Urban Health and Mobility Indicators and the Impacts of COVID-19 Pandemic: Case Study of Passo Fundo-RS

Me. Júlia Brum Campestrini [1]
Me. Letícia Müller [1]
Dr. Thaísa Leal da Silva[1] (corresponding author)

[1] Postgraduation Program of Architecture and Urbanism, School of Engineering and Applied Sciences, ATITUS Educação, Rua Senador Pinheiro, 304, Passo Fundo/RS 99070-220, Brazil. Phone: (+55) 54-3045.6100.

Emails: jliabrumcampestrini@gmail.com; letimuller18@hotmail.com; thaisa.silva@atitus.edu.br.

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Abstract

Rapid urbanization has generated several challenges for urban management, such as issues related to mobility and health. An alternative to mitigate these problems is the concept of Smart Cities that uses Information and Communication Technologies (ICTs) as agents for transforming the urban environment. The general objective of this research is to analyze the indicators of urban mobility and health in the municipality of Passo Fundo/RS, using as a reference the indicators from the Ranking Connected Smart Cities (RCSC) for the years 2019, 2020 and 2021, the period with the highest number of cases of COVID-19. Furthermore, the study seeks to understand the relationship between the indicators analyzed and the epidemiological data resulting from the COVID-19 pandemic. The results demonstrated some weaknesses and potential of Passo Fundo. In relation to health, the city presented some satisfactory indicators, however the city needs more investment and planning in mobility.

Keywords: Urban Health; Mobility; Smart Cities; Urban Indicators.

1 Introduction

The urbanization process is characterized by the concentration of population and different economic activities in urban areas (Hussain et al., 2022). However, this disorderly urban growth without proper planning affects the distribution of urban form, its efficiency, equity and sustainability, as well as economic aspects (Marques et al., 2021).

From these perspectives, the environmental impacts caused by the uncontrolled growth of cities have been worsening in recent years, and therefore, the environmental crisis has had impacts on health. Problems such as the lack of adequate infrastructure for the supply of water and basic sanitation, the lack of adequate treatment and disposal of solid waste, and pollution, have caused higher rates of respiratory diseases (Ribeiro, 2004).

According to Almeida et al. (2020), the lack of adequate planning and infrastructure leads to the proliferation of infectious diseases. In this way, the urban environment can become a major generator of diseases, such aspects are also related to social factors.

In this context, in addition to environmental problems, urbanization influences inequality, causing problems of violence and economic imbalance in income distribution, demonstrating the new reality of large cities (Shan et al., 2020; Furtado et al., 2020). Valued urban areas have complete infrastructure and services, which are occupied according to purchasing power, while the low-income population lives in cheaper areas and in precarious conditions (Mateus Lima, 2022).

For instance, the new Corona virus (COVID-19) pandemic, which started in 2019 in China rapidly spreading worldwide (Thombre & Agarwal, 2021) highlighted social problems, such as hunger, lack of sanitation and support for families in need. Thus, COVID-19 reinforces the in society, demonstrating the crisis of public management in different government spheres (Paixão, 2020).

Measures for effectiveness and sustainability in this scenario depend on social protection policies and support for populations in vulnerable situations, granting the survival of individuals and families while restrictions on the development of economic activities continue (Aquino et al., 2015).

In this context, policies and strategies aimed at organizing the territory, urban policies and environmental policies are necessary (Torres et al., 2013). Therefore, thinking about the future, smart cities are concerned with the development of the population, the environment and the city as a

whole (Guimarrães et al., 2021). Therefore, the objective of smart cities is to use the data obtained to improve the services provided to citizens and, if necessary, offer new ones (Cruz, 2017).

Smart cities become a support structure for municipal governments, aiming for better urban planning, greater assertiveness in decision-making and improving the quality of urban life.

Through information and communication technologies (ICTs), it becomes possible to collect data and store it, making it possible to monitor the evolution of cities and influence changes to adapt and improve urban infrastructure. In other words, governments can use urban data as a benefit to seek the development of smart cities, sustainability practices, efficiency and resilience (Bribi & Allam, 2022).

With the database, it is possible to use them to measure cities through indicators. Indicators are able to inform everything you want to measure (CODEPLAN, 2023). Specifically, indicators become important tools for evaluation and monitoring, and can be used in different systems (Pereira et al., 2018).

There are several examples of indicators dedicated to each segment or area that we seek to evaluate. Therefore, programs aimed at smart cities use indicators to measure whether a city is becoming smarter or not. As an example of this, the Connected Smart Cities Ranking aims to evaluate Brazilian cities using indicators from 11 main axes, classifying the cities considered most intelligent, and enabling a broader vision regarding the development of urban centers (RRSC, 2019).

Therefore, this work aims to analyze the urban indicators of Passo Fundo, within the scope of the Health and Mobility axes, using as a reference the data from the Connected Smart Cities Ranking of 2019, 2020 and 2021, as well as comparing such indicators with those of the medium-sized cities in the Southern region of Brazil that qualified best in the same ranking. Next, the study seeks to understand these data and the indices of the COVID-19 pandemic, in order to analyze the number of infected people and deaths per municipality studied and their possible relationship with the urban infrastructure of these municipalities. Finally, some alternatives aimed at mobility are proposed and developed based on the results found in this analysis.

2 Methodology

This work was carried out through qualitative, exploratory research, based on a case study analyzing Health and Mobility indicators in the city of Passo Fundo/RS. Therefore, this research has an applied nature, which aims to seek knowledge that can be used to mitigate real problems. Scientific research becomes better understood through its division into methodological stages (Bardin, 2016):

-Step 01: Carrying out bibliographical research, with the aim of understanding the concepts of Passo Fundo's urban infrastructure and its planning, as well as the concept of smart cities, urban health and mobility, based on studies already carried out, through books, theses, dissertations, as well as publications from the Scopus Science and Google Scholar databases.

-Step 02: Case study regarding the city of Passo Fundo/RS, seeking to present aspects of urban development related to the city. In addition to understanding how the municipalities of Rio Grande do Sul, together with the cities analyzed, faced the COVID-19 pandemic.

-Step 03: Survey and collection of data on the Health and Mobility indicators of Passo Fundo/RS, using as references the Connected Smart Cities Ranking of 2019, 2020 and 2021. In addition, a collection was carried out regarding the epidemiological data of the new Coronavirus in the cities analyzed.

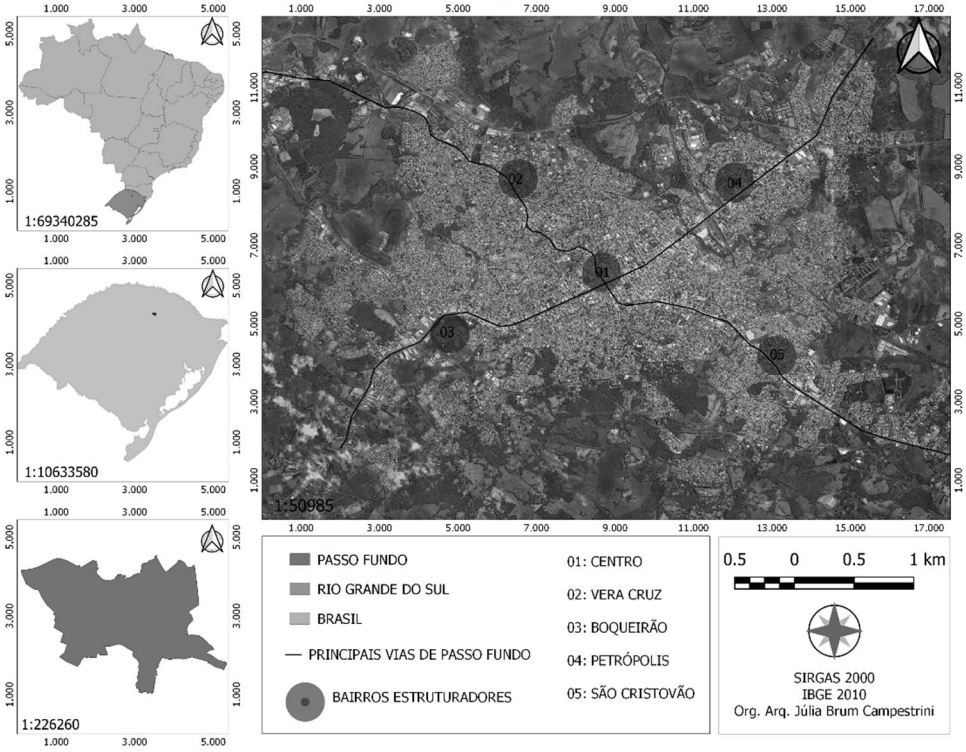
-Step 04: From the analyses, the data were tabulated and presented using graphs, for better understanding and visualization of the results.

2.1 Study Objects

Located in the north of the state of Rio Grande do Sul, the city of Passo Fundo (Figure 1) is characterized by being an educational, medical and economic hub. It has a demographic density of 235.92 inhabitants/km² (IBGE, 2010).and an estimated population of 206,103 people (IBGE, 2019). Furthermore, according to the latest census, around 180,120 people live in urban areas, while 4,706 people live in rural areas (IBGE, 2010).

Passo Fundo has an urban network of small municipalities, becoming a reference in the socioeconomic and population dynamics of nearby cities (Ferreto, 2012; Muller & Silva; 2021). Six municipalities surround the object of study, namely Pontão, Coqueiros do Sul, Carazinho, Santo Antônio do Planalto, Ernestina, Marau and Coxilha, connecting with roads RS-135 and RS-324, BR 153 and BR 285.

Figure 1 - Location map of Passo Fundo/RS.



Source: Authors.

Still, as shown in Figure 1, Passo Fundo developed from two main axes, namely Avenida Brasil and Avenida Presidente Vargas, on which the railway was built bringing great development to the area (Ferreto, 2012). Thus, in red are the two avenues responsible for the structure of the city, which currently has 22 sectors, divided between neighborhoods, subdivisions and villages. Among these sectors, it is possible to note that from the center of the municipality, four neighborhoods formed subcenters according to the structure of the city, namely the neighborhoods Boqueirão, Vera Cruz, São Cristóvão and Petrópolis.

In this way, the city of Passo Fundo/RS becomes the object of study, with the objective of investigating the city's development in the health area, in comparison with RCSC best-qualified medium-sized cities in the southern region of the country in 2019, 2020 and 2021, as presented in

Table 1, seeking to understand the needs and potential of the cities analyzed in relation to public health services.

As shown in Table 1, the four best-ranked cities in the south of the country were selected for comparison with the municipality of Passo Fundo, three of them are in the state of Santa Catarina and one in Paraná. Then, they were compared based on the investigation of the RCSC urban indicator data presented in the next section.

Table 1 - Classification of medium-sized cities in the South region (RCSC, 2020).

CITY	RANKING POSITION 2019	RANKING POSITION 2020	RANKING POSITION 2022
Balneário Camburiú (SC)	17º	16º	12º
Blumenau (SC)	9º	19º	16º
Jaraguá do Sul (SC)	41º	62º	17º
Maringá (PR)	26º	24º	25º
Passo Fundo (RS)	-	-	-

Source: Authors.

2.2 Ranking Connected Smart Cities

The proposed evaluating method for this study consists of collecting data from sources referenced in Tables 2 and 3, which present the indicators of the Health and Mobility axes of the Connected Smart Cities Ranking (RCSR, 2021), measured during the years of 2019, 2020 and 2021, as well as the units of measurement planned for each indicator.

In summary, as shown in Table 2, the Connected Smart Cities Ranking indicators (RCSR, 2021) for the health axis are related to the supply of beds, qualified professionals, service coverage, public investments, infant mortality and remote medical care. This last indicator was only listed in 2021, shortly after the COVID-19 pandemic scenario, where with isolation it was necessary to use new strategies for medical care for the population, using the internet as a means of communication.

Table 2 - Urban indicators of the health axis of the Connected Smart Cities Ranking (RCSC).

AXLE	INDICATOR	UNIT	SOURCE
HEALTH	Hospital beds per thousand inhabitants	# / thousand inhabitants	Datasus
	Doctors per 100 thousand inhabitants	# / 100 thousand inhabitants	CNES
	Population coverage of the family health team	Percentage	Datasus
	Expenses per capita paid with health	R$ / inhabitants	Siconfi
	Deaths / thousand living deaths (place of residence)	# / thousand living deaths	Datasus
	Online appointment scheduling in the public health network	-	IBGE - P. M.

Source: Authors.

In addition to collecting data on health indicators, an in-depth study of the health of municipalities was carried out by collecting epidemiological data on COVID-19. The number of people infected and deceased due to the Coronavirus were investigated, specifically in the cities analyzed.

For the evaluation, the data presented in Table 3 was used, which was collected based on data shared by the Municipal Governments of the cities analyzed, until a defined cutoff date for collection. Furthermore, for a better understanding of the data, and to enable a more uniform comparison of cities, as they have different numbers of inhabitants, indices were used to calculate the number of deaths and infections per thousand inhabitants.

Table 3 - COVID-19 epidemiological data in the cities analyzed.

City	Number of inhabitants	Number of deaths	Number of infected	Number of deaths from covid-19/1000 inhabitants	Number of infected from covid-19/1000 inhabitants	% of mortality
Name	Total inhabitants	Until cut-off date	Until cut-off date	Number of deaths/1000 inhabitants	Number of infected /1000 inhabitants	Number of deaths / number of infected x 100

Source: Authors.

Table 4 presents the Mobility indicators of the Connected Smart Cities Ranking (RCSR, 2021), data from the ten indicators presented in the table were collected. These indicators analyze public and individual transport, cycle paths, vehicle emissions, other modes of transport, average age of the vehicle fleet, interstate connections and air destinations and, in 2021, two new indicators were added, namely: electronic ticket public transport and smart traffic lights.

Table 4 - Urban indicators of the mobility area of the Connected Smart Cities Ranking (RCSC).

AXLE	INDICATOR	UNIT	SOURCE
MOBILITY	Cars per Inhabitant	# / 1000 Inhabitant	Denatran / IBGE
	Average Vehicle Fleet Age	Years	Denatran
	Buses/automobiles	#	Denatran
	Other modes of public transport	KM / 100 thousand habts	Levantamento
	Cycle paths	KM / 100 thousand habts	Levantamento
	Interstate connections	Destinations	ANTT
	Airline destinations	Destinations	Anac
	Percentage of low emission vehicles	Percentage	Denatran
	Public transport electronic ticket	-	IBGE - P. M.
	Smart traffic lights	-	IBGE - P. M.

Source: Authors.

From the collection of this data, we sought to understand whether the urban indicators analyzed are interrelated with COVID-19 data, and whether the cities classified as smart by the RCSC achieved a better response to the pandemic, in relation to the city of Passo Fund/RS.

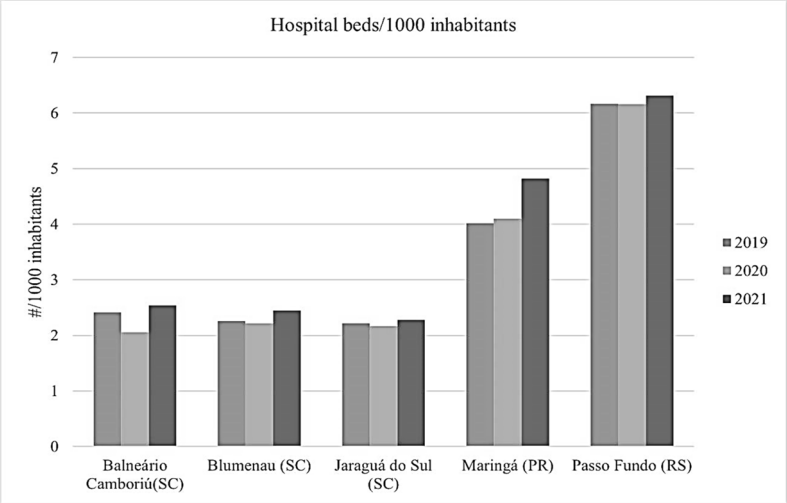
3 Results and Discussion

In this section, the results obtained from the data collection regarding Health indicators and their relationship with COVID-19 data will be presented, as well as the analysis of Mobility indicators in Passo Fundo and the other cities analyzed.

3.1 Analysis of urban health indicators

The first health indicator measured was hospital beds per 1000 inhabitants, shown in Graph 1. It is worth highlighting that in 2020, the time of collecting bed information did not coincide with the increase in beds generated by the coronavirus pandemic (COVID -19), being linked to the common offer available to the population (RCSC, 2020). From Graph 1, Passo Fundo has high rates of beds per inhabitants in the last three years, in relation to the compared cities. As cases of COVID-19 increased, the number of beds also increased, especially in the most populous cities in the state, including Passo Fundo (COVID-19 – Leitos e Hospitalizações, 2021). The same occurred in the city of Maringá, which also had high rates, especially in 2021. This factor may be related to the increase in beds made available to better combat COVID-19 (Maringa, 2021).

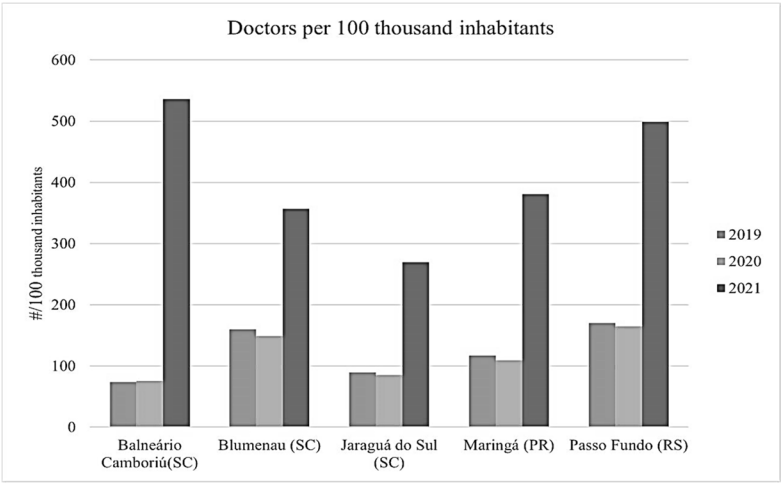
Graph 1 Indicators of hospital beds/1000 inhabitants in the 2019, 2020 and 2021 Rankings.



Source: Authors.

In Graph 2, in the comparison of doctors per 1000 inhabitants, the results obtained demonstrated that there is a marked contrast in the indicator between the three years of analysis. In 2019 and 2020, Blumenau and Passo Fundo ranked first in the supply of doctors per thousand inhabitants, and in 2021 all the cities analyzed showed significant growth in these rates compared to other years, especially Balneário Camboriú and Passo Fundo. This increase was possibly due to the need for medical care due to the COVID-19 pandemic. In this scenario, many recent graduates went to work in emergencies, helping to care for patients with Coronavirus (Destefani, 2021).

Graph 2 Indicators of doctors per 100 thousand inhabitants in the 2019, 2020 and 2021 Rankings.

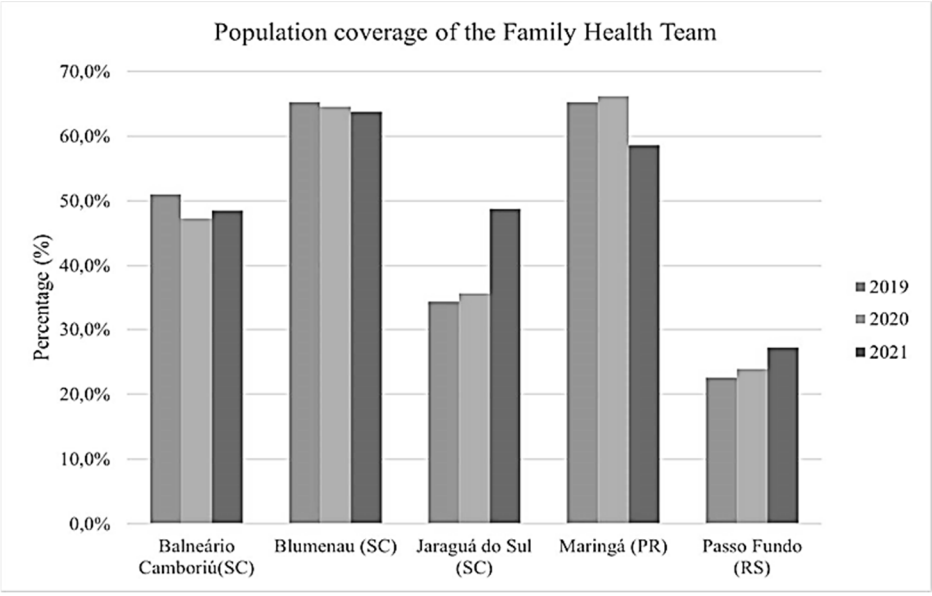


Source: Authors.

Regarding the Family Health Team population coverage indicator (Graph 3), Passo Fundo has had rates below 30% in the last three years, requiring more planning in the area. According to

Graph 3, the best ranked cities in relation to this indicator were Blumenau and Maringá, demonstrating concern about the services offered.

Graph 3 Population coverage indicators of the family health team in the 2019, 2020 and 2021 Rankings.

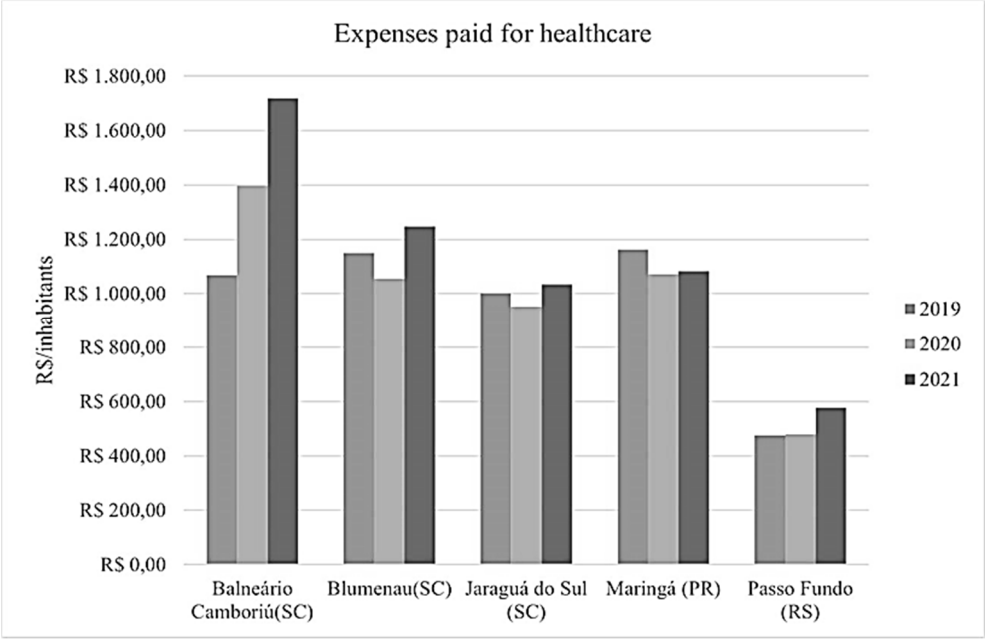


Source: Authors.

The fourth analysis evaluated per capita expenditure on healthcare. According to Graph 4, during the three years of ranking analysis, Passo Fundo presented low rates in investments in health expenses in relation to the other cities analyzed, showing greater investment during the year 2021, a factor that may be related to the Health Indicator Beds/1000 inhabitants, shown in Graph 1. The cities of Balneário Camboriú and Blumenau revealed the highest investment during the three years, but presented higher rates in 2021, showing interest in improving the infrastructure of the health sector, which may also be related with some COVID-19 peak periods occurring in early 2021.

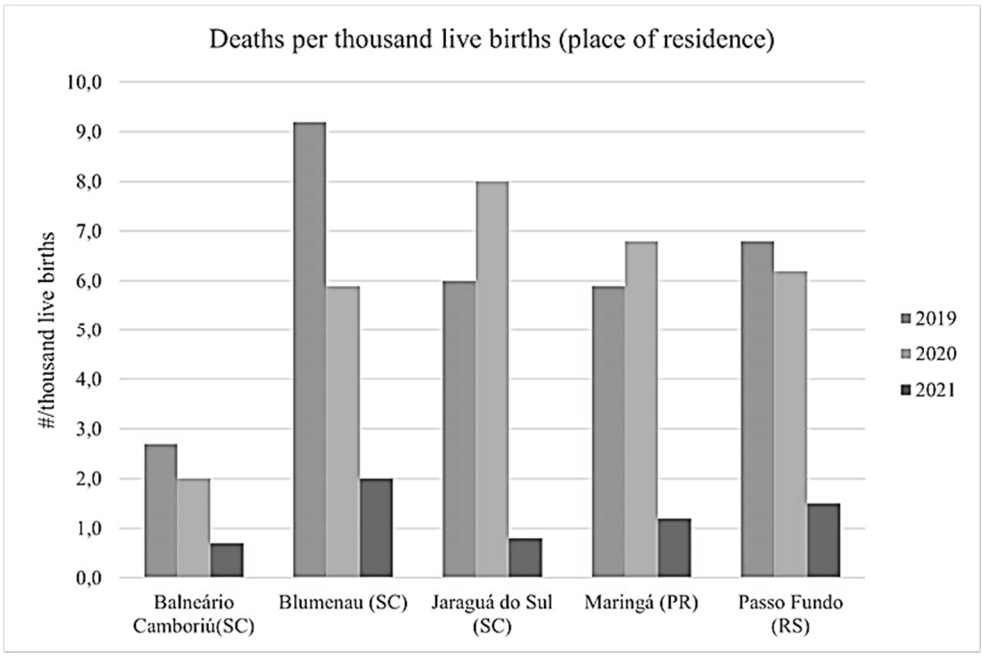
The fifth analysis measures the indicator of the number of deaths per live birth per occurrence in the municipality. As shown in Graph 5, the 2021 indices show a contrasting drop in numbers compared to the years 2019 and 2020, demonstrating improvements in the infrastructure and services offered in these cities. Thus, in 2019, the city with the highest number of deaths per live birth was the municipality of Blumenau, followed by the city of Passo Fundo in second place this year. In relation to the year 2020, Jaguará do Sul presented high numbers of deaths due to live births, followed by the city of Maringá. In the 2021 analysis, Blumenau again presented high rates, followed by the cities of Maringá and Passo Fundo, while the cities of Balneário Camboriú and Jaraguá do Sul showed lower occurrences.

Graph 4 Indicators of health expenses paid in the 2019, 2020 and 2021 Rankings.



Source: Authors.

Graph 5 Death indicators per thousand live births in the 2019, 2020 and 2021 Rankings.



Source: Authors.

The last indicator was added to the Health axis in the 2021 Ranking, and analyzes the cities that offered online appointment-scheduling in the public health network. According to the study, only Maringá and Passo Fundo do not have online scheduling, while the other cities do, making it possible to observe different methods used by cities to avoid crowds and contamination during the

pandemic period. This indicator is important to verify the possible methods that cities have adopted, especially during the COVID-19 pandemic, to avoid crowding and the spread of the virus.

Furthermore, in order to investigate whether there is any relationship between this information and the Health indicators of the cities analyzed, epidemiological data on COVID-19 was collected, as shown in Table 5. A cutoff date was used for collection, being this one from July 13, 2022 and used the data shared by the Municipal Governments of each city.

Table 5 - List of COVID-19 data until July 14, 2022.

City	Number Of Inhabitants	Number Of Deaths	Number Of Infected	Number Of Deaths From Covid-19/1000 Inhabitants	Number Of Infected From Covid-19/1000 Inhabitants	% Of Mortality
Balneário Camboriú(SC)	149.227	493	34.036	3,30	228,08	144,8%
Blumenau (SC)	366.418	791	131.049	2,16	357,65	60,4%
Jaraguá do Sul (SC)	184.579	460	59.904	2,49	324,54	76,8%
Maringá (PR)	436.472	1.791	140.073	4,10	320,92	127,9%
Passo Fundo (RS)	206.103	797	64.682	3,87	313,83	123,2%

Source: Authors.

Thus, in relation to the COVID-19 pandemic, the data collected available by the municipal councils of each city analyzed, was calculated using new indices, linking the number of deaths and infections per thousand inhabitants, seeking a better understanding of the data, and to enable the comparison of cities with different numbers of inhabitants. From the data in Table 5, it is possible to note that in relation to the number of deaths per thousand inhabitants, Maringá and Passo Fundo are the cities that presented the highest number of deaths due to COVID-19. However, Blumenau and Jaraguá do Sul presented low mortality percentage rates, in relation to the other cities analyzed, which presented high rates, which may be related to the search for improvements in the services offered, as seen in graphs 1, 2 and 4.

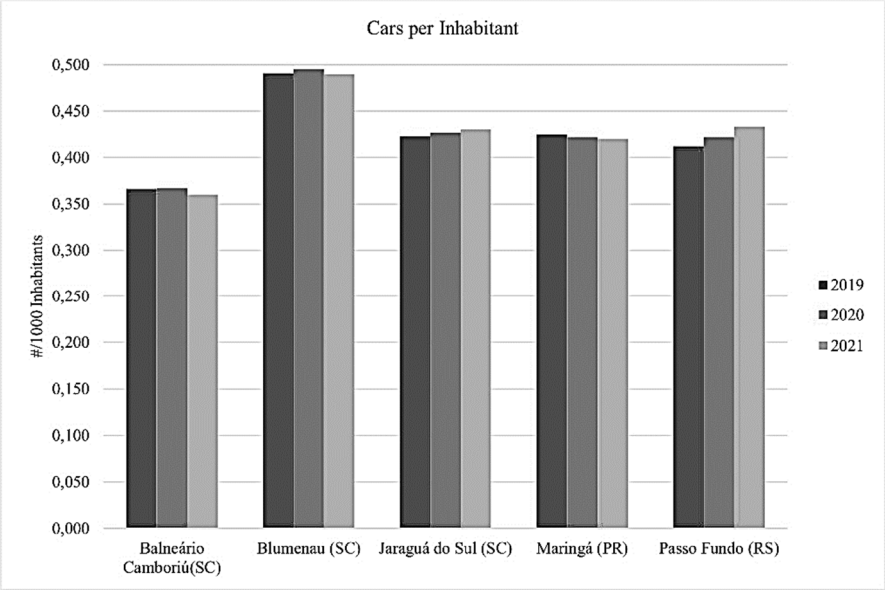
Thus, relating the data with the cities' indicators, it is possible that there is a relationship between the city's infrastructure on the recovery and on assisting the population However, it is worth noting that the population's attitudes towards the spread of the virus and its care were not explored in depth in this study, however, they can also influence the indices analyzed.

3.2 Analysis of urban mobility indicators

The following analysis is regarding the urban Mobility indicators of the Connected Smart Cities Ranking for the years 2019, 2020 and 2021. As shown in Graph 6, referring to the Cars per Inhabitant indicators, it is noted that the cities of Jaraguá do Sul, Maringá and Passo Fundo have seen an insignificant increase in the number of cars per inhabitant in recent years. However, the

demand for private vehicles may be related to the search for safety during the COVID-19 pandemic, as public transport becomes a means of agglomeration. According to data relating to the relationship between mobility in the pandemic, the survey by NZN Intelligence (2021) together with Estadão Summit Mobilidade showed that around 40.2% of respondents started using private cars, while 4.2% started using motorbikes. The survey showed that 83.5% of respondents said they no longer felt safe riding public transport during the pandemic, due to possible contamination by COVID-19 (IPXK, 2023).

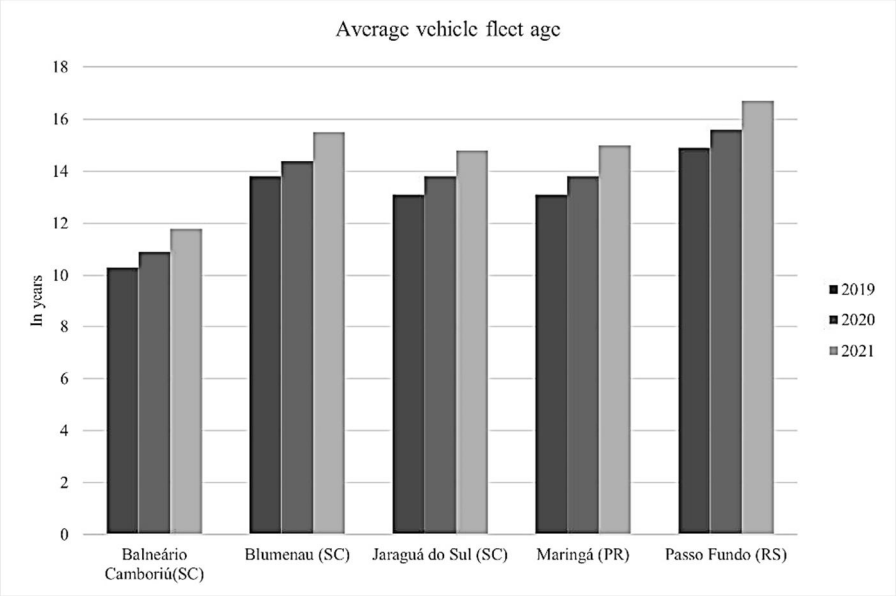
Graph 6 Automotive indicators per inhabitant in the 2019, 2020 and 2021 Rankings.



Source: Authors.

The seventh analysis presented the Average Age of the Vehicle Fleet indicator (Graph 7). This indicator seeks to present better quality and speed in terms of mobility, also affecting health, as older transport has greater consequences for air quality, increasing pollution levels. Therefore, according to the research, the cities of Blumenau, Jaraguá do Sul, Maringá and Passo Fundo presented a greater challenge in updating vehicles during the last three years, unlike Balneário Camboriú, with the newest vehicles.

Graph 7 Average vehicle fleet age indicators in the 2019, 2020 and 2021 Rankings.



Source: Authors.

The next checking is regarding the Bus Indicator by Cars. According to the analysis, the five cities analyzed presented an index of 0.01 buses per car in the years 2019, 2020 and 2021. The use of public transport results in less traffic of vehicles for individual use, reducing pollution levels and helping in urban transportation. Therefore, initiatives from the cities analyzed are necessary to improve and readjust the public transport offered.

Table 6 presents the Cycle Paths indicator in the cities analyzed. According to the results, it is possible to verify that the city of Jaraguá do Sul had around 51.94 kilometers of cycle paths in 2021 and in second place Blumenau had 31.23 kilometers of cycle paths. However, it is noteworthy that the Rio Grande do Sul city of Passo Fundo has cycle paths implemented since before 2019, but they were not included in the RCSC in previous years, only in 2021 with the increase in mileage. The same occurs in Balneário Camboriú, the municipality has cycle paths and cycle lanes, which were expanded and presented in the 2021 RCSC. This fact varies from the cutoff date for collecting indicators each year, influencing the increase in mileage over the three years (RCSC, 2019; RCSC, 2020; RCSC, 2021).

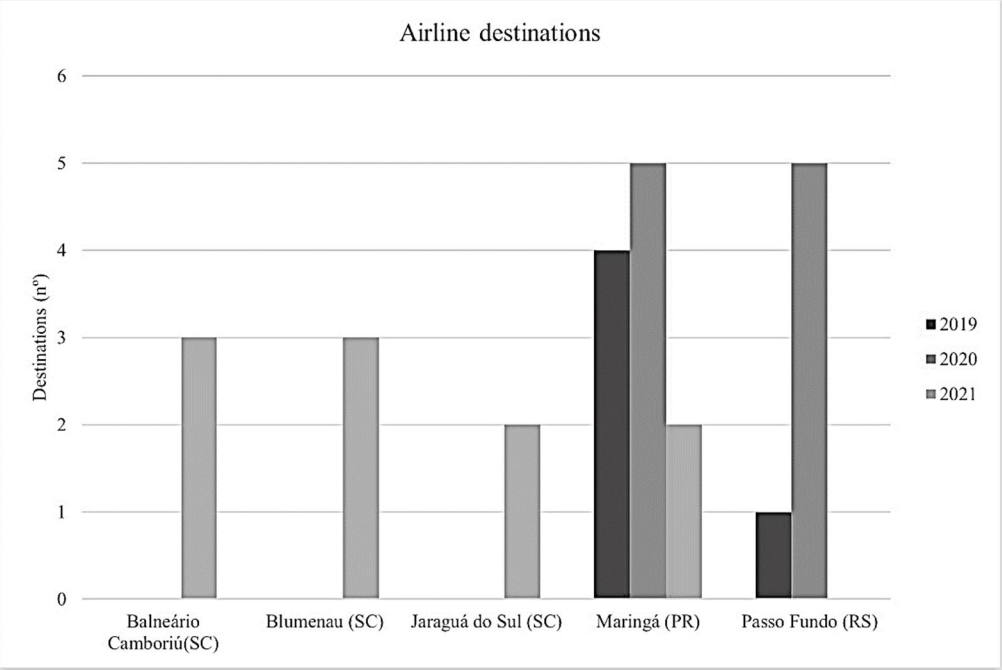
Table 6 - Cycle path indicators in the 2019, 2020 and 2021 Rankings.

CITY	CYCLE PATHS 2019	CYCLE PATHS 2020	CYCLE PATHS 2021
Balneário Camburiú(SC)	NA*	NA*	27,44
Blumenau (SC)	12,34	12,34	31,23
Jaraguá do Sul (SC)	NA*	NA*	51,94
Maringá (PR)	3,27	3,27	9,3
Passo Fundo (RS)	NA*	NA*	7,33

Source: Authors.

Graph 8 refers to the Airport Access indicator, which aims to provide information on the number of weekly flights, thus qualifying the connectivity capacity of the municipalities, however in relation to the cities studied, the numbers of Balneário Camboriú, Blumenau and Jaraguá do South in the years 2019 and 2020 are null. Passo Fundo showed regular rates in these same years, however, in 2021 the airport was closed due an expansion on the runway and passenger terminal (G1,2022).

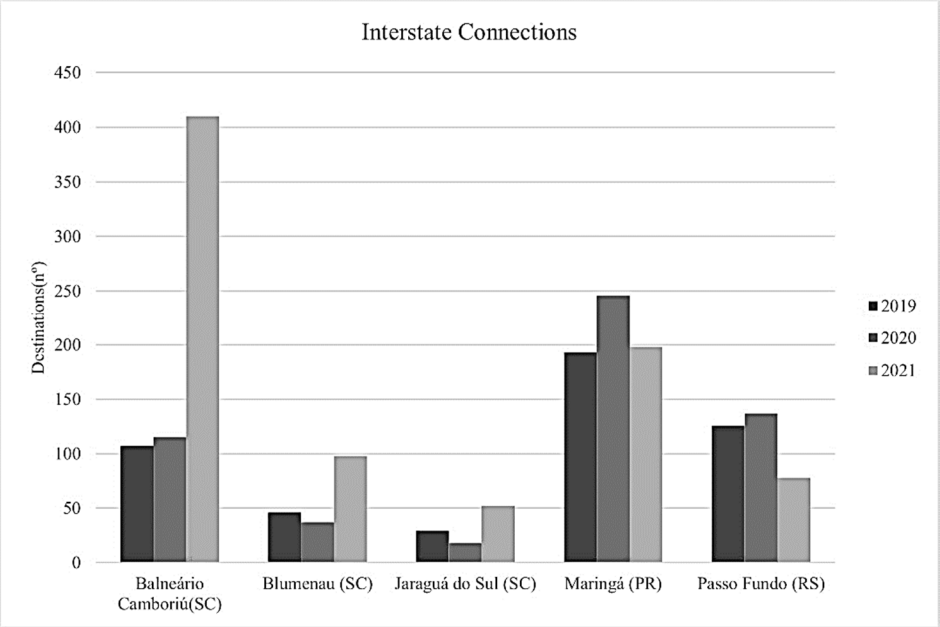
Graph 8 Airport access indicators in the 2019, 2020 and 2021 Rankings.



Source: Authors.

Graph 9 presents the Road Transport indicator, which aims to inform road destinations outside the state. In relation to the city of Passo Fundo, destinations decreased from 2019 to 2021, which may be related to the increase in private vehicles and the reduction in bus schedules during the pandemic period. In this regard, Balneário Camboriú has the largest number of interstate connections between cities compared in 2021, enabling access to different cities by road transport. In this way, this branch becomes one of the main connections of the state.

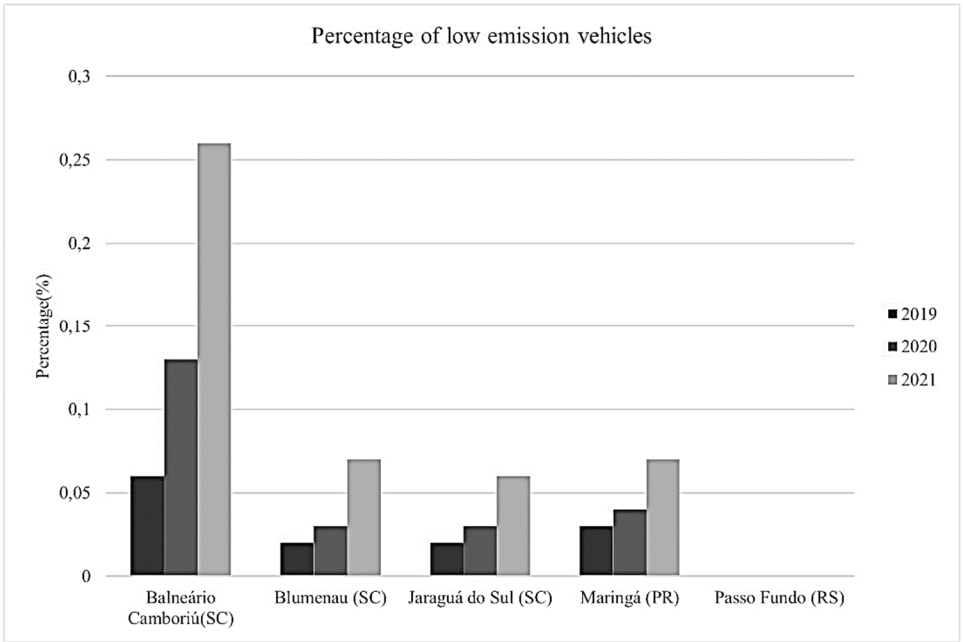
Graph 9 Road transport indicators in the 2019, 2020 and 2021 Rankings.



Source: Authors.

The last graph presents the Low Emission Vehicles indicator. Thus, according to Graph 10, Balneário Camboriú ranked first during the last three years of analysis, while Passo Fundo occupies last place with rates of less than 0.03%, requiring alternatives aimed at offering more efficient alternative vehicles.

Graph 10 Low emission vehicle indicators in the 2019, 2020 and 2021 Rankings.



Source: Authors.

The research also includes an analysis of the “Electronic Public Transport Ticket Indicator”, in which only Balneário Camboriú and Passo Fundo do not have electronic tickets, a technology that aims to assist the population's routine. Therefore, it is suggested that in the future these cities

can improve public transport, as seen in the Bus by Car Indicator, and seek to introduce automation systems, in search of safety and a better quality of life for their citizens.

The same is seen in the Indicator of Other Modes of Public Transport, in which the five cities analyzed do not have other modes of public transport, besides the bus. Thus, the need for adequate urban planning and infrastructure is understood, seeking to improve mobility in these cities, through the offer of other means of public transport that can be an alternative to using the bus.

Finally, the Connected Smart Cities Ranking also analyzes the Smart Traffic Lights Indicator. In this survey, only the city of Blumenau does not have the technology, while the other cities do. Information collection via Smart Traffic Lights can be used for safety alerts, driver assistance and traffic control (Aquino et al., 2020).

4 Conclusions

The research presented a survey and analysis of urban Mobility and Health indicators in the city of Passo Fundo and the four medium-sized cities in the Southern region of Brazil that ranked best in the Connected Smart Cities Ranking of 2019, 2020 and 2021.

The study demonstrated that Passo Fundo, compared to the other four municipalities, has some lower indices such as those presented in the indicators of “paid health expenses”, “population coverage by the family health team”, “road transport”, “low-income vehicles issue”, and “public transport electronic ticket”. However, the city stood out mainly in health-related indicators, such as “Hospital beds/1000 inhabitants”, “Doctors per 1000 inhabitants”, “Deaths/thousand live births”, demonstrating the importance of seeking improvements in the infrastructure offered.

From these initial analyses, it was possible to understand the weaknesses and potential of Passo Fundo. In terms of health, the city presents some satisfactory results, however, incentives in the health area need to continue to be reinforced, in order to provide quality services to its citizens. Furthermore, the city needs investments and initiatives in the area of mobility, mainly in public transport and automation systems, in order to provide citizens with greater mobility flexibility and a better quality of life, in addition to generating less pollution.

With regard to COVID-19 data, there was a significant change between the three years of analysis in the health and mobility axis, mainly in the indicators of “Beds/1000 inhabitants”, “Doctors per 1000 inhabitants”, “Cycle paths” , and “Cars per Inhabitants”, however, it is necessary as future research to investigate other issues in the analyzed cities that may have influenced the rates of people infected and killed by COVID-19, such as strategies to combat the spread and even cultural issues, for greater basis and understanding of these analyses.

Finally, it is important to encourage cities within the scope of new management, administration and planning strategies to improve the analyzed urban indicators. In this way, measuring and monitoring the urban indicators of smart cities become an interesting alternative for cities, as they can help public managers to have a greater understanding and transparency of the current situation of their cities, so that it is possible to outline new strategies for improvements and adaptation to urban planning.

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