

35<sup>ème</sup> colloque annuel

de l'Association Internationale de Climatologie

Centre International de Conférences  
Météo-France, Toulouse, France

6-9 juillet 2022



fapesc  
Fundação de Amparo à  
Pesquisa e Inovação do  
Estado de Santa Catarina

# CLIMATE AND SPATIALIZATION OF RESPIRATORY DISEASES

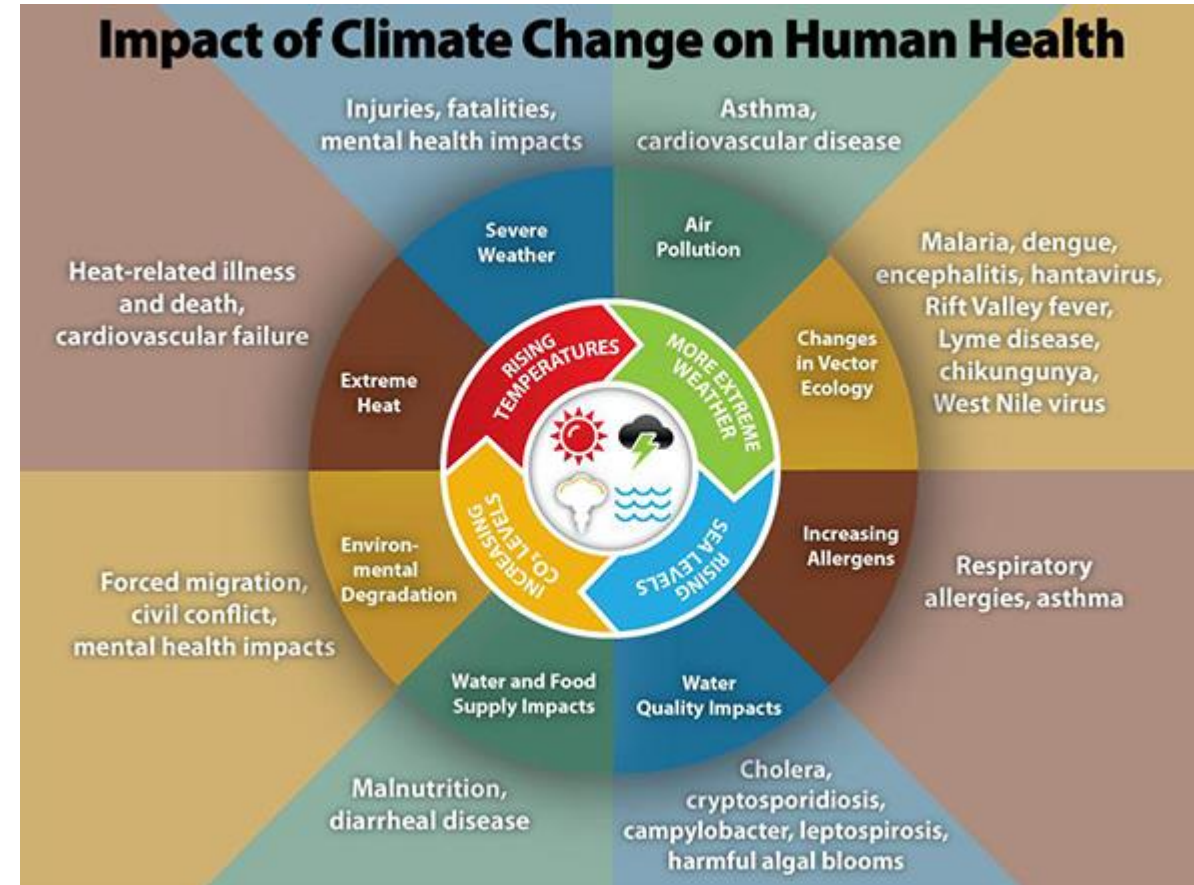
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# INTRODUCTION

The relations between climate, health and human diseases have been addressed specifically since changes in the environment can have consequences in human daily life and as a result in human health.



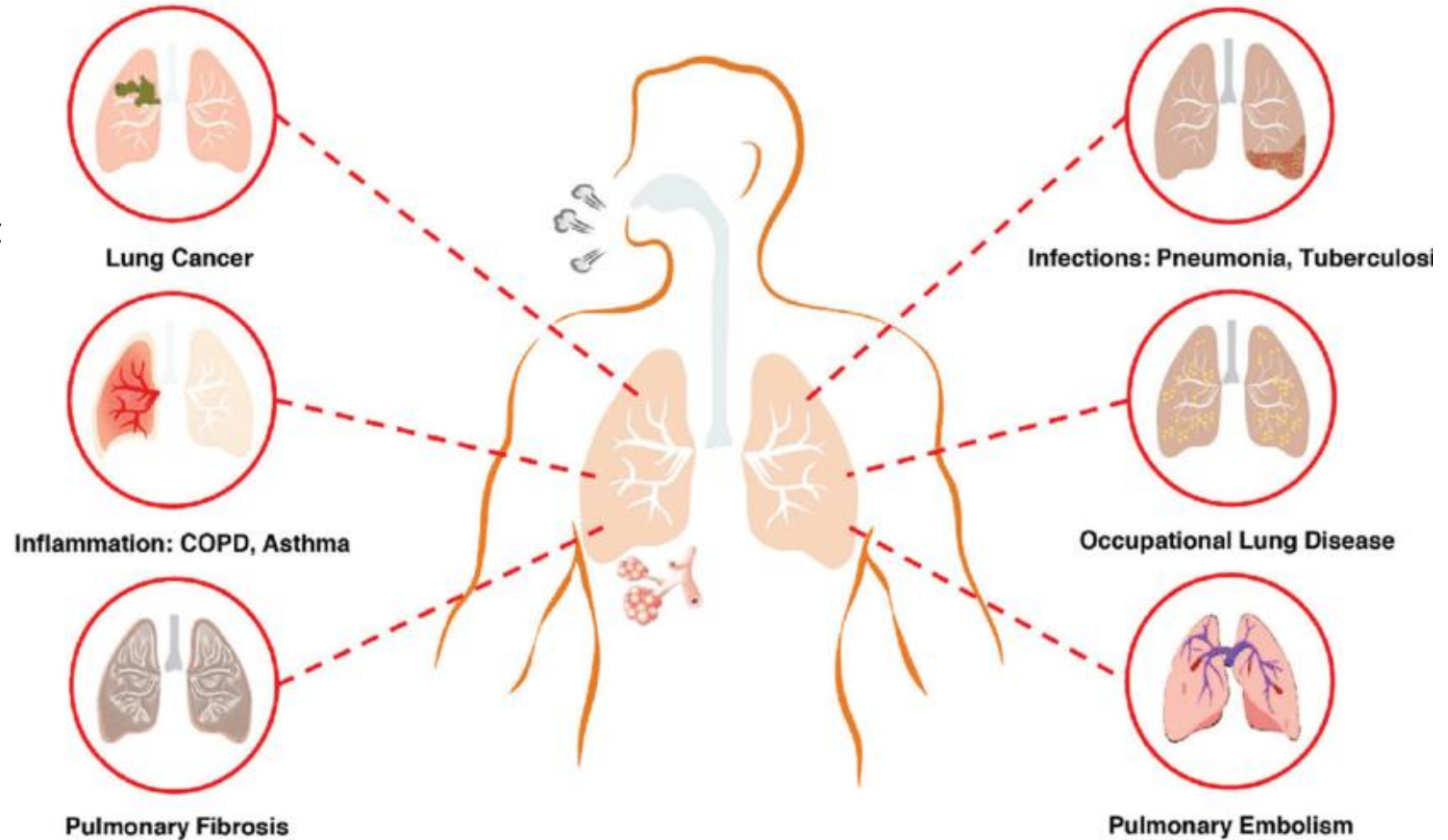
Source: National Center for Environmental Health (2022)

# CLIMATE AND HEALTH

The climate is not the cause of disease.

It should be understood as an element to be considered in the occurrence of a disease.

As a probability factor of increasing case records.



Source: Shrestha et al (2020)

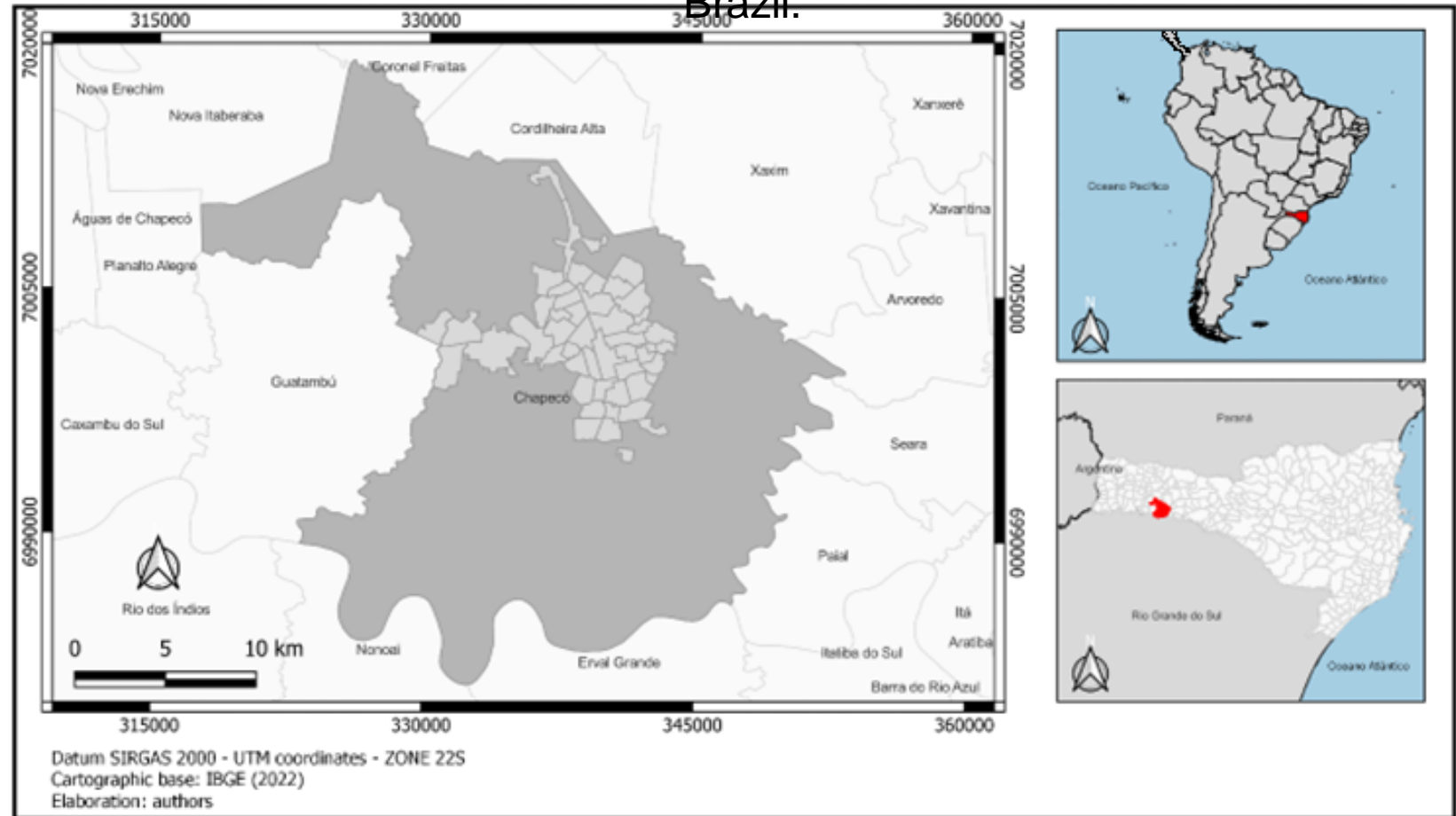
# CLIMATE AND RESPIRATORY DISEASES

Registration of hospitalizations (of residents), according to ICD-10, period 2008 - 2019, Brazil.

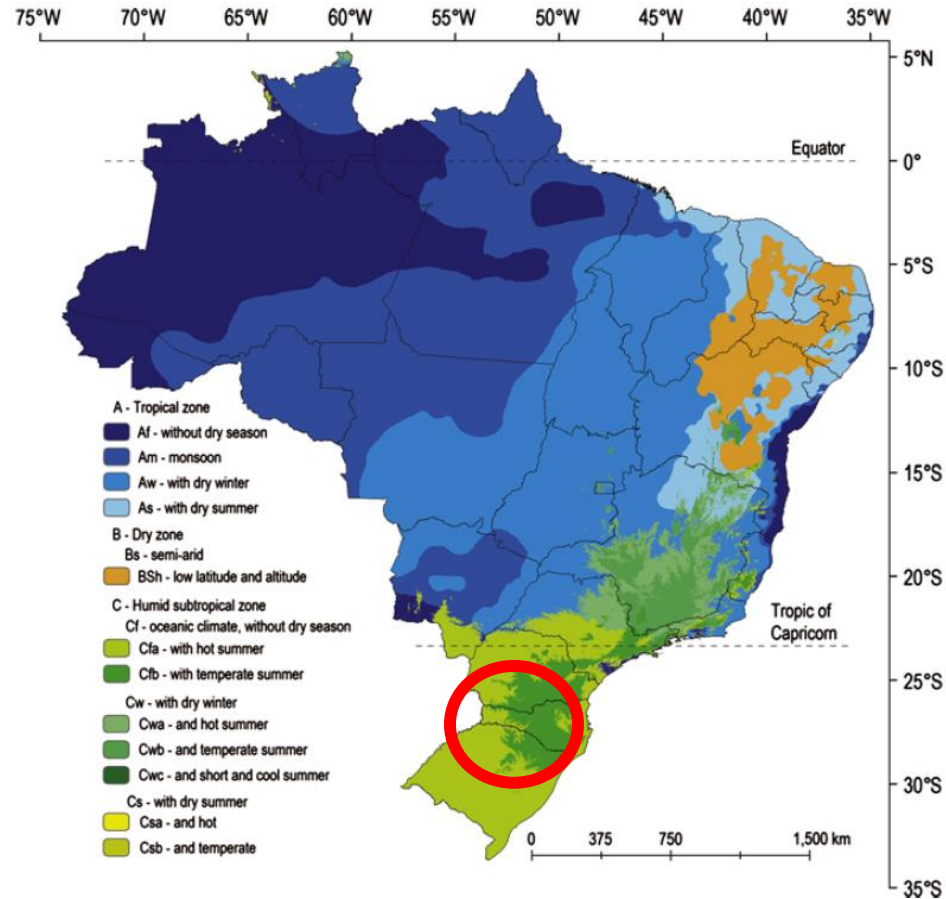
Chapter ICD-10	%
I. Infectious and parasitic diseases	7,60 %
II. Neoplasms (Cancer)	6,21 %
III. Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	0,81 %
IV. Endocrine, nutritional and metabolic diseases	2,35 %
V. Mental and behavioural disorders	2,24 %
VI. Diseases of the nervous system	1,59 %
VII. Diseases of the eye and adnexa	0,85 %
VIII. Diseases of the ear and mastoid process	0,17 %
IX. Diseases of the circulatory system	10,04 %
<b>X. Diseases of the respiratory system</b>	<b>11,45 %</b>
XI. Diseases of the digestive system	9,42 %
XII. Diseases of the skin and subcutaneous tissue	2,01 %
XIII. Diseases of the musculoskeletal system and connective tissue	1,82 %
XIV. Diseases of the genitourinary system	6,94 %
<b>XV. Pregnancy, childbirth and the puerperium</b>	<b>20,98 %</b>
XVI. Certain conditions originating in the perinatal period	2,11 %
XVII. Congenital malformations, deformations, and chromosomal abnormalities	0,71 %
XVIII. Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	1,46 %
XIX. Injury, poisoning and certain other consequences of external causes	9,20 %
XX. External causes of morbidity and mortality	0,02 %
XXI. Factors influencing health status and contact with health services	2,03 %
<b>Total</b>	<b>100%</b>

# City of Chapecó, state of Santa Catarina, Southern Region of Brazil.

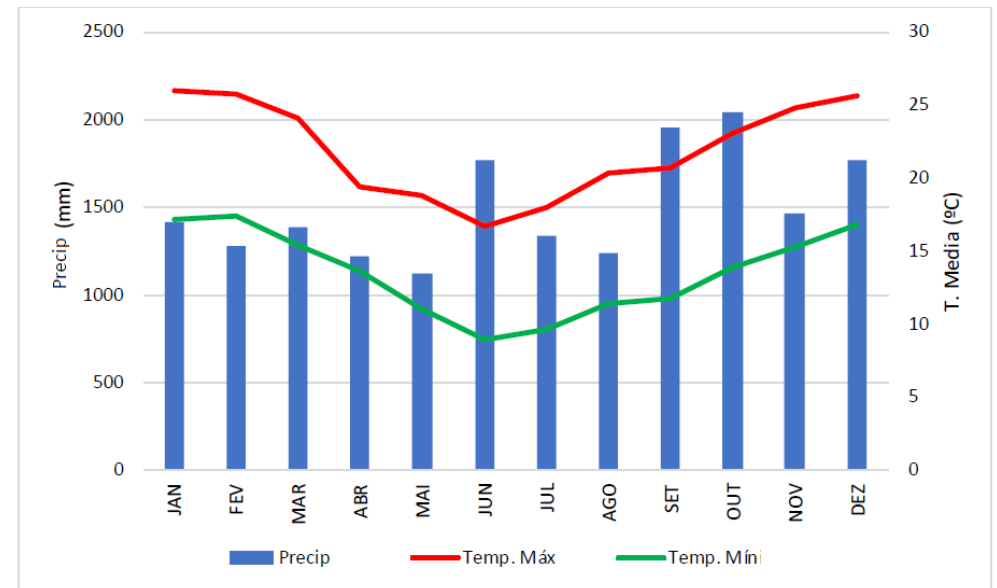
## STUDY AREA



# STUDY AREA



## Subtropical climate – Chapecó (SC) - Brazil



Climate classification for Brazil, according to the Koppen.

Source: Alvares, et al. 2014

# STUDY AREA

Registration of hospitalizations (of residents), according to ICD-10, period 2008 - 2019, Brazil vs Chapecó.

Chapter ICD-10	Brazil	Chapecó
I. Certain infectious and parasitic diseases	7,60 %	2,78 %
II. Neoplasms (Cancer)	6,21 %	10,67 %
III. Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	0,81 %	0,80 %
IV. Endocrine, nutritional and metabolic diseases	2,35 %	0,73 %
V. Mental and behavioural disorders	2,24 %	1,39 %
VI. Diseases of the nervous system	1,59 %	1,76 %
VII. Diseases of the eye and adnexa	0,85 %	0,26 %
VIII. Diseases of the ear and mastoid process	0,17 %	0,27 %
IX. Diseases of the circulatory system	10,04 %	7,20 %
<b>X. Diseases of the respiratory system</b>	<b>11,45 %</b>	<b>12,32 %</b>
XI. Diseases of the digestive system	9,42 %	10,27 %
XII. Diseases of the skin and subcutaneous tissue	2,01 %	1,25 %
XIII. Diseases of the musculoskeletal system and connective tissue	1,82 %	3,89 %
XIV. Diseases of the genitourinary system	6,94 %	6,69 %
XV. Pregnancy, childbirth and the puerperium	20,98 %	19,49 %
XVI. Certain conditions originating in the perinatal period	2,11 %	2,70 %
XVII. Congenital malformations, deformations, and chromosomal abnormalities	0,71 %	0,87 %
XVIII. Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	1,46 %	2,18 %
XIX. Injury, poisoning and certain other consequences of external causes	9,20 %	<b>13,31 %</b>
XX. External causes of morbidity and mortality	0,02 %	0,02 %
XXI. Factors influencing health status and contact with health services	2,03 %	1,14 %
<b>Total</b>	<b>136.256.124</b>	<b>144.685</b>

# OBJECT

Our objective was to analyze the relationship between the records of hospitalizations for respiratory diseases and the production of urban space in Chapecó - Santa Catarina - Brazil.

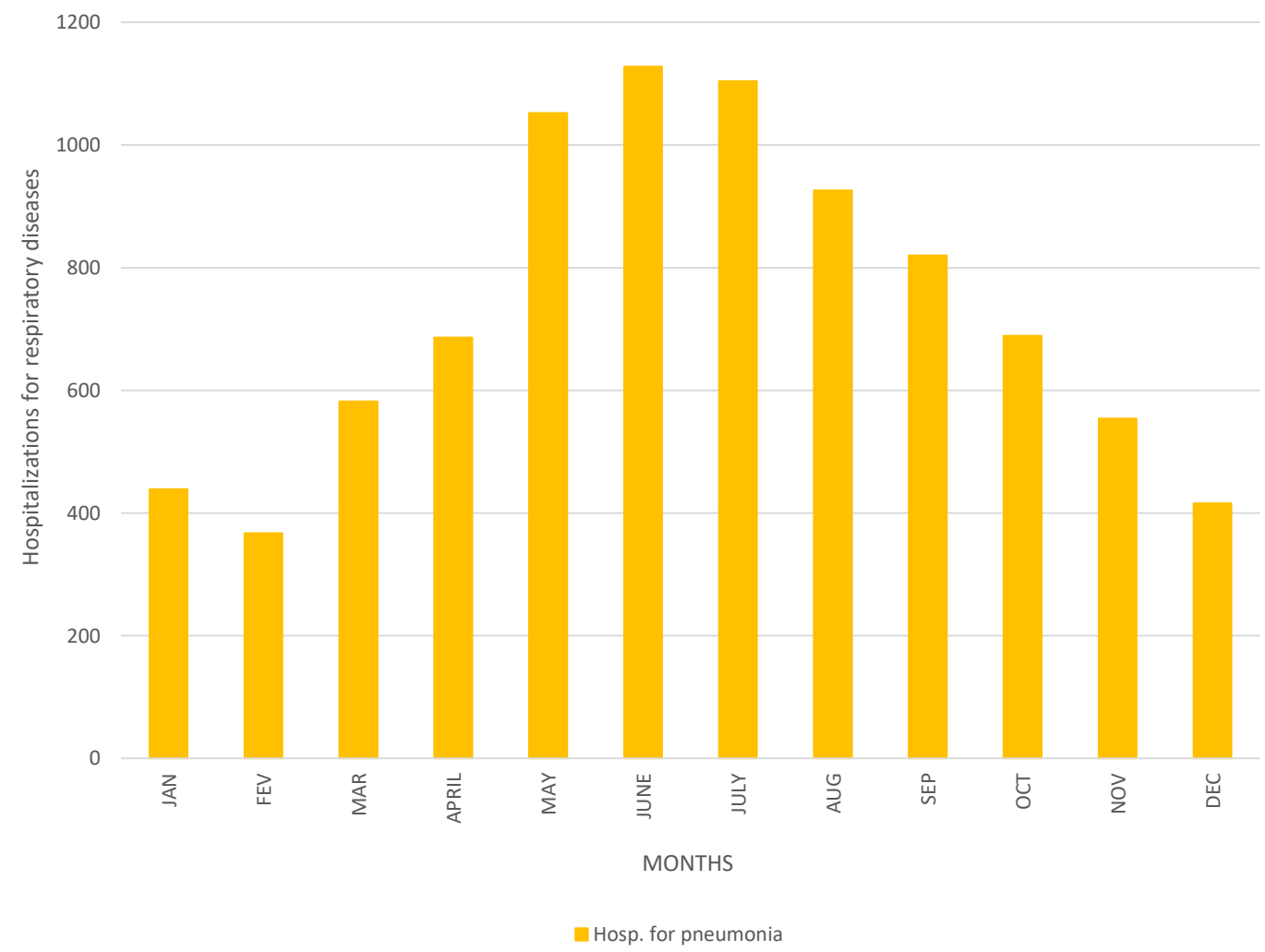


# MATERIALS AND METHODS

- ✓ Data from the hospitalization register;
- ✓ Meteorological data;
- ✓ Period January 2008 until December 2019 (monthly data)
- ✓ Statistical tests (normality test of Shapiro-Wilk; Spearman correlations);
  
- ✓ We classified data from the Brazilian Postal Addressing Code;
- ✓ Maps – ArcGis;
  
- ✓ For the hospitalization rate, the following formula was used:  
$$\text{(number of hospitalizations / population of the neighbourhood) x 1000.}$$
- ✓ For the mapping and differentiation of the neighborhoods, we used Nascimento (2014) which presents a spatial pattern of downtown vs periphery based on the socioeconomic (monthly income of the head of the family).

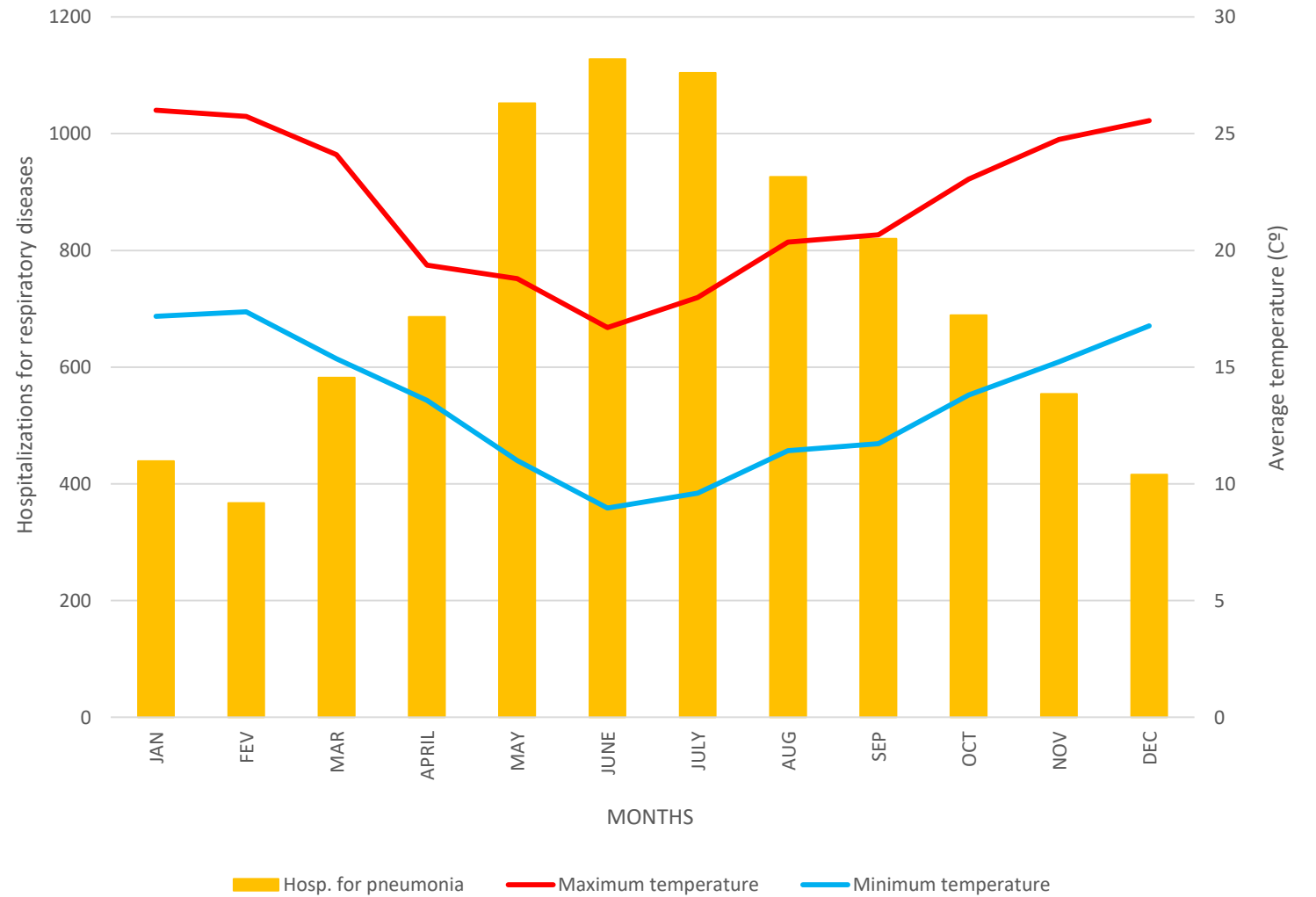
# RESULTS

Distribution of monthly records of hospitalizations for diseases of the respiratory system, 2008 to 2019, Chapecó-SC



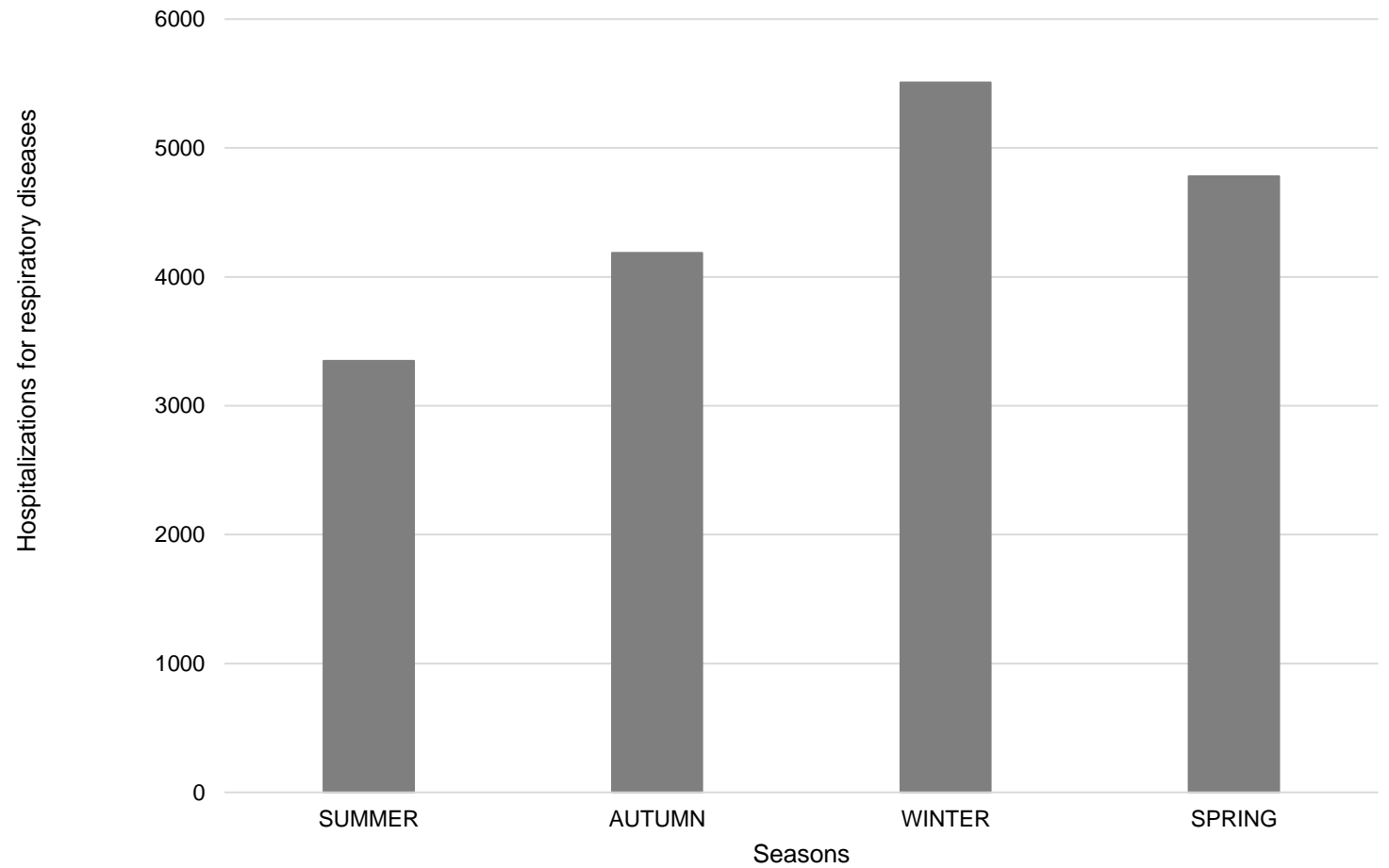
# RESULTS

Distribution of monthly records of hospitalizations for respiratory diseases and average monthly temperatures, 2008 to 2019, Chapecó-SC



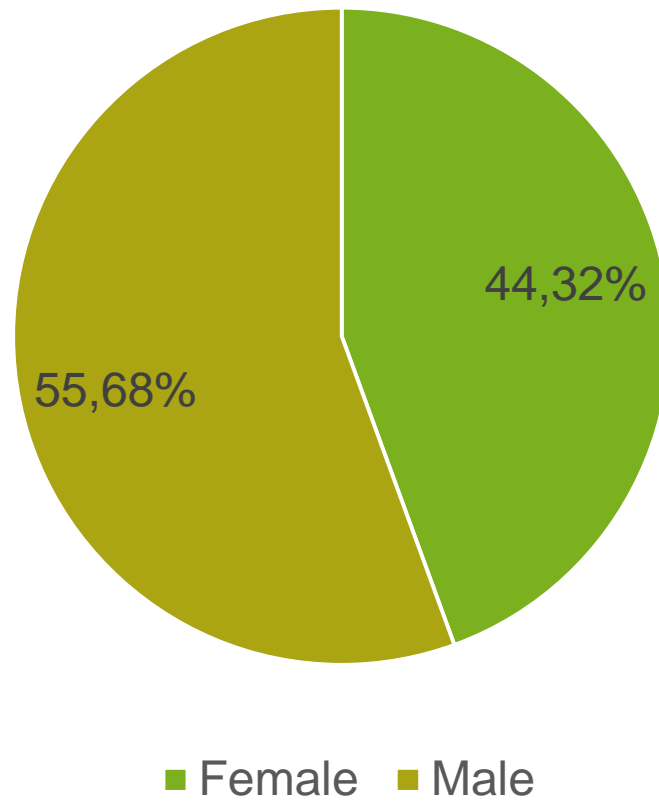
# RESULTS

Seasonality of hospitalizations for respiratory diseases from 2008 to 2019, Chapecó-SC



# RESULTS

Records of hospitalizations for respiratory diseases by male and female gender from 2008 to 2019, Chapecó-SC.



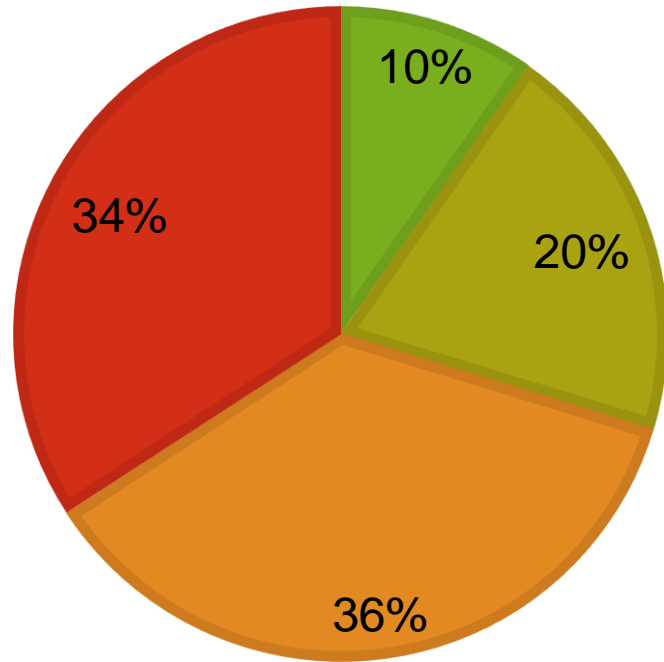
The records of hospitalizations by sex showed a higher prevalence for males, 55.68%, while females had 44.32% of hospitalizations.

The female population is larger in Chapecó (50.62% women and 49.38% men). The studies by Toyoshima et al. (2005) and Rosa et al. (2008) also show that males were more often hospitalized for respiratory diseases than females.

# RESULTS

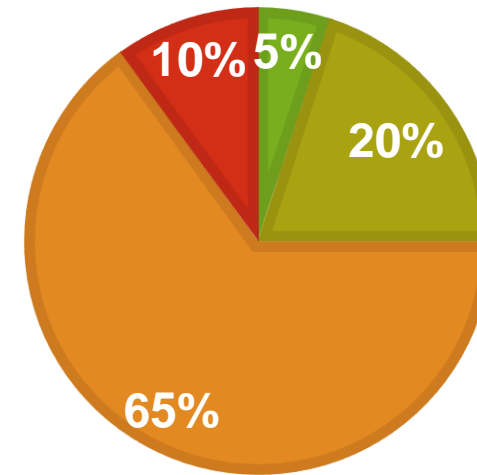
For children under five years old, an increase in hospitalization records is related to the decrease in temperature during the winter months (PONTES et al, 2016).

Group of diseases of the respiratory system from 2008 to 2019, Chapecó-SC.



■ Newborn ■ Children ■ Adult ■ Elderly

Distribution of age groups, 2010, Chapecó-SC.



The elderly population is the most sensitive to low temperatures as seen with the highest rate of hospitalization for respiratory diseases (MOTA, 2009; NOGUEIRA et al., 2011; PANET et al., 2015; PONTES et al., 2016).

# RESULTS

Pneumonia records represent more than half (50.8%) of the hospitalization cases in Chapecó.

Second records Other diseases of the respiratory system (16.0%)

Third, chronic diseases of the tonsils and adenoids (11.6%)

DISEASES OF THE RESPIRATORY SYSTEM	PERCENTAGE
Acute pharyngitis and acute tonsillitis	0,10%
Acute laryngitis and tracheitis	0,11%
Other acute upper airway infections	0,81%
Influenza	0,96%
<b>Pneumonia</b>	<b>50,86%</b>
Acute bronchitis and acute bronchiolitis	2,18%
Chronic sinusitis	0,13%
Other diseases of the nose and sinuses	7,30%
Chronic diseases of the tonsils and adenoids	11,63%
Other diseases of upper respiratory tract	0,80%
Emphysema bronchitis and other chronic obstructive pulmonary diseases	7,87%
Asthma	1,00%
Bronchiectasis	0,20%
Pneumoconiosis	0,03%
Other diseases of the respiratory system	16,03%

Pneumonia has great relevance in hospitalization rates during the winter season, since it accounts for more than half of the total records in the city.

Spearman correlation values for number of hospitalizations for pneumonia vs. weather parameters.

<b>Tmax</b>	<b>Tmin</b>	<b>Rain</b>	<b>RH</b>
<i>-0,22</i>	<i>-0,27</i>	<i>-0,05</i>	<i>0,04</i>

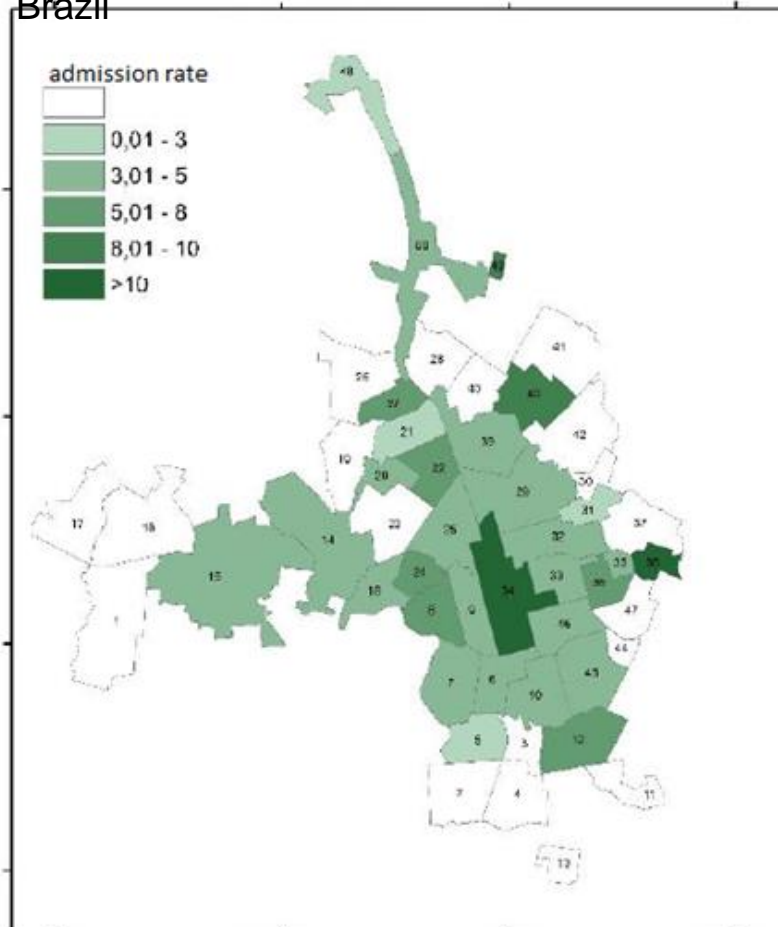
Significant at the level of  $p = 0,05$ .

## RESULTS

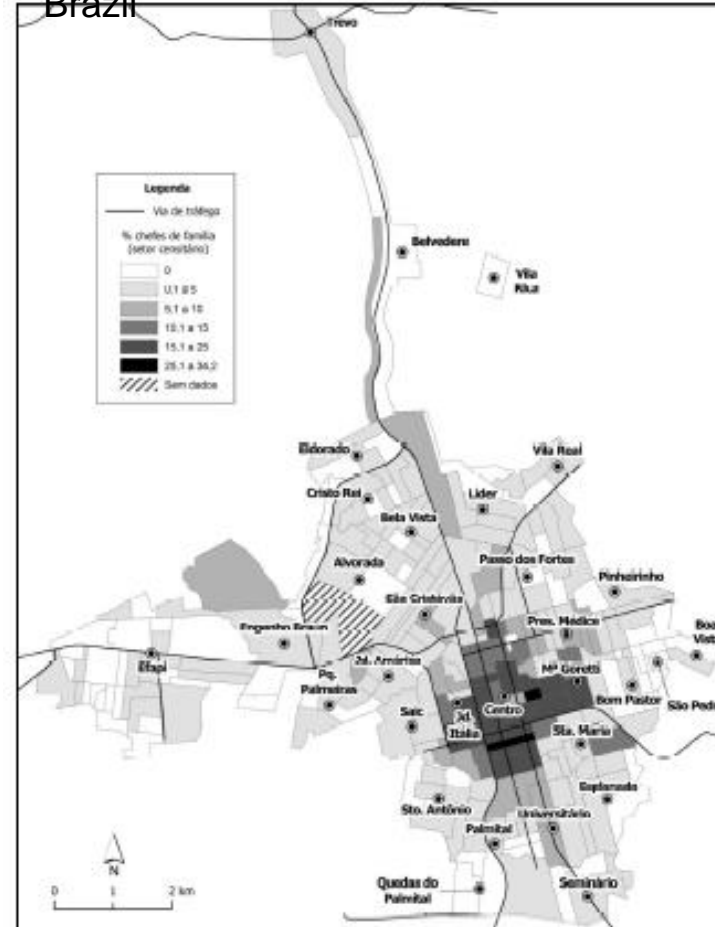


# RESULTS

Pneumonia hospitalization rate, Chapecó - Brazil



Socioeconomic inequality, Chapecó - Brazil



# CONCLUSION

Hospitalizations are more frequent during the autumn and winter periods when temperature are lower.

The increase of diseases of the respiratory system and pneumonia during autumn and winter months may be linked with variations in weather conditions, but also with greater occurrence of viruses and respiratory bacteria.

The urban growth in Chapecó may be related to the increase in records for peripheral neighbourhoods, following the pattern of development of medium-sized Brazilian cities.

Though there is a relationship between climate and the occurrence of human diseases, not all city dwellers are affected in the same way.

The relationship is indeed dependant on economical situation of the inhabitants as seen from the difference of hospitalization rates between neighbourhoods with differentiated average family income.

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