo Horizonte ranked last, with an average efficiency below 0.40. Although this operator exhibited strong financial indicators in absolute terms, such as profit margin and return on equity, its performance under the DEA model suggested less efficient use of available inputs compared to the other cooperatives analyzed.

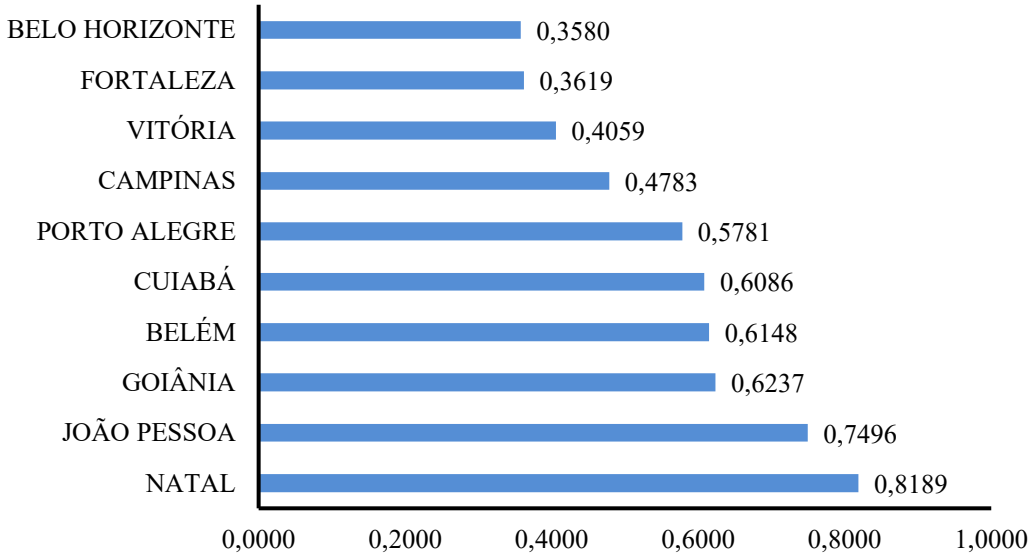
Appendix – Table I presents the efficiency scores of all operators, ordered by the sum of efficiencies over the years.

Figure 3
Ranking of Unimed Operators with the Highest/Lowest Average Efficiency Using the VRS-in Model

Panel A – Unimed Operators with the Highest Average Efficiency



Panel B – Unimed Operators with the Lowest Average Efficiency



Source: Research Data (2025)

It is important to emphasize the relationship between the economic-financial indicators of the Unimed operators and their efficiency in the DEA model. The DEA analysis focused on relative efficiency, that is, it assessed how each operator transformed inputs (such as number of beneficiaries, complaints, and healthcare costs) into outputs (performance indicators such as profit margin, return on equity, and current liquidity). Thus, an operator could be considered efficient even without presenting the best absolute indicators, since DEA values the proportionally effective use of available resources.

An illustrative example is the comparison between Unimed Blumenau and Unimed Belo Horizonte. The former, despite being a smaller operator, achieved maximum efficiency in all analyzed years, suggesting effective utilization of its inputs while maintaining balance between expenses and results. In contrast, Unimed Belo Horizonte, one of the largest operators in the country, with an excellent reputation and robust financial indicators (such as high Net Profit Margin (NPM), Return on Equity (ROE), and current liquidity) demonstrated lower performance in the DEA assessment. This occurred because, despite its strong absolute results, the relationship between inputs used and outputs generated was not considered the most efficient by the model.

Therefore, the comparative analysis between financial indicators and relative efficiency made it possible to understand that efficiency is not synonymous with size or high revenue, but rather with the ability to generate favorable results proportionally to the resources employed. This distinction proved essential for promoting performance-based and sustainable management, particularly in the current supplementary healthcare context, characterized by high healthcare costs, judicialization, and increasing regulatory complexity.

5 RESULTS OBTAINED

The application of Data Envelopment Analysis (DEA) revealed significant performance distinctions among the evaluated operators. The VRS-in model, which considers variable returns to scale and focuses on input minimization, demonstrated that only a small proportion of the medical cooperatives operated at full efficiency throughout all analyzed years. Among them, Unimed Blumenau stood out with full technical efficiency across eight consecutive evaluation cycles, establishing itself as a benchmark within the group. This result reinforces the operator's ability to maintain balanced and effective management of healthcare and administrative resources, even in challenging scenarios such as the post-pandemic period.

Conversely, large-scale operators such as Unimed Belo Horizonte, although presenting stronger absolute economic-financial indicators and a well-established market reputation, did not rank among the most efficient under the DEA framework. This finding highlights that technical efficiency is not necessarily associated with the absolute volume of results, but rather with the proportional capacity to convert inputs into outputs. Thus, smaller operators may achieve full efficiency when operating close to the technical frontier defined by the model, whereas larger operators may exhibit relative inefficiencies if there remains room for

optimization in the use of their resources.

This distinction underscores the importance of employing complementary approaches in evaluating the performance of health operators: while economic-financial indicators reflect absolute results, DEA captures nuances of relative efficiency among organizations with different operational profiles.

Among the study's limitations, it is noteworthy that although the DEA model is effective for comparing units, it does not directly identify the causes of the observed inefficiencies. Furthermore, relevant external factors (such as the local regulatory environment, clinical management model, quality of care, or qualitative governance aspects) were not incorporated into the analysis, which may have influenced the results obtained.

As suggestions for future research, the application of DEA using a window analysis approach is recommended, as well as conducting year-by-year analyses to capture cyclical variations and employing unbalanced panel data to enhance the robustness and applicability of findings across different operational contexts.

In addition to the non-parametric approach, the use of parametric statistical models, such as linear regressions or panel data analyses, is recommended to identify the factors that most influence efficiency or economic-financial performance among operators. Cluster analysis and principal component analysis techniques may also be employed to classify operator profiles and synthesize patterns across the various indicators analyzed.

6 TECHNOLOGICAL-SOCIAL CONTRIBUTION

This study proposes the practical application of Data Envelopment Analysis (DEA), a method widely employed in efficiency studies, as a managerial tool for diagnosing the economic-financial efficiency of large-scale medical cooperatives in Brazil. In a context characterized by intense regulatory pressures, the continuous increase in healthcare costs, the judicialization of healthcare, and growing complexity in the management of supplementary health services, the research presents a useful and replicable model for managers of Health Plan Operators (OPS), aligned with the guidelines established by ANS Normative Resolution No. 518.

The application of the VRS-in model, focused on input minimization, enables comparisons among organizations of different sizes under a proportional efficiency framework, facilitating the identification of internal benchmarks and the establishment of realistic

improvement targets. It constitutes a robust decision-support instrument with potential for periodic application or adaptation to distinct regional contexts, capable of supporting strategic planning based on empirical evidence.

In addition to contributing to the enhancement of management practices within OPS, the findings may also be valuable for regulatory bodies, administrative boards, and investors by clarifying how technical efficiency can (and should) be incorporated into governance practices. By demonstrating the transformative potential of quantitative methods as management tools in healthcare, this study advances toward a more sustainable, transparent, and performance-oriented model in the supplementary health sector.

REFERENCES

Agência Nacional de Saúde Suplementar (2021). Dados e Índices de Reclamações. Disponível em: <https://www.gov.br/ans/pt-br/assuntos/informacoes-e-avaliacoes-de-operadoras/indice-de-reclamacoes-2>. Acesso em: 24 abr. 2025.

Agência Nacional de Saúde Suplementar (2021). Histórico. Disponível em: <https://www.gov.br/ans/pt-br/acesso-a-informacao/institucional/quem-somos-1/historico>. Acesso em: 07 out. 2024.

Agência Nacional de Saúde Suplementar (2022). ANS amplia regras de cobertura para tratamento de transtornos globais do desenvolvimento. Disponível em: <https://www.gov.br/ans/pt-br/assuntos/noticias/beneficiario/ans-altera-regras-de-cobertura-para-tratamento-de-transtornos-globais-do-desenvolvimento>. Acesso em: 22 abr. 2025.

Agência Nacional de Saúde Suplementar (2022). Resolução Normativa Nº 507 de 30 de março de 2022. Disponível em: <https://bvsms.saude.gov.br/bvs/saudelegis/ans/2022/res0507_11_04_2022.html>. Acesso em: 20 jan. 2025.

Agência Nacional de Saúde Suplementar (2022). Resolução Normativa Nº 518 de 29 de abril de 2022. Disponível em: <https://www.ans.gov.br/component/legislacao/?view=legislacao&task=textoLei&format=raw&id=NDIxNw==>. Acesso em: 01 out. 2024.

Agência Nacional de Saúde Suplementar (2022). Resolução Normativa Nº 528 de 29 de abril de 2022. Disponível em: <https://bvsms.saude.gov.br/bvs/saudelegis/ans/2022/res0528_06_05_2022.html>. Acesso em: 01 jan. 2025.

Agência Nacional de Saúde Suplementar (2022). Resolução Normativa Nº 531 de 02 de maio de 2022. Disponível em: <https://bvs.saude.gov.br/bvs/saudelegis/ans/2022/res0531_04_05_2022.html>. Acesso em: 07 out. 2024.

Agência Nacional de Saúde Suplementar (2023). ANS incorpora novas tecnologias ao Rol de Procedimentos e Eventos em Saúde. Rio de Janeiro, RJ, Brasil. Disponível em: <https://www.gov.br/ans/pt-br/assuntos/noticias/sobre-ans/ans-incorpora-novas-tecnologias-ao-rol>. Acesso em: 19 abr. 2025.

Agência Nacional de Saúde Suplementar (2023). Demonstrações Contábeis. Rio de Janeiro: ANS, 2023. Disponível em: <https://dadosabertos.ans.gov.br/FTP/PDA/demonstracoes_contabeis/>. Acesso em: 30 out. 2024.

Agência Nacional de Saúde Suplementar (2025). ANS divulga a 8ª edição do Panorama – Saúde Suplementar. Rio de Janeiro, RJ, Brasil. v.6, nº 8. Disponível em: <https://www.gov.br/ans/pt-br/assuntos/noticias/numeros-do-setor/ans-divulga-a-8a-edicao-do-panorama-2013-saude-suplementar>. Acesso em: 08 abr. 2025.

Agência Nacional de Saúde Suplementar (2025). ANS participa de fórum sobre judicialização na saúde. Disponível em: <https://www.gov.br/ans/pt-br/assuntos/noticias/sobre-ans/ans-participa-de-forum-sobre-judicializacao-na-saude>. Acesso em: 20 mar. 2025.

Agência Nacional de Saúde Suplementar (2025). Painel Econômico-Financeiro da Saúde Suplementar. Rio de Janeiro, RJ. Disponível em: <https://app.powerbi.com/view?r=eyJrIjoiMjM4YTYyMDEtMmRjMS00NWFhLWFkMTEtMDk0YmMzZTk2YzZkIiwidCI6IjlkYmE0ODBjLTRmYTctNDJmNC1iYmEzLTBmYjEzNzVmYmU1ZiJ9>. Acesso em: 09 abr. 2025.

Agência Nacional de Vigilância Sanitária (2020). Aprovado registro de produto de terapia gênica. Brasília, DF, Brasil. Disponível em: <https://www.gov.br/anvisa/pt-br/assuntos/noticias-anvisa/2020/aprovado-registro-de-produto-de-terapia-genica>. Acesso em: 19 abr. 2025.

Agência Nacional de Vigilância Sanitária (2022). Spinraza, INN-nusinersen. Bruxelas, União Europeia. Disponível em: <https://ec.europa.eu/health/documents/community-register/2022/20220131154171/anx_154171_pt.pdf>. Acesso em: 19 abr. 2025.

Aguiar, M. (2025). A judicialização na saúde suplementar: causas e impactos. Colégio Registral Rio Grande do Sul. Disponível em: <https://colegioregistralrs.org.br/noticias/20135/artigo-a-judicializacao-na-saude-suplementar-causas-e-impactos-por-marcio-aguiar/>. Acesso em: 17 mar. 2025.

Araújo, A. A. S.; Silva, J. R. S. (2018). Análise de tendência da sinistralidade e impacto na diminuição do número de operadoras de saúde suplementar no Brasil. Ciência e Saúde Coletiva, v. 23, n. 8. DOI: https://doi.org/10.1590/1413-81232018238.20572016.

Charnes, A.; Cooper, W. W.; Rhodes, E. (1978). Medindo a eficiência das unidades de tomada de decisão. Revista Europeia de Pesquisa Operacional, v. 2, n. 6, p. 429-444. DOI: https://www.sciencedirect.com/science/article/abs/pii/0377221778901388?via%3Dihub.

Deungaro, E. C. (2024). Desempenho econômico-financeiro de operadoras de planos de saúde no mercado brasileiro. Revista Brasileira de Saúde Suplementar, v. 2, n. 1, p. 1-16.

Goya, M. (2023). Medicina S/A: envelhecimento e custos na saúde. Disponível em: <https://medicinasa.com.br/envelhecimento-custos/#:~:text=Os%20idosos%20tendem%20a%20enfrentar,medida%20que%20a%20idade%20avan%C3%A7a>. Acesso em: 13 mar. 2025.

Instituto de Estudos de Saúde Suplementar [IESS]. 2023. Medicamentos de alto custo: tendências e impacto nos planos de saúde. São Paulo, SP, Brasil. Disponível em: <https://www.iess.org.br>. Acesso em: 13 abr. 2025.

Johnson & Johnson Innovative Medicine. (2023). Terapia avançada CAR-T. São Paulo, SP, Brasil. Disponível em: <https://innovativemedicine.jnj.com/brasil/terapia-avancada-car-t>. Acesso em: 13 abr. 2025.

Magalhães, J. N. (2017). Relação entre despesas administrativas e a solvência das operadoras de planos de saúde no Brasil. São Cristóvão: Universidade Federal de Sergipe, 2017. Monografia (Bacharelado em Ciências Atuariais). Disponível em: <https://ri.ufs.br/jspui/handle/riufs/7181>. Acesso em: 13 abr. 2025.

Marques, T. R. R.; Oliveira, E. R.; Santos, G. C.; Ferreiro Neto, B. J. (2023). Desempenho das operadoras de planos de saúde: antes e durante a pandemia. Revista Ambiente Contábil, v. 15, n. 1, p. 1-21. DOI: https://doi.org/10.21680/2176-9036.2023v15n1ID28087.

Reis, T. A.; Macedo, M. A. S.; Marques, J. A. V. C. (2021). Desempenho econômico-financeiro e as decisões de instauração de regimes especiais no setor de saúde suplementar brasileiro. Revista Contemporânea de Contabilidade, v. 18, n. 48, p. 156–174. DOI: https://doi.org/10.5007/2175-8069.2021.e77327.

Silva, A. L.; Dias, W. S. (2022). Estratégias de redução de custo em operadoras de planos de saúde: um estudo de caso junto ao município de Palmas-TO. Revista Multidebates, v. 6, n. 1, p. 81-88. Disponível em: <https://www.seer.ufal.br/index.php/multidebates/article/view/14302>. Acesso em: 13 abr. 2025.

Xavier, D. O.; Souza, A. A. (2020). A eficiência econômico-financeira de operadoras de planos de saúde: a influência da modalidade. For Science, v. 8, n. 2, e00707. DOI: https://doi.org/10.29069/forscience.2020v8n2.e707.

Appendix

Table I

Efficiency Generated by the VRS-in Model by Operator and by Year

Operator	Name	2017	2018	2019	2020	2021	2022	2023	2024
334561	BLUMENAU	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
315729	PIRACICABA	1,00	1,00	1,00	1,00	0,99	1,00	1,00	1,00
312851	CAMPO GRANDE	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,95
327689	MACEIÓ	0,99	0,99	1,00	0,97	1,00	1,00	0,92	1,00
343731	LESTE FLUMINENSE	1,00	0,97	1,00	0,94	0,95	1,00	1,00	1,00
319121	DIVINÓPOLIS	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,81
351202	RIBEIRÃO PRETO	1,00	1,00	1,00	0,93	1,00	1,00	0,89	0,85
371254	REGIONAL MARINGÁ	1,00	1,00	1,00	1,00	1,00	1,00	0,80	0,79
343269	LONDRINA	1,00	1,00	0,94	0,91	0,86	1,00	0,82	1,00
306886	JUIZ DE FORA	1,00	0,94	0,93	0,87	0,94	1,00	0,92	0,85
304701	CURITIBA	1,00	1,00	0,79	0,87	0,76	1,00	1,00	1,00
355691	SANTA CATARINA	1,00	1,00	1,00	0,96	1,00	0,92	0,80	0,73
344885	RECIFE	1,00	0,90	0,80	0,78	0,91	0,94	1,00	1,00
306398	VALES DO TAQUARI E RIO PARDO	1,00	1,00	0,98	0,99	0,86	0,91	0,78	0,69
312720	PARANÁ	1,00	1,00	1,00	1,00	1,00	0,78	0,73	0,65
335100	SÃO JOSÉ DO RIO PRETO	1,00	1,00	0,78	0,72	0,78	1,00	0,95	0,75
355721	SANTOS	1,00	0,94	0,79	0,75	0,96	1,00	0,79	0,71
319996	DO ESTADO DE SÃO PAULO	0,41	0,75	1,00	1,00	1,00	1,00	1,00	0,73
339679	NACIONAL	1,00	1,00	0,39	1,00	0,40	1,00	1,00	1,00
360449	GRANDE FLORIANÓPOLIS	0,93	1,00	1,00	0,85	0,81	0,95	0,57	0,58
325571	SERRA GAÚCHA	1,00	0,77	0,92	0,95	0,92	1,00	0,53	0,46
335592	NATAL	1,00	1,00	1,00	0,70	0,77	0,77	0,63	0,68
321044	JOÃO PESSOA	0,85	0,79	0,77	0,80	0,73	0,81	0,66	0,59
382876	GOIÂNIA	1,00	0,71	0,44	0,43	0,42	1,00	0,60	0,38
303976	BELÉM	0,61	0,50	0,44	0,39	1,00	0,46	0,52	1,00
342084	CUIABÁ	0,58	0,56	0,58	0,53	0,51	0,58	1,00	0,53
352501	PORTO ALEGRE	0,77	0,60	0,72	0,54	0,59	0,56	0,45	0,39
335690	CAMPINAS	0,62	0,51	0,79	0,33	0,32	0,65	0,34	0,26
357391	VITÓRIA	0,52	0,49	0,50	0,36	0,40	0,37	0,34	0,27
317144	FORTALEZA	0,42	0,36	0,35	0,33	0,35	0,39	0,34	0,35
343889	BELO HORIZONTE	0,60	0,35	0,29	0,41	0,30	0,47	0,26	0,17

Source: Research Data (2025)