Report

Seasonal variation of dermatologic disease in the USA: a study of office visits from 1990 to 1998

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Abstract

Background Seasonal variation has been demonstrated in many diseases, including certain skin diseases.

Objective To determine whether there is seasonal variation in dermatologic office visits in the USA.

Methods Data on dermatologic office visits were obtained from representative visits to outpatient physicians in the USA from the National Ambulatory Medical Care Survey from 1990 to 1998. Office visit seasonality was examined for all skin conditions, and individually for the 15 most commonly diagnosed conditions.

Results Office visits for skin conditions were seasonal ($P = 0.002$). The magnitude of variation can be roughly expressed by the following scheme: actinic keratosis ($P = 0.0001$) > acne ($P = 0.0001$) > folliculitis ($P = 0.002$) > dyschromia ($P = 0.01$) > seborrheic keratosis ($P = 0.04$) > psoriasis ($P = 0.07$) > seborrheic dermatitis ($P = 0.09$). Visits for skin cancer, not otherwise specified (skin cancer NOS), atopic dermatitis, cysts, common wart, wart, not otherwise specified (wart NOS), rosacea, contact dermatitis, and benign tumors showed no significant seasonal variations or trends.

Conclusions Dermatologic office visits are seasonal, with visits for individual diseases varying in their magnitude of seasonality. This seasonal variation may be a result of biological and nonbiological variables.

Introduction

Seasonal variation in disease frequency has been of great interest in epidemiologic investigation, and the seasonality of disease and mortality has been observed for centuries. Hippocrates (*c.* 460–377 BC) wrote many aphorisms about the effects of season on health, and John Graunt (1620–1674), the "first epidemiologist," made a brief mention of the seasonality of disease.[1] Quetelet[2] (1796–1874), however, was the first to collect excellent data on the subject. Investigators have also known for years that environmental factors weigh heavily on skin disease. Hellier[3] examined the seasonality of skin disease from 1934 to 1938 at The General Infirmary at Leeds, and found spring peaks for "dermatitis," atopic dermatitis, and rosacea, and a fall peak for urticaria. Recent seasonality research emphasizes malignancy, precursors of malignancy, and contact dermatitis. The seasonality of these and other individual skin conditions has been observed in both small and large populations.[4–9] Nevertheless, a study of the seasonality of dermatologic office visits in a large representative sample of an entire country's population has not been performed. To this end, we examined the seasonal variation of office visits for (i) all dermatologic conditions and (ii) the 15 most common individual diagnoses in the USA over a 9-year period.

Methods

Data

Data were compiled from the National Ambulatory Medical Care Survey (NAMCS) between 1990 and 1998. The NAMCS is a national probability sample survey conducted by the Division of Health Care Statistics, National Center for Health Statistics, Centers for Disease Control and Prevention. A national sample of office-based physicians provides data on patients' office visits. The data are weighted to produce national estimates that describe the usage of ambulatory medical care services in the USA. A detailed description of the survey design, data collection procedures, and the estimation process has been published.[10,11] For this study, 296,168 dermatologic visits, which estimate 260 million visits, were analyzed from 1990 to 1998. Dermatologic visits were operationally defined as those having the ICD-9-CM

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codes listed in Appendix 1 (International Classification of Diseases, 9th Edition, Clinical Modification). The 15 most common diagnoses, in descending order, were: contact dermatitis (ICD-9-CM code 692.9), acne (706.1), actinic keratosis (702.0), common wart (078.10), cyst (706.2), benign tumors (216.9), skin cancer, not otherwise specified (skin cancer NOS) (173.9), psoriasis (696.1), rosacea (695.3), atopic dermatitis (691.8), seborrheic keratosis (702.19), folliculitis (704.8), wart, not otherwise specified (wart NOS) (078.19), seborrheic dermatitis (690.00), and dyschromia (709.00). Skin cancer NOS includes nonmelanoma skin cancers for which no anatomic site is specified, and wart NOS makes no distinction between verrucae, flat, plantar, or other wart types. We defined the seasons in the commonly recognized fashion based on the astronomical criteria of the spring equinox, summer solstice, autumn equinox, and winter solstice.[12] Therefore, March 22 to June 21 is spring, June 22 to September 21 is summer, September 22 to December 21 is fall, and December 22 to March 21 is winter. We also examined the data using meteorologically defined seasons: March 1 to May 31 is spring, June 1 to August 31 is summer, September 1 to November 30 is fall, and December 1 to February 28 is winter.[12] Meteorological definitions place the peak ultraviolet radiation (UVR) levels in the summer and the lowest in the winter. Estimates were derived using weighted data with SAS (SAS Institute, Cary, NC, USA) and STATA (StataCorp, College Station, TX, USA). All hypothesis-testing computations were performed with STATA, which is able to account for the variability of the estimates. Analysis of variance (ANOVA) was used to examine significance.

Results

Using astronomically defined seasons, office visits for dermatologic conditions displayed significant seasonality ($P = 0.002$), as did three individual diseases (Table 1 and Fig. 1). Trends towards seasonality were also observed in four conditions (Table 1 and Fig. 1). Of the diseases that displayed seasonal variability, the magnitude of variation can be expressed by the following scheme: actinic keratosis ($P = 0.0001$) > acne ($P = 0.0001$) > folliculitis ($P = 0.002$) > dyschromia ($P = 0.01$) > seborrheic keratosis ($P = 0.04$) > psoriasis ($P = 0.07$) > seborrheic dermatitis ($P = 0.09$). Office visits were most common in the spring and least common in the fall. Visits for the diagnosis of skin cancer NOS, atopic dermatitis, cysts, common wart, wart NOS, rosacea, contact dermatitis, and benign tumors showed no significant seasonal variations or trends.

Using meteorologically defined seasons, office visits for skin conditions remained seasonal ($P = 0.0001$), but there were differences in the diseases that displayed significant seasonality and/or in the magnitude of the variability (Table 2). With these seasons, the magnitude of variation was as follows: actinic keratosis ($P = 0.0001$) > dyschromia ($P = 0.005$) > psoriasis ($P = 0.006$) > seborrheic dermatitis ($P = 0.01$) > common wart ($P = 0.01$) > contact dermatitis ($P = 0.02$) > seborrheic keratosis ($P = 0.1$) > folliculitis ($P = 0.1$). No other disease showed a statistically significant variation or trend.

Discussion

UVR, temperature, humidity, wind, flora, and fauna all change with season. The intensity of sunlight at noon in midsummer is about 130 times that at noon in midwinter.[13] Low temperature and humidity are harsh on the epidermal barrier, as they lower the extensibility, resistance to fissuring, and hydration status of the stratum corneum.[14] Animal experiments have shown that increased wind, humidity, and heat intensify

Table 1 Dermatologic office visits ranked by seasonality for astronomical seasons

	Peak season	% of annual visits	Trough season	% of annual visits	*P* value
All skin conditions	Spring	27.7	Fall	22.3	**0.002**
Actinic keratosis	Spring	29.7	Winter	18.6	**0.0001**
Acne	Winter	28.6	Summer	19.3	**0.0001**
Folliculitis	Winter	32.4	Summer	21.3	**0.002**
Dyschromia	Spring	35.8	Fall	14.2	**0.01**
Seborrheic keratosis	Spring	32.8	Winter	18.7	**0.04**
Psoriasis	Winter	30.6	Summer	20.3	0.07
Seborrheic dermatitis	Spring	41.7	Summer	7.8	0.09
Skin cancer NOS	Summer	30.6	Winter	21.2	0.2
Atopic dermatitis	Winter	27.9	Summer	22.7	0.2
Cyst	Spring	26.9	Summer	23.1	0.3
Rosacea	Spring	27.5	Winter	23.0	0.4
Benign tumor	Summer	29.9	Fall	22.4	0.6
Contact dermatitis	Winter	25.8	Summer	24.2	0.6
Common wart	Summer	26.2	Fall	23.0	0.7
Wart NOS	Summer	29.0	Fall	14.1	0.9

NOS, not otherwise specified.

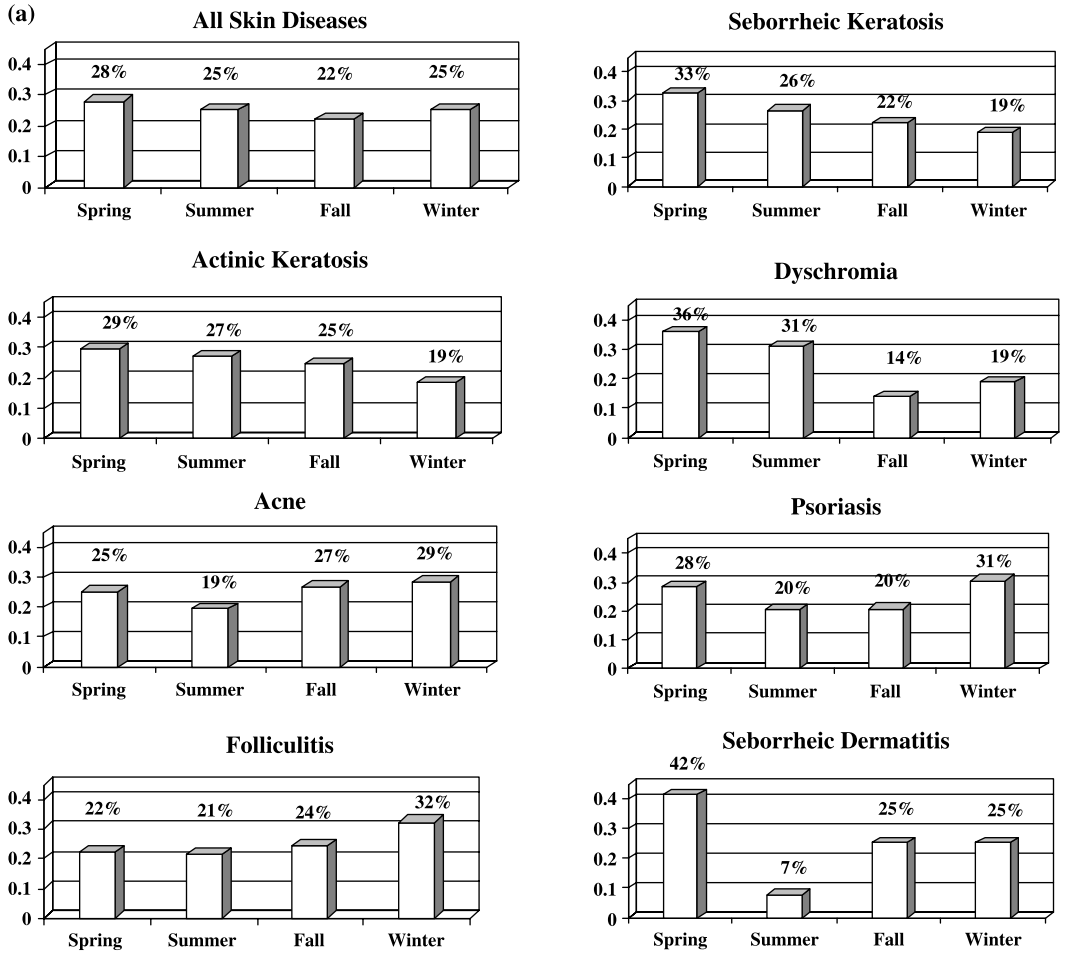

Figure 1 Proportion of annual dermatologic visits in each season

UVR injury.[13] Warm, humid climates create propensities for individuals to develop fungal dermatoses, such as pityriasis versicolor.[15] Plant allergens are known to exhibit extreme seasonal variation.[16]

Human immune function exhibits seasonal variation,[17] including seasonal differences in B and T cells[18] and phagocyte function.[19] Pineal melatonin, which codes day length information and is believed to influence human immunity, is secreted more vigorously in darkness and suppressed in sunlight.[20]

The observation that office visits for actinic keratoses showed strong seasonal variation is not surprising. Sun exposure is directly related to actinic keratoses, and the link between actinic keratoses and malignancy has been supported.[21] Ultraviolet B (UVB) light, the portion of UVR in the wavelength range 290–320 nm, may induce skin cancer by directly damaging DNA and other cellular constituents, or by altering the immune system. UVB may also react with photoactive exogenous chemicals in or on the skin, causing them to absorb UVB and initiate or accelerate carcinogenesis.[22,23] UVB is also believed to prevent the immune surveillance system from detecting and eradicating UV-induced tumors.[22]

Diagnoses of basal cell carcinoma and squamous cell carcinoma have been shown to have a summer peak,[24] and studies have confirmed that chronic, repeated sun exposure is the primary cause of these malignancies.[25] Furthermore, epidemiologic evidence suggests that a spring and summer peak cannot be explained solely by a heightened awareness of skin cancer in warm weather.[26] We found a distinct, nonsignificant observation that nonmelanoma skin cancer is more frequently diagnosed in summer than in winter.

It is the traditional opinion of dermatologists that acne improves in summer and is exacerbated in winter.[6] Although previous studies do not support this belief,[6] our data showed considerable seasonal variation for office visits. They peaked in winter and were considerably lower in summer. Adolescents (those most likely to have acne) attend school during the winter months, and office visits may more easily fit into this regular routine. Because acne has a profound psychosocial effect on adolescents,[27] the importance of physical appearance

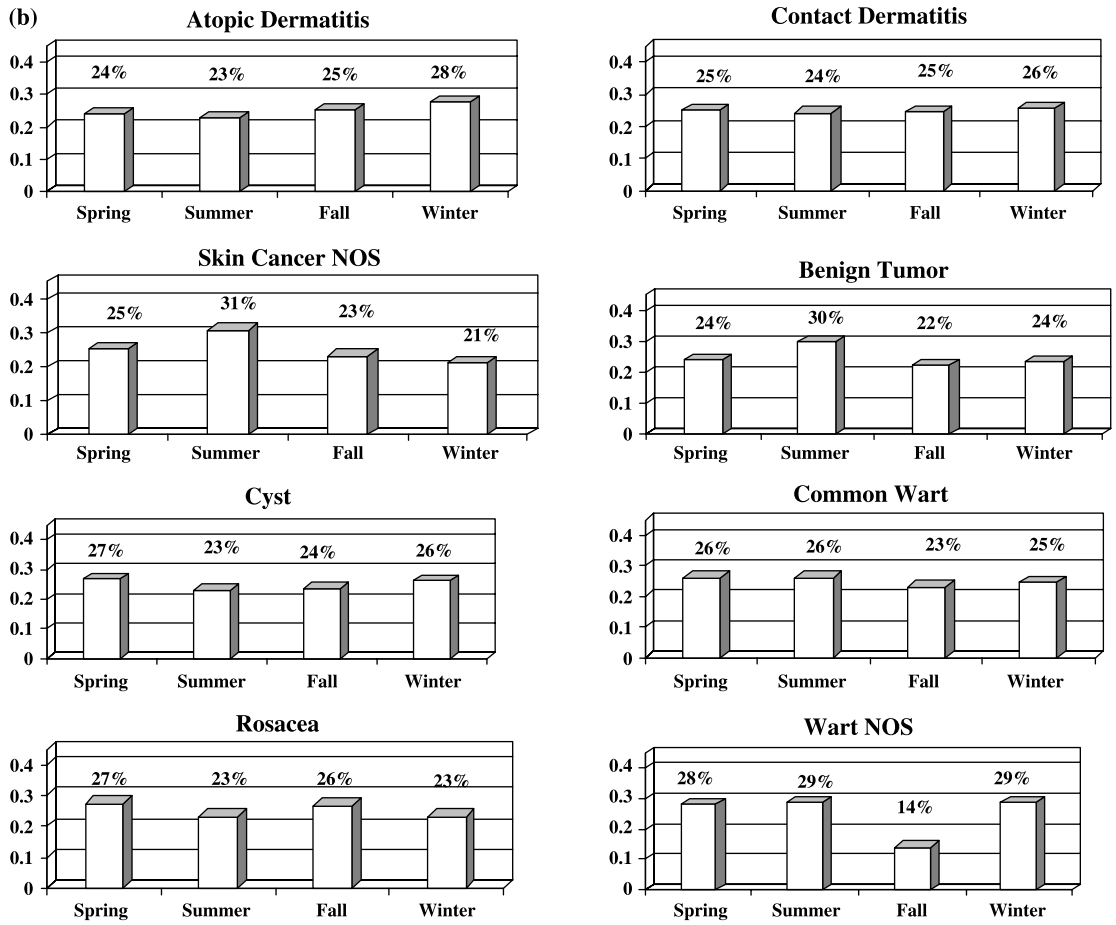

Figure 1 *Continued*.

in school may be the impetus to seek care. If acne truly improves in summer, decreased inflammation from UV-induced immune suppression or inhibition of pathogenic bacteria may be possible explanations. We observed significantly more visits for folliculitis in the winter. Occlusion from heavier winter clothing may contribute to the increase in folliculitis-related visits. Furthermore, the supposed summertime benefits of UVR for acne may also exist for folliculitis.

We observed impressive trends for the seasonality of visits for seborrheic dermatitis, psoriasis, seborrheic keratoses, and dyschromia. The literature suggests that both seborrheic dermatitis and psoriasis worsen in the winter and improve in the summer. UV light inhibits the growth of *Pityrosporum ovale*, a possible etiological factor in seborrheic dermatitis,[28] and those with less sun exposure have higher rates of the condition.[29] This and the suppression of Langerhans cell antigen presentation in UV light are possible reasons for the seasonal trend of seborrheic dermatitis.[28] Psoriasis data from an Indian study showed that 43% of patients improved in the summer, whilst only 8% worsened. Conversely, 42% worsened in the winter, whilst only 7% improved.[7] Climate therapy has been reported to be an effective treatment for psoriasis,[30] as are modern treatments such as psoralen plus UVA light (PUVA) and UVB.[31] Cumulative sun exposure causes dyschromia, and thus more visits in spring seem logical. Seborrheic keratoses, thought to be genetically inherited, are most commonly diagnosed in the spring.

The differences in the data resulting from the changing seasons may be related mainly to the intensity of UVR exposure. The important determinants of UVR intensity are the day length and sun angle.[12] In astronomically defined seasons, these two components are virtually identical in the spring and summer, and climate differences come from the lag effect of heating the ground and the oceans. When using the meteorological definitions, the most intense sun exposure occurs in the summer, the season with the highest sun angles and longest days.[12] Indeed, skin conditions with the greatest seasonality of office visits – actinic keratosis, dyschromia, psoriasis, and seborrheic dermatitis – are greatly influenced by UVR. Visits for these disorders remained seasonal or became more seasonal by changing the definition (Tables 1 and 2). For all

Table 2 Dermatologic office visits ranked by seasonality for meteorological seasons

	Peak season	% of annual visits	Trough season	% of annual visits	*P* value
All skin conditions	Spring	29.1	Winter	21.8	**0.0001**
Actinic keratosis	Spring	29.2	Winter	17.8	**0.0001**
Dyschromia	Spring	35.1	Fall	17.9	**0.005**
Psoriasis	Spring	33.8	Fall	20.3	**0.006**
Seborrheic dermatitis	Spring	45.7	Summer	9.1	**0.01**
Common wart	Spring	28.9	Winter	20.9	**0.01**
Contact dermatitis	Spring	28.2	Winter	22.6	**0.02**
Seborrheic keratosis	Spring/fall	32.3	Winter	15.7	0.1
Folliculitis	Fall	26.4	Summer	23.4	0.1
Acne	Spring	32.3	Summer	18.8	0.2
Cyst	Spring	27.2	Summer	22.2	0.2
Benign tumor	Summer	27.0	Winter	22.4	0.2
Skin cancer NOS	Summer	29.6	Winter	20.9	0.3
Atopic dermatitis	Spring	27.4	Summer	23.5	0.3
Rosacea	Spring	30.2	Winter	20.2	0.4
Wart NOS	Winter	27.0	Fall	20.4	0.6

NOS, not otherwise specified.

conditions, spring remained the most common season for visits, and winter was the least common.

This study examined the seasonality of the utilization of health care, not the seasonality of the disease process. Financial, social, and psychologic variables are very important in determining when patients seek care. Additional investigation of the data stratifying for age, income, insurance status, medical history, and family history may be useful. ICD-9-CM codes are not always specific, and the majority of the data were obtained from nondermatologists. The demonstration that office visit seasonality equals seasonality of the disease process is easier for rapid-onset conditions such as keratoacanthomas.[8] The diagnoses that we examined are typically chronic conditions, and equating the two is more difficult.

This study represents the seasonal utilization of dermatologic care for the US population from 1990 to 1998. Our data also lend support to the seasonality of skin disorders from a pathophysiologic standpoint, even though office visits are not the best proxy for disease onset. The enormous number of dermatologic visits examined in our data adds greater confidence to the use of such a proxy. Further studies should examine the presentation or exacerbation of skin conditions to better investigate whether season directly affects cutaneous disease. Much more research is needed to unravel the complex role of seasonal variation in dermatologic visits and the pathophysiology of skin disease.

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Appendix 1 – Skin Condition ICD-9-CM Diagnoses

078.00	078.10	078.11	110.00	110.10
110.20	110.30	110.40	110.50	110.80
110.90	111.00	111.80	111.90	112.00
112.10	112.30	112.90	172.40	172.50
172.60	172.70	172.90	173.10	173.20
173.30	173.40	173.50	173.60	173.70
173.90	216.10	216.20	216.30	216.40
216.50	216.60	216.70	216.90	238.20
680.20	680.90	681.00	681.01	681.02
681.10	681.90	682.00	682.20	682.30
682.40	682.60	682.70	682.90	684.00
685.00	685.10	686.00	686.10	686.90
690.10	691.00	691.80	692.30	692.40
692.60	692.70	692.71	692.72	692.74
692.79	692.90	693.00	693.10	694.50
695.10	695.30	695.40	695.89	695.90
696.00	696.10	696.20	696.30	696.50
697.00	697.90	698.00	698.10	698.30
698.90	700.00	701.00	701.10	701.30
701.40	701.50	701.80	701.90	702.00
702.11	702.19	702.80	703.00	703.80
704.00	704.01	704.02	704.09	704.20
704.80	704.90	705.81	705.83	706.00
706.10	706.20	706.30	706.80	706.90
707.10	707.80	707.90	708.10	708.50
708.80	708.90	709.00	709.01	709.09
709.20	709.30	709.80	709.90	

