

Influence of climatic factors on the medical attentions of dermatologic diseases in a hospital of Lima, Peru^{*}

Influência de fatores climáticos no tratamento médico de doenças dermatológicas em um hospital em Lima, Peru

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Abstract: BACKGROUND: Significant associations have been described between climatic factors and human health, which can occur in dermatologic diseases too.

OBJECTIVE: To determine the influence of the climatic factors on the medical attentions of dermatologic diseases in a general hospital in Lima (Peru). PATIENTS AND METHODS: Observational study which was carried out in a national hospital between January 2004 and December 2007. The diagnoses were classified according to the ICD-10 system. The climate information was provided by the National Oceanographic and Atmospheric Administration from USA (NOAA).

RESULTS: 3 294 patients were included in the study, the average age was 35.4 ± 20.7 years old, and 53.2% were females. The "El Niño" phenomenon was associated with an increase in the prevalence of actinic keratosis ($p=0.002$), viral warts ($p=0.001$) and rosacea ($p=0.014$). The "La Niña" phenomenon was associated with a reduction in viral warts ($p=0.026$). Spring was associated with an increase of dermatitis ($p=0.003$), and summer was associated with an increase of benign neoplasms ($p=0.049$).

CONCLUSION: The climatic variations influenced the occurrence of certain dermatologic diseases. The present study may represent an orientation guide to specialists and general practitioners identifying the most common dermatologic diagnoses and thus enabling better preparation to treat these cases in determined seasons of the year.

Keywords : El Niño; El Niño Oscillation South; La Niña Phenomenon

Resumo: FUNDAMENTO: Associações significativas entre fatores climáticos e saúde humana têm sido descritas, inclusive na área de Dermatologia.

OBJETIVO: Determinar a influência de fatores climáticos no tratamento de doenças dermatológicas em um hospital em Lima (Peru).

PACIENTES E MÉTODOS: Estudo observacional realizado em um hospital em Lima entre janeiro de 2004 e dezembro de 2007. Os diagnósticos foram classificados de acordo com o sistema ICD-10. Informações climáticas foram fornecidas pela "National Oceanographic and Atmospheric Administration" (NOAA - USA).

RESULTADOS: 3.294 pacientes participaram do estudo. A idade média foi 35.4 ± 20.7 anos e 53,2% eram mulheres. O fenômeno "El Niño" foi associado a um aumento da prevalência de queratose actínica ($p=0,002$), verrugas virais ($p=0,001$) e rosácea ($p=0,014$). O fenômeno "La Niña" foi associado a diminuição das verrugas virais ($p=0,026$). A primavera foi associada a um aumento de dermatite ($p=0,003$) e o verão, a um aumento de tumores benignos ($p=0,049$).

CONCLUSÃO: Variações climáticas influenciam o aparecimento de algumas doenças dermatológicas. O presente trabalho pode orientar especialistas e clínicos gerais por meio da identificação dos diagnósticos dermatológicos mais comuns e, conseqüentemente, prepará-los para tratar doenças sazonais.

Palavras-chave: El Niño; El Niño Oscilação Sul; El Niño; Fenômeno la Niña

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INTRODUCTION

Previous studies have shown the influence of climatic factors on the occurrence of different dermatologic diseases. Hellier showed an increase in the frequency of dermatitis and rosacea and a decrease in urticaria during the spring season.¹ Hancox observed a seasonal variation tendency for actinic keratosis, vulgar acne, folliculitis, psoriasis, dyschromias, seborrheic dermatitis and seborrheic keratosis.² Recently, Jha found a seasonal variation in the occurrence of vulgar acne, melasma, contact dermatitis, scabies, photo-dermatitis and vitiligo.³

Lima is located in the central region of South America, to the west of the Andes, with an average altitude of 133 meters above sea level. It has an average temperature of 16.8 to 17.8 °C (62 to 64°F). The relative humidity reduces the penetrance of sunlight, especially in populated and industrialized towns.⁴ Also, Peru has four climatic seasons: summer, fall, winter and spring, with the former starting at the summer solstice on December 21st. However, the transition from one season to another does not occur in a uniform way because of the “El Niño” and “La Niña” phenomena, which cause a variation in expected meteorological conditions in certain times of the year. The “El Niño” phenomenon produces a generalized increase in the sea surface temperature over the eastern and central parts of the Equatorial Pacific.⁵ It is associated with changes in atmospheric pressure, producing a drop in the Southeastern Pacific and a rise in Oceania,⁶ and also with an increase in the environmental temperature of the Peruvian coast. On the other hand, the “La Niña” phenomenon behaves in the opposite way, being considered by many as the “Anti-Niño” phenomenon.

A previous study in Lima showed a significant increase in dermatologic diseases such as tinea, pityriasis versicolor, miliaria and folliculitis when the environmental temperature raises an average of 1.6°C as a conse-

quence of the “El Niño” phenomenon. It also showed that the frequency of dermatitis, scabies, psoriasis and papular urticaria as reasons for consultation decreased.⁷

The aim of this study was to determine the influence of the climatic factors such as the “El Niño” and “La Niña” phenomena, air temperature and climatic seasons on dermatologic diseases diagnosed in a national hospital of Lima between January 2004 and December 2007.

PATIENTS AND METHODS

This was an observational study carried out in a national hospital in Lima, Peru between January, 2004 and December, 2007. All new patients presenting to the dermatology clinic during that period were included. The gender, age, dermatologic diagnosis and month of medical attention were recorded for each patient. The patients who had more than one dermatologic condition were considered as independent cases. The diagnoses were classified in different groups according to the International Classification for Diseases (ICD-10). When necessary, direct microscopic examinations and skin biopsies were performed to confirm diagnosis.

The average temperature was obtained from the Monthly Climatic Data for the World Publication,⁸ given by the National Oceanographic and Atmospheric Administration in USA (NOAA). The Oscillation Niño Index (ONI)⁹ was used to define the periods of the “El Niño/La Niña” phenomena. (Figures 1, 2 and 3) This indicator is based on the quarterly average of the climate anomalies in the temperature of the sea surface [°C] of the El Niño 3.4 region (5°N-5°S, 120°-170°W), calculated by the program ERSST.v3.

The events called “El Niño” include five consecutive months of anomalies 0.5°C greater above the average temperature, and result in an increase in the sea surface temperature. On the other hand, the events called “La Niña” present as anomalies 0.5°C

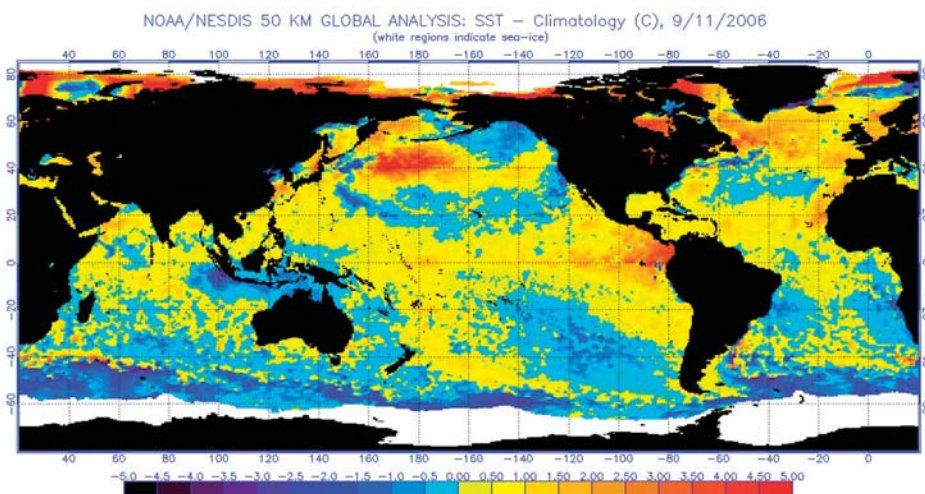


FIGURE 1: The Oscillation Niño Index(ONI) and the “El Niño” phenomenon

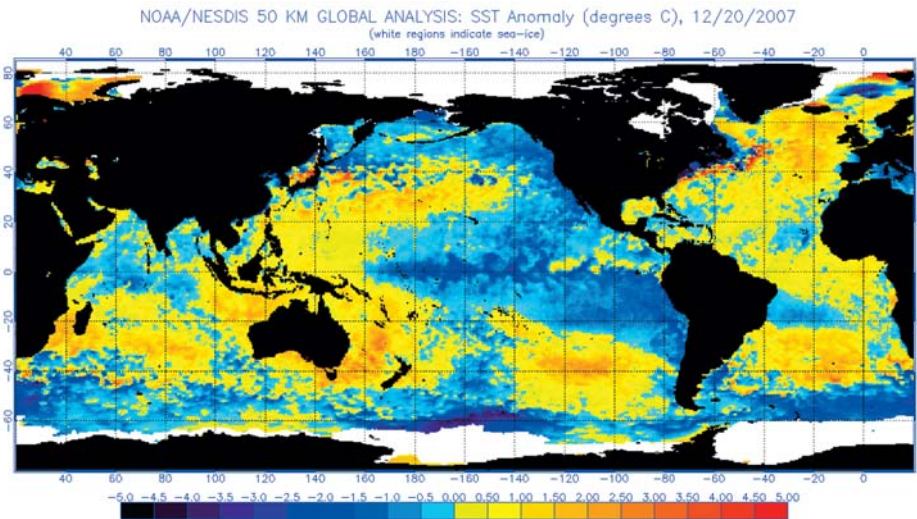


FIGURE 2: The Oscillation Niño Index(ONI) and the “La Niña” phenomenon

below the average during 5 consecutive months and result in a decrease in the temperature of the sea surface. According to this index, the events can be classified as weak (with anomalies ranging from 0.5 to 0.9°C in the sea surface temperature (SST), moderate (1.0 to 1.4) and strong (>1.4).

The months were classified according to the presence or absence of the “El Niño/La Niña” phenomena (ONI), and the phenomena were characterized as weak, moderate, or strong. The seasons were defined as summer (January, February, and March), fall (April, May, and June), winter (July, August, and September) and spring (October, November, and December).

A database was created using the SPSS program version 15.0 (SPSS 15.0, Chicago, IL), univariate statistics based on calculations of frequencies, percentages and central and dispersion tendency measurements were used as well as bivariate statistics such as chi-square test for qualitative variables Those variables that were statistically significant were analyzed by Forward conditional logistic regression. The calculations were made with a 95% confidence level.

RESULTS

A total of 3 294 new patients were included. The average age was 35.4 ± 20.7 years (range: 1 month to 94 years old) and the age group of 16-30 years old was the most prevalent (30%); 53.2% were females and 46.8 % were males (Table 1).

CLIMATIC PHENOMENA: The majority of patients were seen during summer season (37.6%); 30.9% were seen during the appearance of the “El Niño” phenomenon and 7.1% during the “La Niña” phenomenon (Table 2).

DERMATOLOGIC DIAGNOSES: By group, the infectious dermatoses were the most common (29.3%), followed by dermatitis (17.7%), benign neoplasms (9.9%) and disorders of skin appendages (9.8%). The most frequent skin disorders found were viral warts (14.3%), vitiligo (6%) and acne (4.8%) (Table 3).

CLIMATIC PHENOMENA AND DERMATOLOGIC DISEASES: In the Analysis with Forward conditional

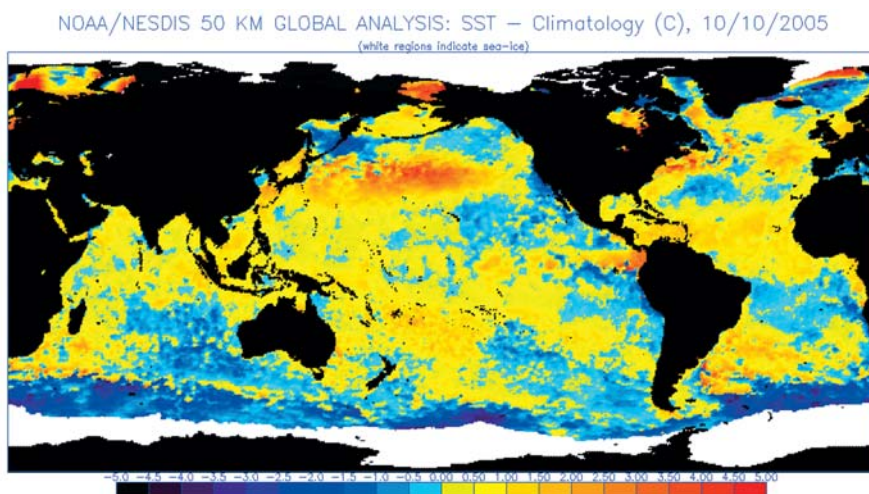


FIGURE 3: The Oscillation Niño Index(ONI); neutral conditions

TABLE 1: Distribution of patients seen between January 2004 and December 2007

AGE- GROUPS	GENDER				Total	%
	Male	%	Female	%		
0-15	278	8.5	265	8.1	544	16.5
16-30	491	14.9	498	15.1	989	30.0
31-45	299	9.1	396	12.0	695	21.1
46-60	239	7.3	399	12.1	638	19.4
61-75	169	5.1	155	4.7	324	9.8
>75	64	1.9	41	1.2	104	3.2
Total	1540	46.8	1754	53.2	3294	100.0

logistic regression, the moderate intensity "El Niño" phenomenon was associated with a statistically significant increase of medical attentions of viral warts ($p=0.038$) and rosacea ($p=0.001$). Finally, there was a significant increase of medical attentions of patients with dermatitis during spring season ($p=0.000$), and benign neoplasms ($p=0.011$) during summer. Also, there was an increase of medical attentions of people with acne when the temperature was between 12 - 14°C (Table 4). Also, there was an increase in the total number of medical attentions during summer months when the temperature is slightly elevated and the "El Niño" phenomenon typically presents. The humidity did not have any influence on the number of medical attentions (Graphic 1). Moreover, there was a partial

correlation between the Oscillation Niño Index (ONI) and the number of medical attention, being more evident during the summer months of 2004, 2005 and 2007. In February 2006, there was an external factor affecting the tendency previously observed. The dermatology service carried out an extra health fair to rule out skin cancer increasing the influx of patients and affecting the correlation between ONI and medical attentions (Graphic 2).

DISCUSSION

The present investigation shows that certain dermatologic diseases are influenced by climatic and environmental factors. Associations between climatic phenomena such as "El Niño" and human health have

TABLE 2: Medical attentions in the Division of Dermatology/UNMSM according to the climatic phenomena. January 2004 - December 2007

CLIMATIC PHENOMENA	FREQUENCY OF MEDICAL ATTENTIONS	% MEDICAL ATTENTIONS
"El Niño" phenomenon	1019	31.0
- Severe	0	0.0
- Moderate	95	2.9
- Weak	924	28.1
- Absent	2275	69.0
"La Niña" phenomenon	234	5.7
- Severe	0	0.0
- Moderate	112	3.4
- Weak	72	2.2
- Absent	3110	94.4
Temperature		
- From 21 to 23 °C	1162	35.3
- From 18 to 20 °C	490	14.9
- From 15 to 17 °C	1085	32.9
- From 12 to 14 °C	557	16.9
Season of the year		
Summer	1237	37.6
Fall	523	15.9
Winter	701	21.3
Spring	833	25.3

TABLE 3: Skin diseases in the study

Diseases	Patients	%
Other bacterial diseases	6	0.15
Tuberculosis of skin and subcutaneous tissue	4	0.09
Cutaneous bartonellosis [Verruga peruana]	2	0.03
Infections with a predominantly sexual mode of transmission	27	0.76
Herpesviral infection of genitalia	22	0.67
Secondary syphilis of skin and mucous membranes	3	0.09
Primary genital syphilis	1	0.00
Viral infections	539	16.36
Viral warts	471	14.30
Herpes Zoster	21	0.64
Molluscum contagiosum	21	0.64
Mycoses	245	7.32
Dermatophytosis	98	2.98
Onychomycosis	88	2.67
Pityriasis versicolor	34	1.03
Protozoal diseases	6	0.18
Cutaneous leishmaniasis	6	0.18
Infestations	48	1.46
Scabies	45	1.37
Cutaneous myiasis	2	0.06
Infections of the skin and subcutaneous tissue	81	2.43
Cutaneous abscess, furuncle and carbuncle	54	1.64
Cellulitis	15	0.46
Impetigo	10	0.30
Dermatologic manifestations of HIV	14	0.43
VIH prurigo	14	0.43
Benign neoplasms	326	9.90
Other benign neoplasms of skin	173	5.25
Melanocytic naevi	153	4.64
Malignant neoplasms	74	2.22
Basal cell carcinoma	40	1.21
Squamous cell carcinoma	14	0.39
Melanoma	10	0.30
Bullous disorders	47	1.43
Pemphigus vulgaris	22	0.67
Pemphigus foliaceus	10	0.30
Endemic pemphigus foliaceus	7	0.21
Dermatitis	583	17.70
Atopic dermatitis	102	3.10
Allergic contact dermatitis	100	3.04
Lichen simplex chronicus and prurigo	93	2.82
Papulosquamous disorders	126	3.83
Psoriasis	84	2.55
Lichen planus	18	0.55
Pityriasis rosea	12	0.36
Urticaria and erythema	62	1.88
Urticaria	47	1.43
Other erythematous conditions	15	0.43
Radiation-related disorders of the skin and subcutaneous tissue	79	2.40
Actinic keratosis	46	1.40
Other skin changes due to chronic exposure to nonionizing radiation	30	0.91
Sunburn	2	0.06
Disorders of skin appendages	324	9.84
Acne	157	4.77
Rosacea	65	1.97
Nail disorders	28	0.85
Other disorders of the skin and subcutaneous tissue	707	21.46
Vitiligo	196	5.95
Seborrhoeic keratosis	119	3.61
Other disorders of pigmentation	81	2.46
TOTAL	3294	100

TABLE 4: Climatic phenomena and associated skin diseases

Climatic phenomena	Group of associated diseases	P value (*)	Odds ratio	Confidence interval
Moderate "El Niño" phenomena	Viral warts	0.038	1.336	1.016-1.756
	Rosacea	0.001	2.989	1.586-5.636
Temperature between 12 -14 °C	Acne	0.036	3.989	1.094-14.549
Summer season	Benign neoplasms	0.011	2.785	1.263 - 6.144
Spring season	Atopic dermatitis	0.000	7.074	2.769-18.072

(*) Analysis with Forward conditional logistic regression.

been described before. These effects occur due to a complex interaction between the climatic phenomenon and factors that are specific to the affected population such as overcrowding, health condition and sanitary conditions.¹⁰

For instance, there is evidence that the "El Niño" influences on the occurrence of vector-borne diseases such as malaria. The elevated temperature and increased precipitations favor the environment for the plasmodium falciparum and its vector.¹¹

It has been described an association between the "El Niño" phenomenon and other vector-borne diseases such as hemorrhagic fever with renal syndrome (HFRS)¹², visceral leishmaniasis.¹³ Moreover, the "El Niño" has been associated with the presence of viral diseases such as hepatitis A¹⁴ and influenza.¹⁵ Previous studies have concluded the "El Niño" influences on the persistence of influenza aviar.¹¹

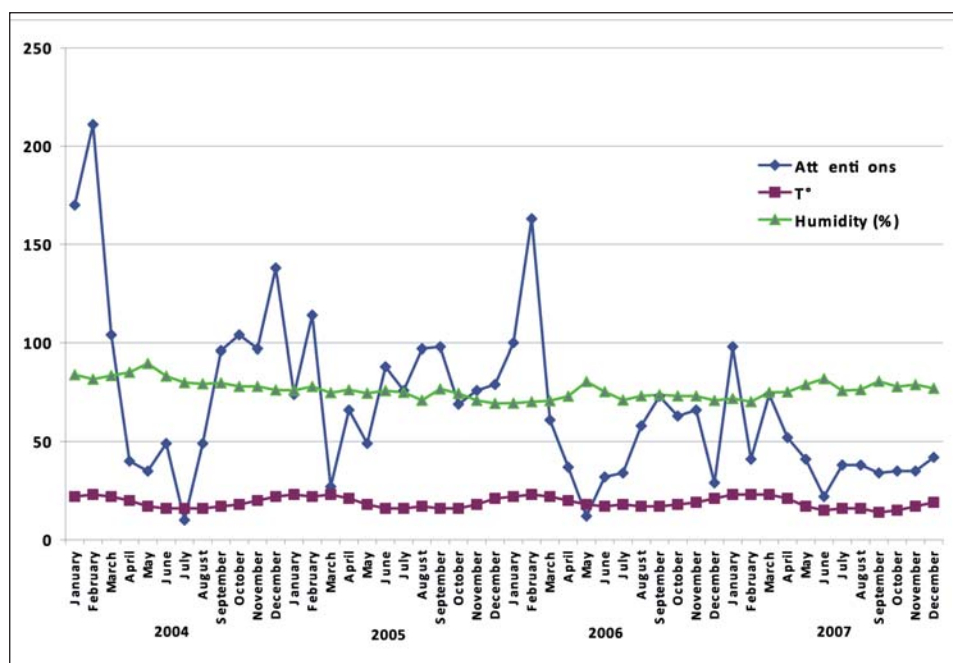
In our study, the infectious diseases were the most common (29.3%) and among them, viral warts were the most common diagnosis (14.3%). This diagnosis was seen mainly in patients younger than 20 years of age. Similar results were found in other

studies that showed viral warts to be predominant in children and adolescents.¹⁶ Currently, it is one of the most common reasons for consulting a dermatologist.¹⁷

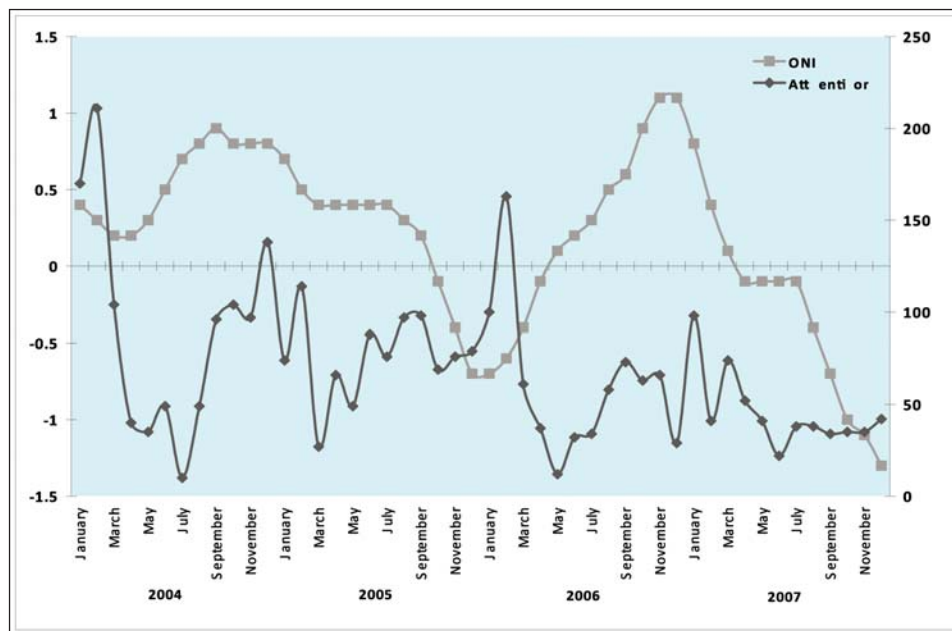
The occurrence of viral warts was associated with the "El Niño" phenomenon (moderate). A previous study in Lima showed an increase in the number of consultations for viral warts when a strong "El Niño" phenomenon was present during the summer 1998.⁷ Indeed, another study in a pediatric population in Mexico showed that this diagnosis appears mainly in summer seasons.¹⁸ In these cases, an increase in the environmental temperature might create an adequate environment for the pathogenic virus to proliferate.

The dermatitis constituted the second most frequent disease group in our study (17.7%). Within this group, atopic dermatitis was the most common (3.1%). The disease is strongly associated with environmental factors such as pollution, allergen exposure and the increase of industrialization and housing development, all features present in Lima.¹⁹

An increase in dermatitis in general was found during spring season, and similar results were found



GRAPHIC 1: Diagram of temperature, humidity and medical attentions



GRAPHIC 2: Oscillation Niño Index (ONI) and number of medical attentions

by Hellier⁽¹⁾. This author proposes that this increase might be caused by a phase of instability provoked by the transition between winter to summer, resulting in an increase in the frequency of certain diseases.²⁰

The increase of temperature caused by “El Niño” might have some influence on the increase of rosacea frequency. This finding was also observed in previous reports that showed an association between rosacea and heat exposure.²¹ The severity of rosacea was increased when the temperature raised secondary to the “El Niño” as well.

There was an increase in the medical consultations for people with benign skin neoplasms during summer months. In reference to melanocytic nevi, their presentation could be influenced by the higher exposure to solar radiation during those months.²² In addition, the number of consultations due to pigmented lesions increased because of aesthetic reasons and the implementation of skin cancer prevention campaigns.²³ However, it is known that their genesis and development occur along years.

When the temperature was lower (between 12-14°C) there was an increase in the medical attentions of patients with acne. This might be because U.V. radiation induces inhibition of pathogenic bacteria and reduces excretion of grease. Therefore, when the radiation is less that might have some influence on the number of medical attentions for acne.²⁴

It is important to consider for people with dermatitis that presence of environmental allergen during the spring might have an impact in the increase of medical consultations. In the case of viral warts, the increase of medical attentions was due to

The “El Niño”. It might represent trigger factor. It is important to recognize that the weather might have some influence on the development and transmissibility of other viral diseases such as Hepatitis B.

All the data was obtained from patients who were seen at a general hospital. Our population was patients who were assessed for first time; however some of them have already a skin ailment for a long period of time. Therefore, it is important to consider that climatic changes might have some influence on the behavior of people when they seek for medical attention due to certain illnesses and it does not mean that they are causing certain skin ailments.

Our main limitation was the absence of a strong “El Niño” phenomenon during the period of study, such as the one occurred between 1997 and 1998. Our study was done during weak and moderate intensity phenomena. Additionally, global warming may shift the properties and dynamics of El Niño. Another limitation would be that this is a hospital based study; however, these types of studies are still important to determine the prevalence of diseases in a population.²⁵

In conclusion, the climatic variations held influence over the occurrence of certain dermatologic diseases. The present study can guide specialists and general practitioners to anticipate the most common dermatologic diagnoses and to be prepared for the medical attention of these cases in determined seasons of the year. It may also help to make more accurate diagnoses and facilitate the use of therapeutic tools to in a timely manner. Additionally, it would help to orientate and to strengthen the academic training of health workers. □

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