

The inverse equity hypothesis in the implementation of NASF-AB in municipalities of Southern Brazil

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Abstract *The present study aimed to analyze the evolution of the implementation of Family Health and Primary Health Care Expanded Support Centers (NASF-AB, in Portuguese) in the municipalities of Southern Brazil, from 2008 to 2019, in light of the inverse equity hypothesis. This was an ecological study, considering 1,188 municipalities of Southern Brazil. The analyses were separated by state, with municipalities divided into quartiles of Municipal Human Development Index – Income (MHDI-Income). Our study calculated the cumulative percentage of the implementation of NASF-AB within the given period and the inequality between Q1 (richest) and Q4 (poorest), assessed by the absolute and relative inequality measures. In Paraná, Q1 presented a higher coverage of NASF-AB than did Q4, and, although the inequality had decreased at the end of the period, it was still quite distinct, according to the “top inequality” pattern. In Santa Catarina, the predictions of the hypothesis were confirmed, with inequalities found in the beginning of the period and a near 90% decline once NASF-AB had been implemented in the municipalities of Q1, characterizing the “bottom inequality” pattern. In Rio Grande do Sul, the hypothesis was refuted observing that since 2014 there was a greater implementation in Q4 as compared to Q1 was observed.*

Key words *Unified Health System, Health Policy, Health Inequalities, Human Development Index*

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Introduction

In Brazil, due to the demands from the Family Health Strategy, linked to Primary Health Care (PHC), and to the health needs of the Brazilian population, the Family Health Support Center (NASF, in Portuguese) was created, currently called the Family Health and Basic Health Care Support Center (NASF-AB, in Portuguese)¹. The NASF-AB consists of a multiprofessional and interdisciplinary team, with the aim of expanding the providing of health care to users and their specific regions, as well as to increase the resolvability inherent within Primary Health Care (AB, in Portuguese). The healthcare team includes health professionals from a wide range of areas or specialties, acting in an integrated manner to provide clinical, sanitary, and pedagogical support to the Family Healthcare Team (eSF, in Portuguese) and/or to the PHC team (eAB, in Portuguese)². The main activities include the evaluation and rehabilitation of psychosocial conditions and the rehabilitation from diseases related to one's diet and nutrition; the evaluation and rehabilitation of the patient's motor skills; the qualification of referrals to other care centers; medical advice to reduce injuries; as well as body practices and physical exercise³.

The work of NASF-AB, as is the case with all health actions and services offered by the Unified Health System (SUS), is based on key principles and guidelines. The principle of equity, for example, is related to the concept of social justice, seeking to recognize the social and health inequalities within the population. In the scope of public health, what stands out is needs-based care, providing greater care to those who most need it and less to those who require less care, thus recognizing that human beings are diversified in their needs⁴.

However, in the implementation of health services, what often occurs is the opposite of what equity proposes. This happens when new interventions and public health programs first reach people in more favorable economic conditions, to only later be made available to those in less economically favorable conditions, thereby causing an initial increase in health inequalities, the so-called "inverse equity". Over time, this inequality tends to decrease due to an increase in the interventions in more vulnerable groups and the stability of health indicators within the population who first received access to the intervention⁵.

Studies have confirmed the inverse equity hypothesis in the providing of varied health ser-

vices^{6,7}. In the Brazilian context, this hypothesis was demonstrated in the flouridation of the public water supply^{8,9}, in the access to technology in childbirth¹⁰, and in the implementation of the Integrated Management of Childhood Illness so as to reduce child mortality¹¹. By contrast, regarding the implementation of PHC in Brazil, the hypothesis was tested but not confirmed, that is, its implementation was guided from its emergence to the most vulnerable groups¹². Inverse equity was also the theme of a trial conducted on the importance of public policies to reduce inequalities through the promotion of physical exercise¹³.

Concerning NASF-AB, some studies indicate that its implementation was diversified throughout the country. In 2011, the North region of Brazil presented the highest number of NASF-ABs, proportionally to eSFs, while the South region presented a lower number of teams¹⁴. Moreover, throughout the country, significant growth was found in the number of NASF-AB teams as of 2013¹⁵. By contrast, no studies were found that investigated the relation between the implementation of NASF-AB and the municipal economic indicators.

Therefore, based on the principle that the NASF-AB has great potential, even in the reduction of health inequalities, this study aimed to analyze the evolution of the implementation of NASF-AB in the municipalities of Southern Brazil, from 2008 to 2019, in light of the inverse equity hypothesis.

Methods

This is an ecological study, constructed using secondary data from a database platform of the Brazilian federal government, considering all of the 1,188 municipalities of the three states of the Southern Brazil: 399 in Paraná (PR), 293 in Santa Catarina (SC), and 496 in Rio Grande do Sul (RS).

Among the five geographic regions of Brazil, the South presents the lowest number of states and the smallest territorial extension (659,144,982 km², about 8% of the national territory); however, it does have the second largest demographic density (41.5 inhabitants/km²) and the highest Human Development Index (HDI) of Brazil (0.756)¹⁶.

The information about the year in which NASF-AB was implemented in each municipality was obtained from the National Registry of Health Facilities in Brazil (CNES, in Portuguese), available in DATASUS (the information technology service for SUS)¹⁷. The variable "the year in which

the NASF-AB was implemented” presents the year in which NASF-AB was officially implemented by the health departments of each municipality, from 2008 to 2019. The current acronym “NASF-AB” has been standardized throughout this text, even when referring to periods before 2017 (year of the change in nomenclature).

Information about the MHDI-Income were obtained by means of a survey conducted by the Brazilian Institute of Geography and Statistics (IBGE) in 2010, made available through the platform of the Institute for Applied Economic Research (Ipea)¹⁸. The HDI is a measurement of progress in three basic dimensions of human development: income, education, and health. The present study opted to use the MHDI-Income, as it is an indicator that shows the economic dimension of development, considering the income per capita of the population, calculated by the sum of the monthly income of all residents of a municipality divided by the number of individuals who reside in this same municipality¹⁹. The classification varies from 0 to 1, considering that the closer to 1, the greater the level of population income. In the present study, the municipalities of each state were divided into quartiles of MHDI-Income (Q1, Q2, Q3, and Q4), with the first quartile (Q1) including the municipalities with the highest MHDI-Income and the fourth quartile (Q4) including the municipalities with the lowest MHDI-Income.

The analyses were conducted separately for the municipalities of PR, SC, and RS. First, the proportion of municipalities that had implemented the NASF-AB each year (2008-2019) were verified, in a cumulative manner, that is, adding the proportion of municipalities that implemented NASF-AB year by year. Later, a description of the municipalities in total and stratified by the MHDI-Income quartile was conducted, presenting the number of municipalities and the average of MHDI-Income in each group. The cumulative percentage of the implementation of NASF-AB during the period was calculated for all of the MHDI-Income quartiles (data presented in detail in the supplementary material of this article). To verify the magnitude of the inequality in the implementation of NASF-AB between the quartile with the highest MHDI-Income (Q1) and the quartile with the lowest MHDI-income (Q4), our study used absolute (calculated through the difference between the extreme quartiles and expressed in percentage points) and relative (calculated by the ratio between Q1 and Q4) inequality measurements²⁰.

The data were organized and analyzed according to the elements of descriptive statistics in the Statistical Package for Social Sciences (SPSS) program, version 19.0. The figures were constructed with the aid of the Equiplot Creator Tool, available online in the International Center for Equity in Health - Pelotas platform²¹.

Results

Figure 1 presents the temporal evolution of the implementation of NASF-AB in the municipalities of the states of PR, SC, and RS, in a cumulative manner. From 2008 to 2009, few municipalities had implemented NASF-AB in the three states. Between 2012 and 2015, the number of municipalities with NASF-AB had increased considerably in PR and SC; however, from 2016-2019, the growth decelerated. In RS, an increase was observed as of 2013 but in a linear and more subtle manner than in other states. In 2019, less than half of the municipalities of RS had implemented NASF-AB (41.3%), whereas the percentage in PR was 67.4% and in SC, 91.5%.

When observing the average MHDI-Income of the municipalities, SC and RS showed similar averages (0.728 and 0.722, respectively), while in PR this average was lower (0.692). If we separate the MHDI-Income quartiles, in SC, the averages in Q1 and Q4 were 0.775 and 0.674, while in RS these were 0.778 and 0.667 and in PR, 0.739 and 0.644, respectively (Table 1).

Regarding the absolute inequalities in the implementation of NASF-AB between Q1 and Q4 (2008-2019) (Table 2), in PR, this value began at 4.9 p.p. and increased year by year up to 2013 (24.3 p.p.), reaching its highest value in 2017 (26.5 p.p.). At the end of the evaluation period, the inequality was 20.4 p.p., with a higher implementation percentage in Q1 when compared to Q4. In SC, the absolute inequality began at 1.3 p.p., increasing to 19.3 p.p. in 2012, but this inequality value diminished in the final period, reaching 5.4 p.p. In RS, the inequality began at 0.8 p.p.; the year with the greatest difference was 2013, at 2.4 p.p. In 2014, this difference inverted (-2,5 p.p.), given that the quartile with the lowest MHDI-Income (Q4) began to have a higher proportion of municipalities with NASF-AB implemented than those of the Q1, reaching -8,9 p.p. in 2018 and -8.8 p.p. in 2019.

As regards the ratio (relative inequality) between Q1 and Q4, in PR, the greatest difference was found in 2012 (ratio=21.60), and, as of 2013,

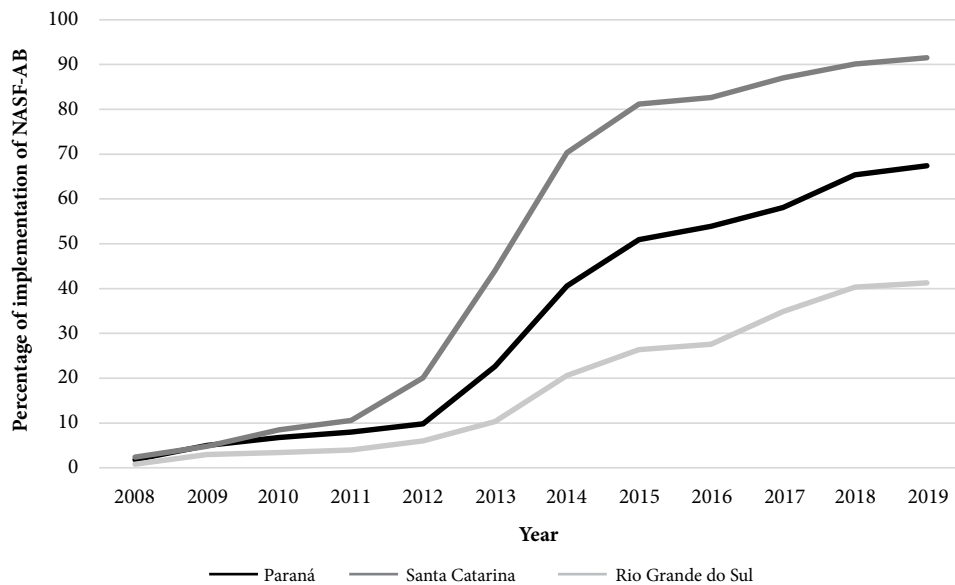


Figure 1. Evolution of the implementation of NASF-AB in the municipalities of the states of Southern Brazil (DATASUS, 2008-2019).

Source: Authors.

Table 1. MHDI-Income measure of the municipalities of the states of Southern Brazil, in total and according to quartiles of MHDI-Income (IBGE, 2010).

Quartiles of municipalities divided by MHDI-Income 2010	Paraná		Santa Catarina		Rio Grande do Sul	
	Number of municipalities	Average MHDI-income	Number of municipalities	Average MHDI-income	Number of municipalities	Average MHDI-income
Total	399	0,692	293	0,728	496	0,722
Q1	102	0,739	73	0,775	124	0,778
Q2	98	0,703	73	0,743	124	0,738
Q3	99	0,681	73	0,721	124	0,706
Q4	100	0,644	74	0,674	124	0,667

Source: Authors.

this value began to decrease, reaching its lowest value in the final year of the studied period (2019: ratio=1.35). One should consider that, despite the decrease, in 2019, the proportion of richer municipalities with NASF-AB was still 35% greater than that among the poorer municipalities. In the first five years (2008-2012), only 1.0% of the municipalities of Q4 had implemented NASF-AB, making it so that small absolute differences meant major relative differences. In SC, the relative inequality was higher in 2011 (ratio=4.06), also reaching the lowest ratio of the entire period in 2019, with the richer municipalities showing

a proportion of the implementation of NASF-AB that was 6% higher than that of the poorer municipalities. In RS, the major difference was in 2011 (ratio=2.00), but this situation was inverted in 2014 when the richer municipalities showed a 13% higher proportion than the poorer municipalities (ratio=0.87), ending the period at a ratio of 0.78.

Figure 2 shows a graph of how all of the quartiles of each state are presented (2008-2019). In PR, the difference in the implementation of NASF-AB between Q1 and Q4 increased over time and, although it had decreased slightly at

Table 2. Absolute and relative inequality measures of the proportion of the implementation of NASF-AB between quartile 1 (highest MHD-Income) and quartile 4 (lowest MHD-Income) in the municipalities of the states of Southern Brazil (DATASUS, 2008-2019).

Year	Paraná		Santa Catarina		Rio Grande do Sul	
	Difference Q1-Q4 (p.p.)	Q1/Q4 Ratio	Difference Q1-Q4 (p.p.)	Ratio Q1/Q4	Difference Q1-Q4 (p.p.)	Ratio Q1/Q4
2008	4.9	5.90	1.3	1.93	0.8	0
2009	10.8	11.80	2.7	1.66	0	1.0
2010	15.7	16.70	9.7	2.80	0.8	1.33
2011	18.6	19.60	16.5	4.06	2.4	2.00
2012	20.6	21.60	19.3	2.58	3.3	1.83
2013	24.3	3.43	10.0	1.30	4.8	1.66
2014	21.9	1.71	10.4	1.17	-2.5	0.87
2015	24.7	1.60	10.6	1.15	-5.6	0.78
2016	25.6	1.60	10.6	1.14	-6.4	0.76
2017	26.5	1.58	7.9	1.10	-5.7	0.83
2018	24.4	1.44	9.4	1.11	-8.9	0.77
2019	20.4	1.35	5.4	1.06	-8.8	0.78

Source: Authors.

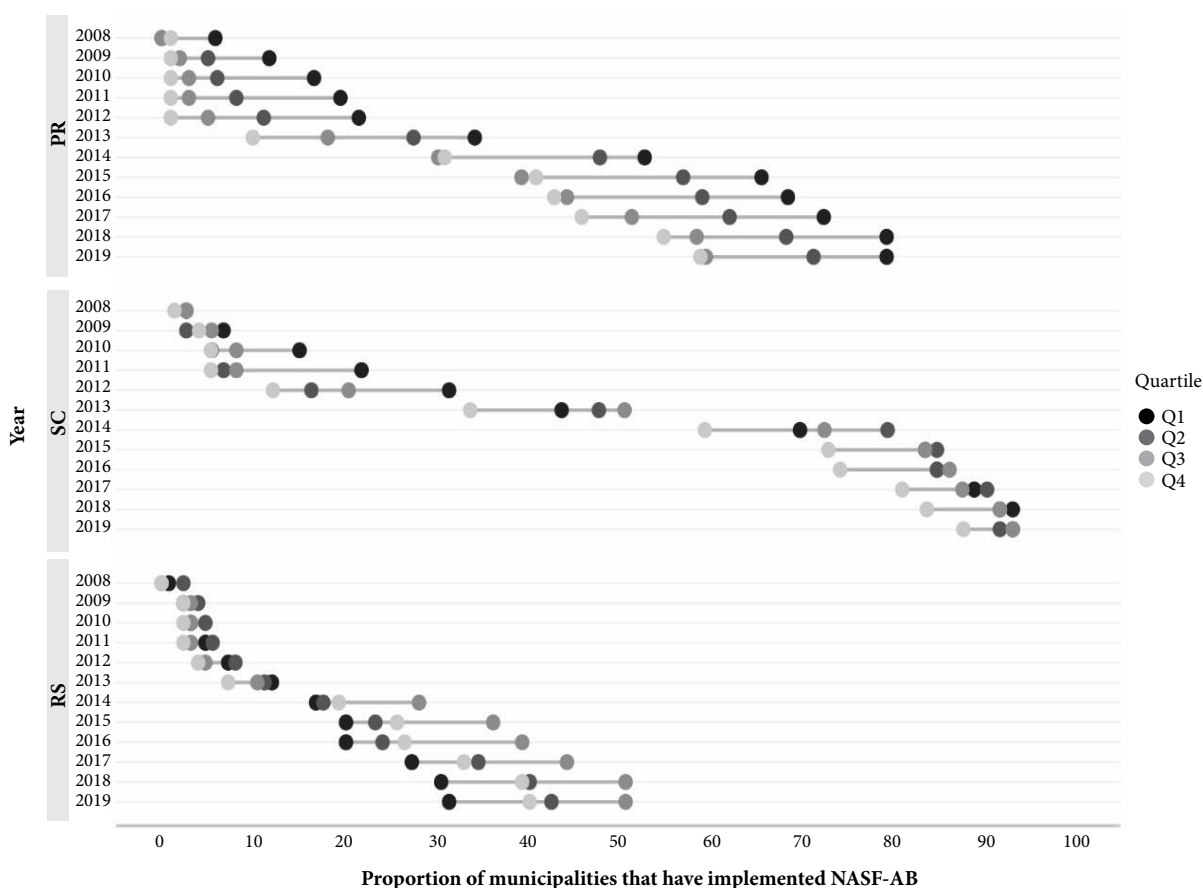


Figure 2. Absolute inequality of the proportion of the implementation of NASF-AB in the quartiles of MHD-Income (Q1=highest MHD-Income and Q4=lowest MHD-Income) in the municipalities of Southern Brazil from 2008 to 2019 (IBGE, DATASUS).

Source: Authors.

the end of the period (inverse equity hypothesis), it was still quite distinct. Our study also found that the Q1 always had the highest percentage of implementation, followed by Q2, Q3, and Q4. Only in 2013 and 2015 did the positions of Q3 and Q4 invert.

In SC, results showed exactly what had been predicted by the hypothesis, in which the reduction of the inequalities between the quartiles only occurred when a high percentage of municipalities with greater MHDI-Income levels had implemented NASF-AB. In 2013 and 2014, Q2 and Q3 were ahead of Q1, and the percentages of implementation of these quartiles remained quite similar year by year, with Q1 and Q2 showing the same percentage in 2016, and Q1 and Q3 in 2015 and 2019.

In RS, the hypothesis was refuted by a more equitable implementation, though in a minor proportion. Moreover, as of 2013, Q3 was ahead of all of the others, while Q4 and Q2 switched between 2nd and 3rd places, and Q1 remained in last place until the end of the period. The percentages of the implementation of NASF-AB of all of the quartiles during the entire period of this study are presented in Table 3.

Discussion

In each state, a different standard was observed in the evolution of the implementation of NASF-AB according to the MHDI-Income quartiles in the studied period. PR showed the highest inequalities and, although these decreased at the end of the period, they were still distinct, demonstrating that the inverse equity hypothesis had still not been completely ended with the final stage of the reduction of inequalities. In SC, the results were exactly as predicted by the hypothesis, with an initial period of increase in inequalities and a later decrease observed in inequalities once NASF-AB had been implemented in nearly 90% of the municipalities with a greater MHDI-Income. Finally, in RS, the hypothesis was refuted. Although this state had the lowest proportion of municipalities with NASF-AB, a greater equity was found in the implementation.

The NASF-AB began to be instituted after the publication of Decree No. 154 from January 24, 2008²², but it had been contemplated long before this date (2000-2002). Its creation occurred in a favorable political-institutional scenario, with the articulation of agents from the bureaucratic field and under pressure from the professional entities and municipal health managers²³. From its creation up to 2010, less than 10% of the municipalities in the three states of Southern Brazil

Table 3. Evolution of the NASF-AB in the municipalities of the states of Southern Brazil, in total and according to quartiles of MHDI-Income, from 2008 to 2019 (IBGE, DATASUS).

Year	Paraná					Santa Catarina					Rio Grande do Sul				
	Cumulative percentage of the implementation of NASF-AB (%)														
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
2008	5.9	0	0	1.0	1.8	2.7	2.7	2.7	1.4	2.4	0.8	2.4	0	0	0.8
2009	11.8	5.1	2.0	1.0	5.0	6.8	2.7	5.5	4.1	4.8	2.4	4.0	3.2	2.4	3.0
2010	16.7	6.1	3.0	1.0	6.8	15.1	5.5	8.2	5.4	8.5	3.2	4.8	3.2	2.4	3.4
2011	19.6	8.2	3.0	1.0	8.0	21.9	6.8	8.2	5.4	10.6	4.8	5.6	3.2	2.4	4.0
2012	21.6	11.2	5.1	1.0	9.8	31.5	16.4	20.5	12.2	20.1	7.3	8.1	4.8	4.0	6.0
2013	34.3	27.6	18.2	10.0	22.6	43.8	47.9	50.7	33.8	44.0	12.1	11.3	10.5	7.3	10.3
2014	52.9	48.0	30.3	31.0	40.6	69.9	79.5	72.6	59.5	70.3	16.9	17.7	28.2	19.4	20.6
2015	65.7	57.1	39.4	41.0	50.9	83.6	84.9	83.6	73.0	81.2	20.2	23.4	36.3	25.8	26.4
2016	68.6	59.2	44.4	43.0	53.9	84.9	84.9	86.3	74.3	82.6	20.2	24.2	39.5	26.6	27.6
2017	72.5	62.2	51.5	46.0	58.1	89.0	90.4	87.7	81.1	87.0	27.4	34.7	44.4	33.1	34.9
2018	79.4	68.4	58.6	55.0	65.4	93.2	91.8	91.8	83.8	90.1	30.6	40.3	50.8	39.5	40.3
2019	79.4	71.4	59.6	59.0	67.4	93.2	91.8	93.2	87.8	91.5	31.5	42.7	50.8	40.3	41.3
NASF-AB absent*	20.6	28.6	40.4	41.0	32.6	6.8	8.2	6.8	12.2	8.5	68.5	57.3	49.2	59.7	58.7

*Municipalities that had implemented NASF-AB at the end of the period.

Source: Authors.

had implemented NASF-AB, this proportion being lower than the national coverage during the same period (19%)¹⁵. The low adherence at that time may well have been influenced by the rather confusing guidelines about the functioning of NASF-AB. The Ministry of Health found it difficult to advise and clarify strategies regarding the implementation and management of the teams, even when these were detailed in their decrees and publications, leading to varying interpretations, in turn causing unnecessary debates about possible ambiguities in their practices, which have lingering repercussions even today^{15,23}.

The MHDI, since its creation, has been important in guiding public policies, especially in the identification of poorer areas in the country. Regarding the inequalities found between Q1 (richer municipalities) and Q4 (poorer municipalities), in each state, a different pattern was observed in the implementation of NASF-AB. In PR, we observed expressive inequalities throughout the entire studied period, while in SC, although inequalities were also observed, these were significantly reduced in the analyzed period. In a study that analyzed the coverage of institutional deliveries in 286 national studies in low- and middle-income countries, it was found that the absolute inequalities were more common when the nationwide coverage proved to be up to 50%. By contrast, when the nationwide coverage was of 60% or higher, the inequality decreased, with only the poorest quintile not receiving coverage⁷, which corroborates with the results found in SC.

The inverse equity hypothesis is predicted that when the health policies and interventions are not adequately geared toward those who truly need it, that is, the health innovations are first made accessible to the population group with the most favorable economic conditions, to only later be made available to those with less favorable economic conditions; this discrepancy is diminished once the health service coverage is increased⁵. A few factors that may have collaborated with the implementation of NASF-AB first in municipalities with higher MHDI-Income include better organization and dialogue with the state level. For the implementation of NASF-AB, the municipalities should create a project that, together with the Bipartite Interagency Commission, conducted an analysis of the proposals and organization of accreditation¹⁴. With this, municipalities that had greater support and participation in these organizational processes found it easier to formulate this type of project.

In RS, this tendency toward inequality between Q1 and Q4 was not observed, since, as of 2014, the richer municipalities showed a lower percentage of the implementation of the NASF-AB than did the other quartiles. Although the RS had presented a greater equality in the implementation, this state had less than half of the municipalities with NASF-AB in 2019 (41.3%). The low adherence may well be related to the limited coverage of eSF in RS. Likewise, SC presented a greater eSF coverage and was the state with the highest percentage of implementation (91.5%). In 2008, the year in which the NASF-AB was created, the coverage of eSF was 32.4% no RS, 50.0% in PR, and 66.3% in SC^{17,24}, increasing to 59.74%, 64.60%, and 81.52% in December 2019, respectively¹⁷. The relation between the coverage of eSF and the number of NASF-AB teams can be predicted, given that these teams are interconnected and a directly proportional relationship is expected³.

In the period from 2012-2015, there was a significant increase in the proportion of municipalities with NASF-AB in PR and SC, while in RS, only a subtle increase was observed as of 2013. This was also a period of decreased inequality between Q1 and Q4 in the three states. When analyzed in the national realm, as of 2012, there was also an increase in the number of teams¹⁵, which could be related to the publication of Decree No. 2,488 from October 21, 2011²⁵, which made the conditions for the creation of the NASF-AB more flexible, and the publication of Decree No. 3,124 from December 28, 2012²⁶, which created the NASF 3 Modality, making it possible for smaller municipalities to join NASF-AB with only one eSF and/or eAB. These decrees made it easier for the smaller municipalities to implement teams.

Victoria *et al.*⁷ described some patterns of inequality that can be observed in order to test the inverse equity hypothesis. Data from the present study highlight that PR follows a pattern similar to “top inequality”, that is, when the beginning of a health intervention clearly reaches a more economically favorable group, shortly thereafter, broad measures are necessary so that all of the groups can reach the indicators of this privileged group. In SC, the “bottom inequality” pattern was observed when a more vulnerable population group is left behind, characterizing a marginal exclusion. In this case, specific measures to reach these population groups need to be adopted. By contrast, RS presents a linear more inverse pattern of inequality when compared to other states. In this state, the investment pattern for the

implementation of NASF-AB should be kept together with the expansion of the municipalities themselves.

It is important to point out that neoliberal reforms in Brazil have compromised the advances achieved in SUS. The Tax Regime created by the Constitutional Amendment (CA) of the Public Expenditures Ceiling (CA No. 95/2016), which freezes primary governmental expenses for 20 years, led to the de-funding of health, incurring immediate negative impacts²⁷. In 2017, the new National Primary Health Care Policy¹ brought changes in the format and composition of the health teams, and, through the *Previne Brasil Program*²⁸, the AB took on a new funding model, with cuts in federal funding to cover costs with eAB, NASF-AB, and PMAQ, which can hinder the implementation of new teams and discourage

the maintenance of those that already exist²⁹. Future studies can investigate the implementation of the NASF-AB, considering the years prior to and after the institution of this program in 2019, as well as verify the functioning and continuity of the teams, especially due to changes that have occurred in recent years. Furthermore, considering that the present work found three different patterns of inequality in the implementation process, it is recommended that future studies include other Brazilian regions in order to better understand the presence or not of inverse equity in the implementation of NASF-AB.

Limitations of this study include the use of only the income per capita indicator (MHDI-Income) to measure the economic situation of the municipality. However, it is important to mention that supplementary analyses have been con-

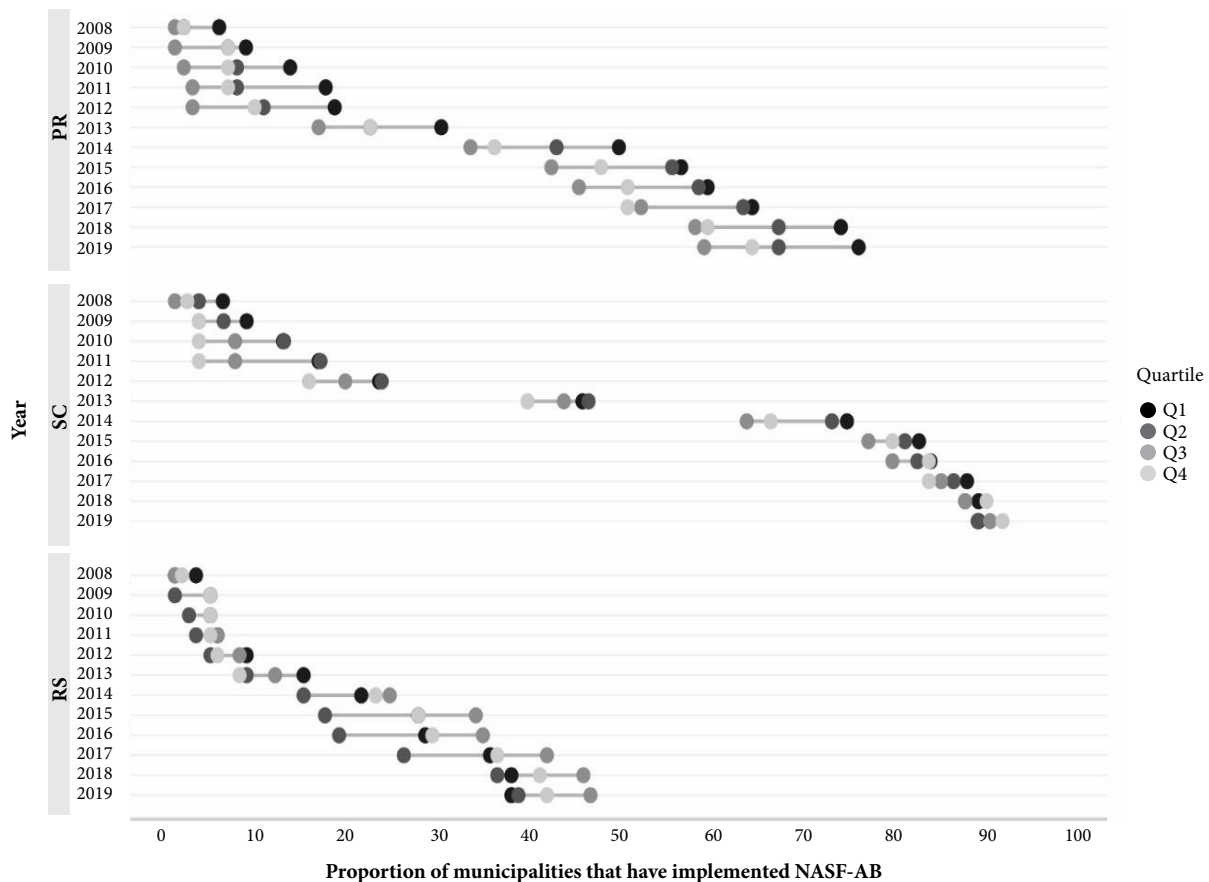


Figure 3. Absolute inequality of the proportion of the implementation of NASF-AB in the quartiles of GDP per capita (Q1=highest GDP and Q4=lowest GDP) in the municipalities of Southern Brazil from 2008-2019 (IBGE, DATASUS).

Source: Authors.

ducted, considering the Gross Domestic Product (GDP) of each municipality for the stratification of the quartiles in an attempt to verify if they in fact present the same trend of inequality when another method to measure the economic scenario of the municipality is used, and the result found proved to be similar (Figure 3). Other limitations refer to the size of the municipalities, an aspect that was not considered in the analyses, as well as the fact that we did not analyze the income inequalities, given that one municipality can present a high per capita income but have major internal inequalities. By contrast, it is important to highlight the originality of this article, which can help to fill in the serious gap in knowledge, in turn aiding in decision-making in order to bring about a decrease in inequality.

Collaborations

NA Augusto and BO Fernandes: conception and design, analysis and interpretation of data, writing of the article and approval of the final version. I Crochemore-Silva and MR Loch: conception and design, interpretation of data, writing of the article, critical review and approval of the final version.

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Conclusion

In the present study, each state presented a different pattern in the evolution of the implementation of NASF-AB and in the absolute and relative inequalities among the MHDI-Income levels. Considering the guiding principles of SUS, especially that if equity, public efforts must make their contribution so that the inverse equity hypothesis ceases to be a reality in the implementation of health policies and services. Furthermore, it is important that health actions and services have the capacity to reduce health inequalities rather than increase them.

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