

Family Health Teams in the Federal District, Brazil: A geospatial approach to inequalities

Equipes de Saúde da Família no Distrito Federal: um olhar geoespacial para as iniquidades

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ABSTRACT The Family Health Strategy is known to minimize the effects of health inequalities. This descriptive study aimed to present the distribution of Family Health teams (eSF) and PHC Units (UBS) in the Federal District (DF) using the Health Vulnerability Index (IVSaúde) and demographic density categorized by census tracts as parameters. We employed data from the most recently published demographic Census and official data from the National Registry of Health Establishments and the DF's State Health Secretariat. The results revealed that the DF has a heterogeneous population when it comes to vulnerability and that most of the high-risk census tracts are in peripheral areas. The DF has 165 UBS and 615 eSFs (mean: 3.7 teams/UBS). Around 35% of the census tracts have low-risk IVSaúde, and 19.8% have high and extremely high risk. The study showed that most UBS and teams are in high demographic density and more significant vulnerability areas. However, there is still a need to increase the number of teams and UBS for adequate coverage of the model adopted in the federal capital and reduce the ratio of teams per health establishment.

KEYWORDS National health strategies. Primary Health Care. Health status disparities. Health vulnerability.

RESUMO A Estratégia Saúde da Família é reconhecida como capaz de minimizar os efeitos das iniquidades em saúde. Este estudo descritivo buscou apresentar a distribuição das equipes de Saúde da Família (eSF) e Unidades Básicas de Saúde (UBS) no Distrito Federal (DF), usando como parâmetros o Índice de Vulnerabilidade da Saúde (IVSaúde) e a densidade demográfica categorizadas por setores censitários. Foram utilizados dados do último censo demográfico publicado e dados oficiais do Cadastro Nacional de Estabelecimentos de Saúde e da Secretaria de Estado de Saúde do DF. Os resultados mostraram que o DF tem uma população heterogênea, quando se trata de vulnerabilidade, e que a maioria dos setores censitários de alto risco está nas zonas periféricas. O DF possui 165 UBS e 615 eSF (média: 3,7 equipes/UBS). Cerca de 35% dos setores censitários apresentam IVSaúde de baixo risco, e 19,8%, de elevado e muito elevado risco. O estudo mostrou que a maior parte das UBS e equipes está localizada em lugares de alta densidade demográfica e de maior vulnerabilidade, embora ainda seja necessário aumentar o número de equipes e de UBS para uma adequada cobertura do modelo adotado na capital federal, bem como reduzir a razão de equipes por estabelecimento de saúde.

PALAVRAS-CHAVE Estratégias de saúde nacionais. Atenção Primária à Saúde. Disparidades nos níveis de saúde. Vulnerabilidade em saúde.

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Introduction

Primary Health Care (PHC) is the main gateway to the health system and is recognized as the organizer of Health Care Networks (RAS)¹. PHC's fundamental elements are longitudinality, comprehensiveness, coordination, family focus, community orientation, and cultural competence as essential attributes and resolvability, communication, and accountability as functions².

Several healthcare models are available, and they vary according to the population's needs. Gil and Maeda³ affirm that healthcare models are technological combinations structured to solve problems and meet people's health demands. In Brazil, the Family Health Strategy (ESF)⁴ is adopted as a priority design for PHC, which is valued nationally and internationally⁵ when compared to the traditional model.

According to the reviewed National Primary Care Policy (PNAB)⁴, Family Health Teams (eSF) comprise a minimum of a doctor, preferably a family and community medicine specialist; a nurse, preferably a family health specialist; a nursing assistant or technician; and a Community Health Worker (ACS). In addition to these professionals, the policy states that the Endemic Disease Control Agent (ACE) and oral health professionals (dentist and oral health assistant or technician) may be part of the team⁴.

The formation of the eSF with the multidisciplinary team aims to comply with ESF's fundamental principles, focusing on health, working with prevention and health promotion, offering care for the entire family, and building a continuous bond with the user based on multiple approaches. Soratto et al.⁶ also point out that the ESF adopts a broader concept of health and understanding the determinants of the health-disease process, proposing a "coordination between technical and popular knowledge and the mobilization of institutional and community resources to address health problems".

In this context, the challenge arises of providing healthcare to the entire population, especially those exposed to vulnerable situations, as some barriers often prevent individuals from accessing health services. Socioeconomic, social, and environmental factors are lifelong impediments since they determine the health-disease balance⁷.

Inequality is understood as the lack of balance in society, mainly due to economic and demographic factors. Regarding health, this concept transcends this imbalance since society also reveals disparities in the social sphere, leading some people to having more access to resources than others. As a result, these disparities make some populations more vulnerable and at greater risk to their health.

Even with the biases of individual preferences over economic conditions, the monetary factor influences the health sector and deprives some populations of access to health services. The economic situation, housing conditions, inadequate urban environment, and substandard working conditions most adversely affect people's health, reverberating in PHC's operating territory⁸.

Measures to minimize or eliminate these inequalities are necessary to solve this problem, which can be achieved in the health sector through health and other fields' policies since, as Barreto⁸ shows, policies that improve economic conditions or strengthen social protection positively affect health conditions. As Carrapato et al.⁷ also point out, it is unquestionable that social, environmental, and economic conditions significantly affect people's health conditions.

Brazil comprises 5,570 municipalities, 26 states, and the Federal District (DF)⁹, responsible for planning and implementing public policies. The DF has a unique profile as it is both a state and a municipality, receiving extraordinary funding from the Federal Government. Thus, to ensure decentralization and healthcare for the population, the DF was divided into seven

Health Regions¹⁰, which comprise its 35 Administrative Regions (RA).

Regarding the provision of primary healthcare, the country has a PHC coverage of 78.5%. In comparison, the Federal District (DF) has a coverage of 68.2% - slightly below the national average, ranking 17th against other capitals¹¹.

This study is justified by the peculiarities of the Federal District and the lack of uniform availability of primary health services in the country, which catalyze social injustice. It aimed to analyze the distribution of eSF and UBS in the Federal District per population demographic density and from the health vulnerability perspective.

Material and methods

This descriptive study analyzed the distribution of eSF and UBS in the DF territory, using the Health Vulnerability Index (IVSaúde)¹² and the demographic density categorized by census tract as a parameter. The UBS were distributed throughout the DF territory, with their respective number of teams, producing a graphic visualization of the distribution through georeferencing.

Data on census tracts (population and area), each tract's boundaries, and data for calculating IVSaúde were retrieved from the 2010 Census⁹ on the Brazilian Institute of Geography and Statistics (IBGE) website. The State Health Secretariat of the Federal District (SES-DF) provided data on the number of UBS and their respective eSF.

Data published in the last Brazilian Census, conducted in 2010, were employed to calculate population density and IVSaúde. The values are broken down by census tract, which allows a more precise analysis of the geographic distribution of population density. Data were stratified into tertiles to analyze population density. The QGIS software version 3.2.3 was adopted to systematize the data and generate the maps.

The Belo Horizonte (MG) experience was taken as a model to calculate the IVSaúde of the DF, which conceived the IVSaúde as an index composed of eight indicators related to i) water supply; ii) sewage; iii) garbage disposal; iv) residents per household; v) illiterate people; vi) per capita income; vii) monthly nominal income; and viii) people of Black, brown, and Indigenous ethnicity/skin color¹². The Federal District was divided into 4,349 census tracts for this demographic Census. Only 4,293 (98.71%) were analyzed since 56 (1.23%) of the tracts had confidential data that allowed identifying the respondents, per the published demographic census methodology. IVSaúde was categorized per the cutoff points defined in the index design¹²:

- Low risk – tracts with IVSaúde values lower than the mean IVSaúde;
- Medium risk – census tracts with IVSaúde values of 1.5 Standard Deviation (SD) around the mean (mean +/- 0.5 SD);
- High risk – tracts with values above the mean IVSaúde up to the limit of 1.5 SD above the mean (upper limit of the mean IVSaúde + 1 SD);
- Extremely high risk – tracts with values above the high IVSaúde.

DF population density was calculated by census tract using data from the 2010 Census available on the GeoPortal-DF¹³ website. The numerator considered the number of inhabitants in the tract and the denominator considered the area of the census tract in square kilometers (km²). After the calculation, the density was divided into three equal-sized classes.

A cartogram of the distribution by demographic density and IVSaúde for the DF was generated. These cartograms identified in detail the distribution of UBS and eSF in the DF in each Health Region and each RA.

Results and discussion

According to the DF Health Information and Transparency Portal (InfoSaúde-DF)¹⁴, in

2022, the DF had approximately 3.1 million inhabitants and, until November 2022, 165 UBS and 615 eSF were distributed in the RA, as shown in *table 1*.

Table 1. Distribution of PHC Units (UBS) and Family Health Teams (eSF) in the Federal District by Administrative Region and mean number of teams per UBS, Nov/2022

Health Region/ Administrative Region ^a	UBS (n)	eSF (n)	eSF by UBS (mean)	Projected population 2022 (n)
Central	9	44	4.9	404,353
Plano Piloto	4	23	5.8	239,687
Cruzeiro	2	10	5.0	16,599
Lago Norte	2	8	4.0	19,641
Varjão	1	3	3.0	9,030
Center-South	18	76	4.2	367,468
Candangolândia	1	5	5.0	16,263
Guará	5	24	4.8	142,971
Núcleo Bandeirante	2	7	3.5	24,305
Park Way	1	1	1.0	23,578
Riacho Fundo I	2	10	5.0	44,956
Riacho Fundo II	5	17	3.4	74,641
SCIA/Estrutural	2	12	6.0	38,097
East	25	68	2.7	337,796
Itapoã	3	15	5.0	76,217
Jardim Botânico	1	4	4.0	60,248
Paranoá	8	23	2.9	75,636
São Sebastião	13	26	2.0	125,695
North	36	99	2.8	369,655
Fercal	3	4	1.3	9,503
Planaltina	20	50	2.5	206,344
Sobradinho	6	24	4.0	74,620
Sobradinho II	7	21	3.0	79,188
West	27	96	3.6	514,933
Brazlândia	9	16	1.8	65,219
Ceilândia	17	76	4.5	354,813
Sol Nascente/Pôr do Sol	1	4	4.0	94,901
Southwest	32	162	5.1	857,986
Águas Claras	2	7	3.5	126,856
Recanto das Emas	9	36	4.0	139,095
Samambaia	13	61	4.7	253,221
Taguatinga	7	50	7.1	212,154
Vicente Pires	1	8	8.0	79,417

Table 1. Distribution of PHC Units (UBS) and Family Health Teams (eSF) in the Federal District by Administrative Region and mean number of teams per UBS, Nov/2022

Health Region/ Administrative Region ^a	UBS (n)	eSF (n)	eSF by UBS (mean)	Projected population 2022 (n)
South	18	70	3.9	277,823
Gama	10	40	4.0	145,104
Santa Maria	8	30	3.8	132,719
DF	165	615	3.7	3,130,014

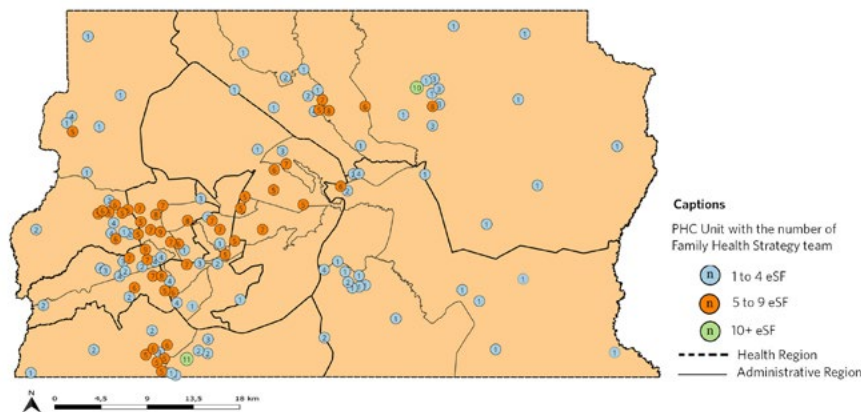
Source: InfoSaúde¹².

^a Only those that have UBS in their territory are listed.

In the DF, the most populous Health Regions are the Southwest, West, and Central, and those with the most significant number of UBS in their territories, as shown in *table 1*, are the North and Southwest Health Regions, with 36 and 32 units each. The Health Regions with

the fewest UBS are the Central, with 9 units, and the South and Center-South, with 18 UBS each. These UBS and teams are distributed throughout the 5,779 km² area of the Federal District. *Figure 1* shows the spatial distribution of UBS and eSF in the DF.

Figure 1. Distribution of PHC Units (UBS) and Family Health Teams (eSF) in the Federal District



Source: Prepared by the authors.

The Health Region with the most eSF is the Southwest, with 162 teams, followed by the North, with 99 teams, and the West, with 96 teams. The Health Region with the fewest teams is the Central, with 44 eSF.

Although it is below the average recommended by PNAB⁴, four teams per UBS, the mean number of teams per UBS in the Federal District is 3.7 (*table 1*), twice the national

average. According to data from the National Registry of Health Establishments (CNES)¹⁵, Brazil had an average of 1.8 teams per UBS in November 2022. Capitals Rio de Janeiro, Fortaleza, and Belo Horizonte stand out with the highest average of eSF per UBS, 4.1, 3.9, and 3.6, respectively¹⁵. On the other hand, Maceió has the lowest average (0.96), with Rio Branco and Cuiabá having 1.2 teams per UBS¹⁵, which

does not rule out some UBS having a higher number of teams against the recommended value, as these are averages.

In the history of the PHC healthcare model in the Federal District, we should underscore that other care models different from the ESF were adopted until relatively recently, which became more relevant in 2017 with the complete change in the care model¹⁶. Until then, as the traditional care model had been hegemonic in the Federal District, the UBS's physical structures were not designed for the ESF; some were even structured with nighttime Emergency Care. In part, this backdrop may explain the average number of teams per UBS (3.7) in the Federal District compared to the national average and reinforces the need for structural investment to adapt to the ESF care model in an advanced stage of consolidation in the Federal Capital.

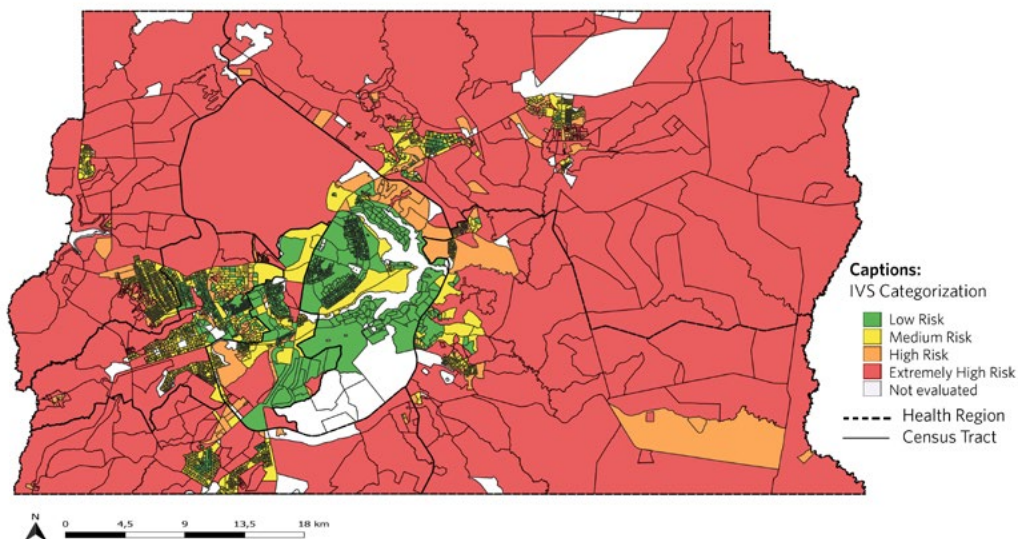
Regarding the IVSaúde of the Federal District, 34.7% (1,511) of the census tracts had

IVSaúde classified as low risk. Around 44.2% (1,921) showed IVSaúde as a medium risk; this category also had the largest population, 49.2%. IVSaúde is classified as high risk, with extremely high risk representing 19.8% (861) of the census tracts. Notably, only 204 (4.5%) census tracts could not be evaluated since their data were confidential.

Even with only 861 (19.8%) of the census tracts with IVSaúde classified as a high and extremely high risk compared to 1,551 (34.7%) of low risk, this value omits inequalities, which are noticeable in *figure 2*, in which 20.2% of the total DF population, that is, 521,519 citizens, live in high or extremely high health risk areas.

A specific trend can be observed: The census tracts classified as low and medium risk are located in the DF's central regions. On the other hand, the tracts with high and extremely high risk are arranged in the peripheral areas, as observed in *figure 2*.

Figure 2. Health Vulnerability Index (IVSaúde) by census tract in the Federal District



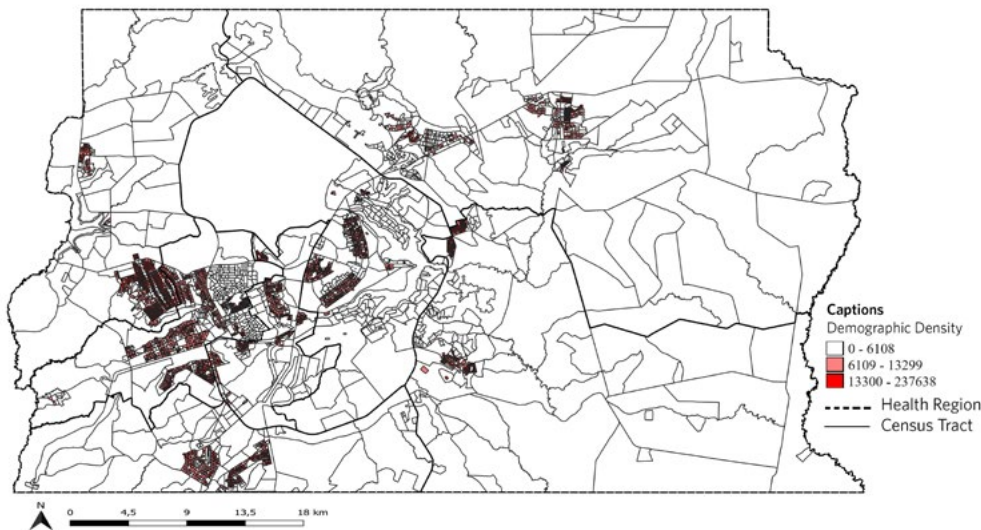
Source: Prepared by the authors.

Regarding population density, *figure 3* shows a population agglomeration in smaller census tracts, and the population density concentration is located in the RA's centers. This fact is explained by the relationship between the division of the territory into census tracts, using the number of inhabitants and area.

Regarding the distribution with IVSaúde, the data showed that most health units and teams are distributed in census tracts with medium and high vulnerability risk and greater population density, as shown in *figure 4*.

Since its implementation in Brazil, the ESF has been expanding nationwide. According to Giovanella et al.¹⁷, by 2019, 62.6% of the people lived in households registered with family health units in Brazil, with 59.8% living in urban households and 78.9% living in rural households. The same study observed that the Great Brazilian Region with the most registered households was the Northeast, with 73.3%. In contrast, the Southwest region had the lowest proportion (54.6%)¹⁷.

Figure 3. Population density (inhabitants/km²) by census tract in the Federal District



Source: Prepared by the authors.

The results of this study align with the findings of the investigation by Alves et al.¹⁸ on the conditioning factors for access to ESF teams. This investigation revealed a direct relationship between population size and team performance and the highest proportions of teams in the highest stratum of ‘reception’, ‘availability’, and ‘access’ in places with larger populations.

We should mention the study by Sousa and Merchán-Hemann¹⁹, in which the authors state that an expanded ESF, especially in large regions and cities, generates inequalities in

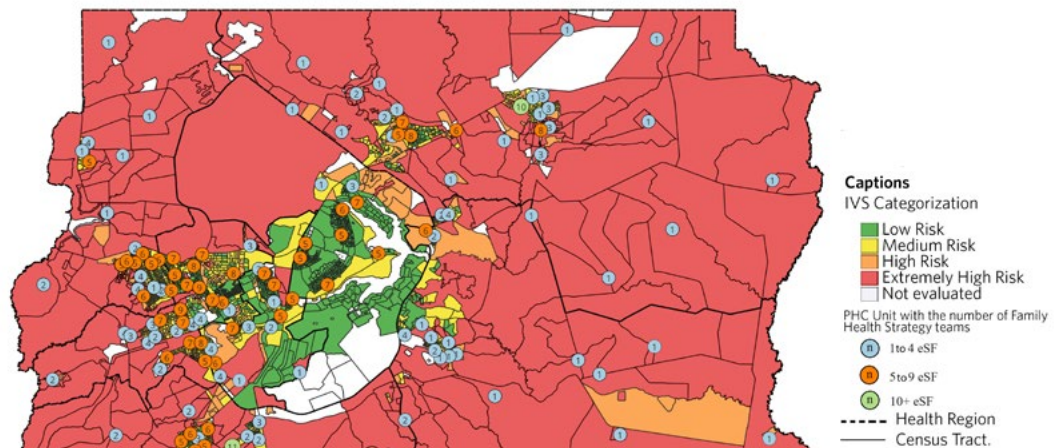
small regions. These regions are not part of the expansion and do not have access to healthcare. However, the ESF expansion in Brazil in recent years has increased actions and services, positively affecting the general population⁵.

Notably, this healthcare model focuses on the most at-risk and vulnerable populations²⁰. ESF’s centralized care for these populations aims to reduce inequities²¹. Thus, the ESF takes on the SUS concern to reduce health inequalities, catalyzed by its direct action within the health territory.

Besides having large coverage proportions in areas of greater vulnerability, the ESF also shows positive gains. Regarding health indicators, we observe a decline in morbimortality indicators⁶. Although it is not yet possible to

analyze the effect of the ESF on the indicators, the results of this study showed that the distribution of UBS and eSF is conducted in a way that serves more vulnerable populations, albeit not absolutely.

Figure 4. Distribution of PHC Units (UBS) and Family Health Teams (eSF) according to the Health Vulnerability Index (IVSaúde) by census tract in the DF



Source: Prepared by the authors.

The results by RA reveal that most units and teams are in areas of higher health vulnerability. According to InfoSaúde, the RA of Ceilândia is the most populated in the DF, has the most eSFs (76), and ranks second in most UBSs (17).

Planaltina also stands out as the RA with the most significant number of UBSs (20) and the third with eSFs (50). This Region is also the fourth most populous in the Federal District. Another point of this RA is that it has seven rural teams among its eSFs. This distribution in the areas of higher risk density is also noticeable in the RAs of São Sebastião, Samambaia, Santa Maria, Sobradinho II, Brazlândia, and Itapoã.

Arantes et al.²² perceive this as one of the ESF's contributions. Their study on the ESF's challenges and contributions showed that implementing the ESF expanded the possibilities of offering services in peripheral and rural areas and benefited health promotion,

disease prevention, active case finding, health education, and home care.

Although this fact is pertinent, some RAs with low health vulnerability had more teams against Regions with high or extremely high risk. However, we observe a balanced distribution when analyzing the demographic density.

The ESF in the Federal District has encountered several barriers in its attempt to consolidate. These challenges range from historical factors to the preference for the specialty care model in PHC, encompassing central management issues. These facts make the consolidation of the model slower, especially for professionals and, mainly, for system users to understand its functioning and benefits.

The Federal District already had the lowest national coverage of eSF²¹. The implementation of the DF's PHC Policy, consolidated by Law N° 6.133 of April 6, 2018, that established

the ESF as a PHC model²³, which named the ESF as the exclusive model for the organization of the health system, clearly translated the expansion of teams and coverage in the district territory. The data show that, although the change is recent, the units and teams are in priority places from the viewpoint of equity, which does not eliminate the need for continued investment in PHC and ESF strengthening until it legitimately reaches the entire DF population.

The findings of this study indicate a distribution of UBS in the territory, especially in areas with higher population density and some places with greater health vulnerability that are still without UBS. However, it cannot be categorically stated that no PHC coverage exists. However, if there is coverage, the health facility is distant from its territory, which is a proxy contrary to the PHC guidelines, including ensuring access and territorialization with resolvability. We should underscore that the ESF cannot overcome all inequalities per se. However, the ESF can reduce health inequities¹⁹ along with other Unified Health System (SUS) services.

Many indicators can assess vulnerabilities, including those transformed into indices. In this study, we selected IVSaúde¹², which comprises eight indicators collected in the IBGE Census⁹, with a possible breakdown at the census tract level, allowing its calculation for the smallest areas of the Federal District, considered a single municipality. However, renowned indices, such as the Social Vulnerability Index²⁴ and the Human Development Index²⁵, along with more recent ones, such as the Social Vulnerability Index Applied to SUS Public Policies²⁶ and the Socio-environmental Vulnerability Index²⁷, complement each other in predicting vulnerabilities and contribute to the targeting of public equity-based policies.

This study has some limitations. First, the study was restricted to data from the 2010 Census. This census' frequency curtailed the study since the population changed between

the years of this study and the Census. Also, although the last Census was conducted in 2021, its data are not fully publicized, preventing RA's calculation of IVSaúde and even the population. Another limitation is that this paper did not analyze access to health services but rather the distribution of establishments and teams under a mapped vulnerability plan, which contributes to guaranteeing access, a PHC attribute. Assis and Jesus²⁸ explain that access is related to the user's possibilities of accessing health services, through available times and days in which the unit provides services, the units' accessible location, and receiving care on a walk-in demand basis. Thus, although this study shows that the vulnerable population has UBS and eSF in their territory, this does not mean they have access to the services.

Conclusions

This study showed that the UBS/eSF distribution encompasses the territory of the Federal District. Although the number of teams or the UBS cannot be said to be well distributed, some vulnerable locations concentrate teams in the same health unit, and others do not even have health establishments.

Even though the results regarding the access indicator are not shown, the findings in this study attest to the ESF's capacity to serve the DF population in the most vulnerable areas, considering the distribution of teams and UBSs. According to Backes et al.²⁹, the presence of an ESF team to serve vulnerable populations strengthens

[...] the autonomy of the different stakeholders involved in the healthcare process, the ability to break with traditional models, the appreciation of human singularities, and the strengthening of interactive and associative networks.

Although this study revealed that the eSFs and UBSs are located in places with higher

demographic densities and risk of health vulnerability, investments cannot be reduced to draw the UBSs closer to the population, adapted to the ESF model, enabling access guarantee and actions more focused on the territory, ESF premises, nor can investments be curbed to increase coverage of the DF population. The PNAB guidelines state that a maximum of four teams are needed per UBS. Each team should be assigned an enrolled population of 2,000 to 3,500 people⁴ for the ESF to achieve its potential, ensuring care coordination, expanding access, and being resolute, which needs to be promptly assessed by the DF, considering the vulnerabilities of its population.

As long as iniquities persist and countless citizens are still without guaranteed access

to quality PHC, the State must continue to innovate and invest in health policies and all areas that influence people's health. In this sense, the ESF needs a more detailed outlook from health managers, who must always be attentive to the population's needs.

Collaborators

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