Seasonality of hair loss: a time series analysis of Google Trends data 2004 to 2016

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Seasonality of hair loss: a time series analysis of Google Trends data 2004 to 2016

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Hair loss is a frequently encountered dermatologic complaint that often generates psychological distress. Prior studies have demonstrated a seasonal pattern to hair loss. Maximal proportions of telogen hair have been found to occur in the summer,[1,2] whereas lowest rates of

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telogen hairs occur in the winter.[1] Additionally, a recent study demonstrated that maximal hair shedding occurs in August and September, and that the percentage of hairs in the anagen phase peaks at the beginning of spring.[3] However, these prior analyses are constrained by small sample sizes or homogenous patient populations in limited geographic locations, and focus on changes in the hair growth cycle stages. Additional studies are needed to further describe the relationship between hair loss and seasonality. In this study, we explore the relationship between seasonality and hair loss at a population level using Google Trends data. As temperature and daylight levels have been hypothesized to be causative factors of observed seasonal hair loss patterns,[3] we also sought to investigate if temperature plays a role in affecting seasonal variation. We hypothesized that "hair loss" search volume index (SVI), a proxy measurement for actual hair loss experienced in the population, would be highest in summer and lowest in spring.

Google Trends is an online, open-access database that aggregates Google search data since 2004. SVI is a normalized quantification of a search topic relative to all other Google searches in a given timeframe and is indexed from zero to 100.[4] Monthly SVI data were evaluated worldwide and in eight English-speaking countries. These countries were chosen by selecting the top four countries by population in the top 15 countries by "hair loss" SVI from January 2004 to October 2016 in each hemisphere. We chose to use the term "hair loss" in this analysis, as the mean SVI for this term was more than 25 times higher than that of "hair shedding." We assigned each month to a season based on meteorological definitions and corrected for hemisphere. We obtained monthly temperature data from the National Oceanic and Atmospheric Administration and 2013 nominal GDP per capita data[5] in order to partially account for the effect of country access to technology. Multivariable Prais-Winsten time series analyses were conducted to examine the association between hair loss SVI and seasonality, adjusted for temperature, hemisphere, and per capita GDP.

Trends in monthly “hair loss” SVI followed a cyclical distribution across all countries examined, such that patterns of peaks and troughs in SVI repeat annually. Across all eight countries analyzed in aggregate, summer and fall were associated with greater “hair loss” SVI compared to spring (coefficient 5.74 [$p<0.001$], 5.05 [$p<0.001$], respectively; **Table 1**), with the most pronounced increase in SVI occurring in summer. Winter also demonstrated a greater SVI than spring, albeit to a lesser extent than summer and fall (coefficient 2.63 [$p<0.001$]. Of the confounding variables, temperature was a minor contributor to SVI findings (coefficient 0.18 [$p=0.020$]), while countries with higher per capita GDP were significantly associated with higher SVI (coefficients 0.62 [$p<0.001$]) and countries in the southern hemisphere were associated with lower SVI (20.23 [$p<0.001$]).

The results of this secular trend study suggest that hair loss in the population is significantly correlated with seasonality, and that hair loss occurs most frequently in the summer and fall. These findings are consistent with prior studies that used trichograms and other hair samples to find that telogen hair loss occurs maximally in the summer[1,2] or the transition between summer and fall.[2] However, the physiology of hair loss as related to seasonal variation is unknown. Clinical implications of this pattern of hair loss seasonality include the potential for confounding diagnosis of hair loss conditions or efficacy of treatment started at different months of the year. While temperature was associated with hair loss seasonality in this study, it did not contribute significantly to hair loss in multivariate modeling. However, other seasonal trends were not evaluated. This suggests that other factors are contributive and that future studies exploring the effect of UV index variation on patterns of hair loss, for example, are warranted.

A limitation of this analysis is that Google Trends SVI data shift slightly depending on acquisition date, as relative percentages of total search volume are continuously altered.[7] However, data for the same time range acquired on three separate days demonstrated close correlation (Spearman correlation 0.97). Nevertheless, this is an initial investigation into seasonal patterns of hair loss worldwide. Further studies evaluating the seasonality and hair loss relationship, as well as exploring the effect of other potential mediating factors, are needed.

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TABLE 1. Multivariable Prais-Winsten model of association between "hair loss" SVI and season

Characteristic	Regression coefficient (95% CI)	P
Spring	**Ref**[1]	**Ref**[1]
Summer	**5.74** (3.91 to 7.58)	**<0.001**
Fall	**5.05** (2.94 to 7.17)	**<0.001**
Winter	**2.63** (0.72 to 4.55)	**0.007**
Temperature	**0.18** (0.03 to 0.33)	**0.020**
Southern Hemisphere[2]	**-20.23** (-23.71 to -16.76)	**<0.001**
Nominal GDP per capita[3]	**0.62** (0.55 to 0.70)	**<0.001**

[1]Spring used as reference
[2]Northern hemisphere used as reference
[3]GDP in thousands
Note: Seasons for countries in the northern hemisphere were defined such that March, April and May constituted spring; June, July, and August constituted summer; September, October, and November constituted fall, and December, January, and February constituted winter. Seasons for countries in the southern hemisphere were defined as the reverse, such that northern hemisphere spring constituted southern hemisphere fall; northern hemisphere summer constituted southern hemisphere winter; northern hemisphere fall constituted southern hemisphere spring; and northern hemisphere winter constituted southern hemisphere summer.