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Original Research Article

Influence of atmospheric temperature on the occurrence of irreversible pulpitis clinical cases

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Abstract

Introduction and Objective: The present study aimed to examine the correlation between atmospheric temperature and the occurrence of irreversible pulpitis. **Material and methods:** Data was collected from the Department of Dentistry, Moinhos de Vento Hospital, Porto Alegre between July 2011 and December 2012. A total of 52 pulpitis clinical cases were examined in 529 days in this study. Data on the atmospheric temperature in Porto Alegre on each day was collected from the Porto Alegre Meteorology Institute. **Results and Conclusion:** Correlation analysis of the temperature data and pulpitis cases was conducted using Student's t-test, with a significance level of 5%. Although no correlation was observed between the occurrence of irreversible pulpitis and atmospheric temperature, the incidence rates were higher on days when the average temperature was greater than 25°C.

Introduction

Atmospheric temperature can affect human health in different ways and influence the manifestation of many diseases [4]. For example, climate variation influences high blood pressure by causing dilation or constriction of the blood vessels [12].

The pulp is the organ responsible for vascularization and innervation of the tooth, and

it is located between the dentinal walls, which are rigid and inelastic. Köling [9] and Abd-Elmeguid and Yu [1] reported that mechanical, electrical, thermal, and chemical stimuli can trigger an inflammatory process in the pulp tissue, leading to pain generation by the nerve fibers caused by high tissue pressure within the pulp cavity.

According to Locker and Grushka [10], dental pain was one of the main factors associated with

demand for emergency services. As a result, most epidemiological studies examining odontogenic pain focus on analysis of its prevalence [16].

Basu and Samet [6] reported that thermal and humidity conditions of the atmosphere influence on the manifestation of many diseases, epidemics, and endemics. According to these researchers, human health is affected more by weather than any other element of the environment.

Auciliems [2] reported that combinations of low temperatures with strong winds induced a feeling of thermal discomfort and increased the risk of hypothermia (body temperature below 35°C). Thus, the heart rate also tends to become lower, breathing slows down, and the blood vessels constrict, resulting in increased blood pressure. According to studies by Sharovsky *et al.* [15] and Basu [5], extreme atmospheric temperatures were related to a greater number of hospitalizations and deaths among individuals with heart failure.

However, studies examining the influence of weather conditions on dental health are limited. Therefore, the current study aimed to analyze the correlation between atmospheric temperature and the occurrence of clinical cases of irreversible pulpitis in a dental care service over a period of 529 days.

Material and methods

We analyzed the medical records of 52 patients presenting with irreversible pulpitis at the Department of Dentistry, Moinhos de Vento Hospital between July 21st, 2011 and December 30th, 2012. We also collected data on the average daily temperature for 529 days from the national weather service in Porto Alegre, Brazil (INMET). For analytical purposes, the temperature ranges

collected from the INMET were split into periods as follows. Initially, three temperature zones were created ranging from 5°C to 35°C, with amplitude of 10°C. Thereafter, 22 additional groups were created with temperature ranging from 6°C to 28°C, with amplitude of 1°C.

Study variables were analyzed using parametric Student's t-test with a significance level of 5%.

Results

On examining the three temperature zones with amplitude of 10°C, a greater likelihood of admission of cases of irreversible pulpitis was observed on days with average temperature higher than 25°C to 35°C (table I).

Table I – Likelihood of clinical cases of irreversible pulpitis by atmospheric temperature range

Climate temperature period	Number of days in the period	Irreversible pulpitis in the period	Probability
5°C to 15°C	88	9	10.23%
15°C to 25°C	358	31	8.66%
25°C to 35°C	82	12	14.63%

Figure 1 presents a generalized linear statistical model, represented by the line equation $Y = 0.002x + 0.067$. The statistical model assumes a linear trend of increased likelihood of admission of clinical cases of irreversible pulpitis (determination coefficient = 0.505). In other words, the odds of endodontic care increased with higher daily average temperatures in this study.

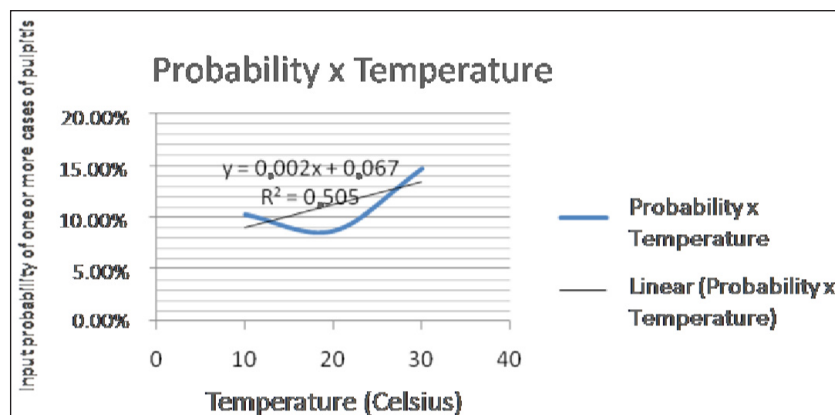


Figure 1 – Graph showing the likelihood of clinical cases of irreversible pulpitis by atmospheric temperature range during the analysis period

In addition, the blue curve in figure 1 shows a trend for increased likelihood of er at extremes of atmospheric temperature, which relates the probability of admission of cases of irreversible pulpitis to different daily average temperatures.

Therefore, we found it appropriate to analyze further stratified data comprising 22 temperature ranges, varying from 6°C to 28°C with amplitude of 1°C (table II).

Table II - Probability of clinical cases of irreversible pulpitis by stratified atmospheric temperature (1°C)

Climate temperature period	Number of days in the period	Irreversible pulpitis in the period	Probability
6°C to 7°C	1	0	0.00%
7°C to 8°C	2	0	0.00%
8°C to 9°C	3	0	0.00%
9°C to 10°C	8	1	12.50%
10°C to 11°C	8	1	12.50%
11°C to 12°C	13	3	23.08%
12°C to 13°C	15	1	6.67%
13°C to 14°C	14	1	7.14%
14°C to 15°C	23	2	8.70%
15°C to 16°C	30	1	3.33%
16°C to 17°C	19	2	10.53%
17°C to 18°C	23	0	0.00%
18°C to 19°C	33	5	15.15%
19°C to 20°C	47	3	6.38%
20°C to 21°C	45	2	4.44%
21°C to 22°C	41	5	12.20%
22°C to 23°C	43	7	16.28%
23°C to 24°C	41	2	4.88%
24°C to 25°C	35	4	11.43%
25°C to 26°C	21	2	9.52%
26°C to 27°C	21	4	19.05%
27°C to 28°C	21	5	23.81%

Based on the data provided in table II, figure 2 presents a generalized linear statistical model represented by the line equation $Y = 0.005x + 0.010$. The linear trend of increased likelihood of cases of irreversible pulpitis was seen to increase with average daily temperature (determination

coefficient = 0.205). On comparing with the linear statistical model proposed in table I, the stratification of the data decreased the strength of the model and the change in the independent variable could explain only 20.5% of the change in the dependent variable.

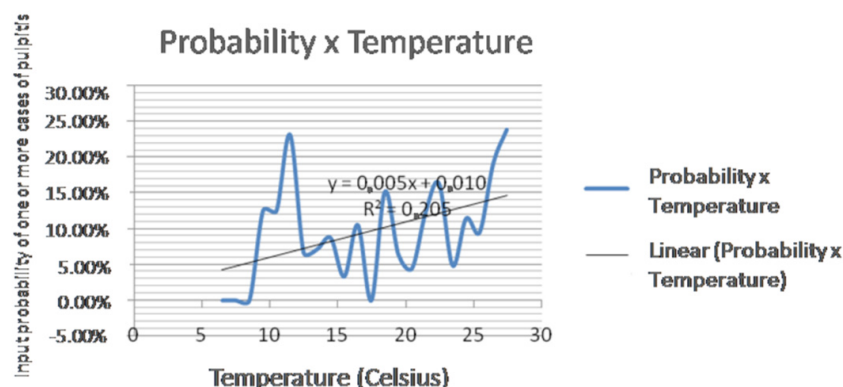


Figure 2 – Graph showing the likelihood of clinical cases of irreversible pulpitis by stratified atmospheric temperature (1°C) during the analysis period

To identify the power of the sample, the average temperature was evaluated using parametric Student's t-test, and data from the days when no cases of irreversible pulpitis occurred (valid 0), days in which there was one case (valid 1), and days when there were two cases of pulpitis (valid 2) were compared.

Table III shows the frequency observed in each situation, whereas table 4 shows that the average of the variable “average temperature” on the days when there were cases of irreversible pulpitis is higher than the average on days that did not have any cases.

Table III – Table showing frequency of irreversible pulpitis in each situation

Valid	Frequency	%	% Valid	% Cumulative
0	477	90.2	90.2	90.2
1	48	9.1	9.1	99.2
2	4	0.8	0.8	100.0
Total	529	100.0	100.0	

Table IV – Table showing differences in average temperature in relation to cases of irreversible pulpitis

	Day of pulpitis	N	Average	Standard deviation	Mean standard error
Maximum temperature mean	.0	477	26.543	5.788	.265
	1.00	52	27.263	6.518	.903
Minimum temperature mean	.0	477	15.726	4.670	.213
	1.00	52	16.402	4.406	.611
Computed temperature mean	.0	477	20.078	4.881	.223
	1.00	52	20.786	5.116	.709
Relative humidity mean	.0	477	73.955	10.258	.469
	1.00	52	72.870	11.726	1.626

However, the t-test, with a significance level of 5%, showed no statistically significant differences in the average of variables on the days with non-occurrence of irreversible pulpitis.

Discussion

Ayoade supported the idea of atmospheric temperature significantly affecting the health of human beings since 1986 [3]. Extremes in temperature weaken the ability of the body to combat diseases and also intensify the inflammatory process [3].

A drop in body temperature causes systemic changes such as vasoconstriction, increased flow density and blood pressure, modified endocrine function, and nervous system reactions [8, 11], thus validating further examination of this correlation with symptoms.

Porto Alegre is located in the southern region of Brazil and has a subtropical climate. Hence, the city experiences extremely rigorous winters and exhibits record maximum temperatures in summer. Extreme temperatures are also observed between autumn and spring, often resulting in abrupt changes throughout the hours [14]. According to the information given in the city hall, the annual average temperature in the municipality is 19.5°C, ranging from 10°C to 25°C in autumn, 2°C to 20°C in winter, 15°C to 30°C in spring, and 25°C to 35°C in summer.

Thus, the results reported in this study reinforce the hypothesis of a correlation between atmospheric temperature and the occurrence of irreversible pulpitis, along with the possibility of deleterious effects on this condition in extreme temperatures. Stands out from these results, the greater likelihood of pulpitis cases at temperatures considered high, above 25°C.

A study conducted in Europe showed that the largest number of urgent dental care cases occurred in the months of June, July, and August, corresponding with the European summer [13].

Another explanation for this increased trend is the noxious stimulation of pulpal receptors, such as that caused by large thermal variations [7] resulting from increased intake of ice cream on hot days. This may have some correlation with the fact that the pulp is exposed to temperature peaks, triggering pain.

However, it is noteworthy that climatic elements are not solely responsible for the development of diseases. However, when linked to physical,

psychological, and social characteristics, resulting in a further contributor to your aggravation. High blood pressure, for example, depends on several factors such as thermal amplitude resulting in vasodilatation and vasoconstriction of the circulatory system [12].

Conclusion

Based on the results of this study, we may conclude that although there was no statistically significant correlation between the occurrence of irreversible pulpitis and atmospheric temperature, a higher incidence of pulpitis was observed on days with average temperature exceeding 25°C.

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