



# Depression-related Internet Search Volume as a Correlate of Future Child and Adolescent Suicides : A Cross-correlational Study of Monthly Google Search Volume and Suicide Rate of Young Individuals in the United States

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## Background

- Suicide rate among the young people (ages 14-25) in the USA increased about 25% between the years 2000 and 2015<sup>1</sup>
- Using statistical methods with a limited validity, previous studies have examined the suicide-related online searches as a possible correlate of future suicides to produce mixed results<sup>2,3,4</sup>
- However, no study has investigated a correlation between suicide-related Google search volumes and suicide rates among the children and adolescents
- This study examined if the trends in monthly Google search volumes (MGSVs) of any suicide-related search term precede those in monthly suicide rates (MSRs) of people with age 0-19 in the USA

## Methods

- Search volumes from Google Trends—normalized according to the total number of searches within a designated region and time—reflect the relative popularity<sup>5</sup>
- MGSVs of 97 suicide-related search terms were obtained by averaging 10 time-series data per term for reliability concerns
- MSRs among the U.S. individuals of age 0-19 between 2004 and 2017 were calculated from the U.S. Census Bureau (assumed linear population change between Julys) and the CDC WONDER data (U03.0; U03.9; X60-X84; Y87.0-Y87.2)<sup>3</sup>
- Time-series analysis techniques—including Box-Jenkins' autoregressive integrated moving average (ARIMA) models—were used
- Cross-correlation coefficients between the residual MGSVs and the filtered MSRs were calculated at lags of -1, -2, and -3 months (lag 0 not included in analyses)
- The Benjamini-Hochberg procedure (false discovery rate=0.25) was applied at each lag to minimize false-positive findings innate to multiple comparisons

Figure 1. Monthly suicide rate of individuals with age 0-19 in the USA (per 100,000)

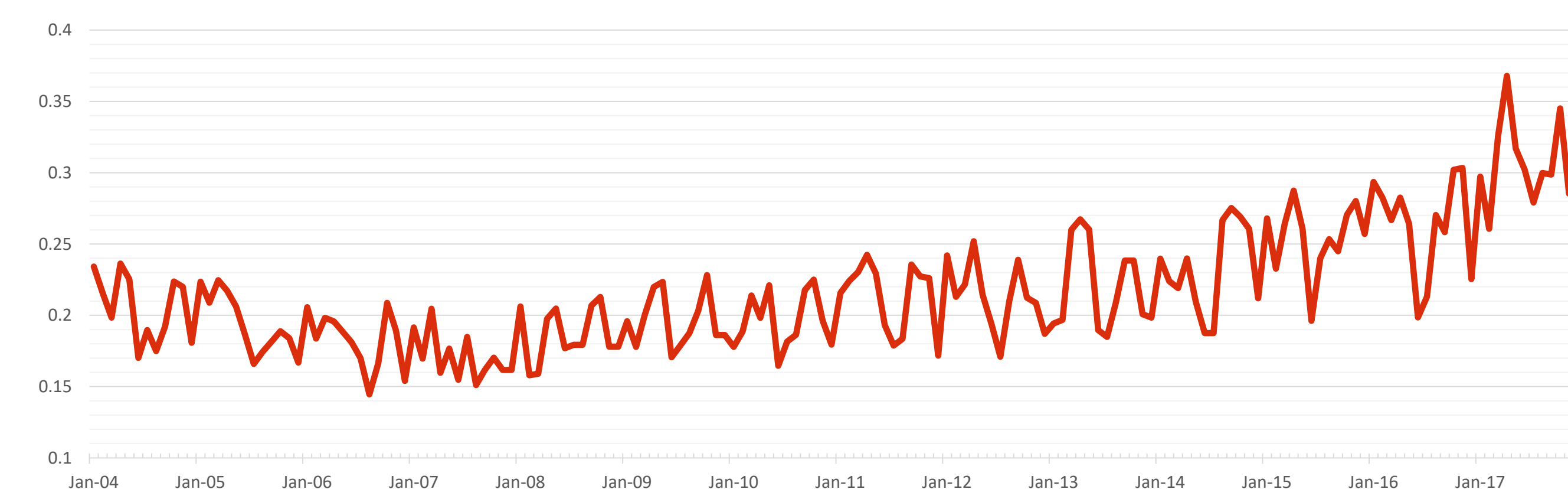
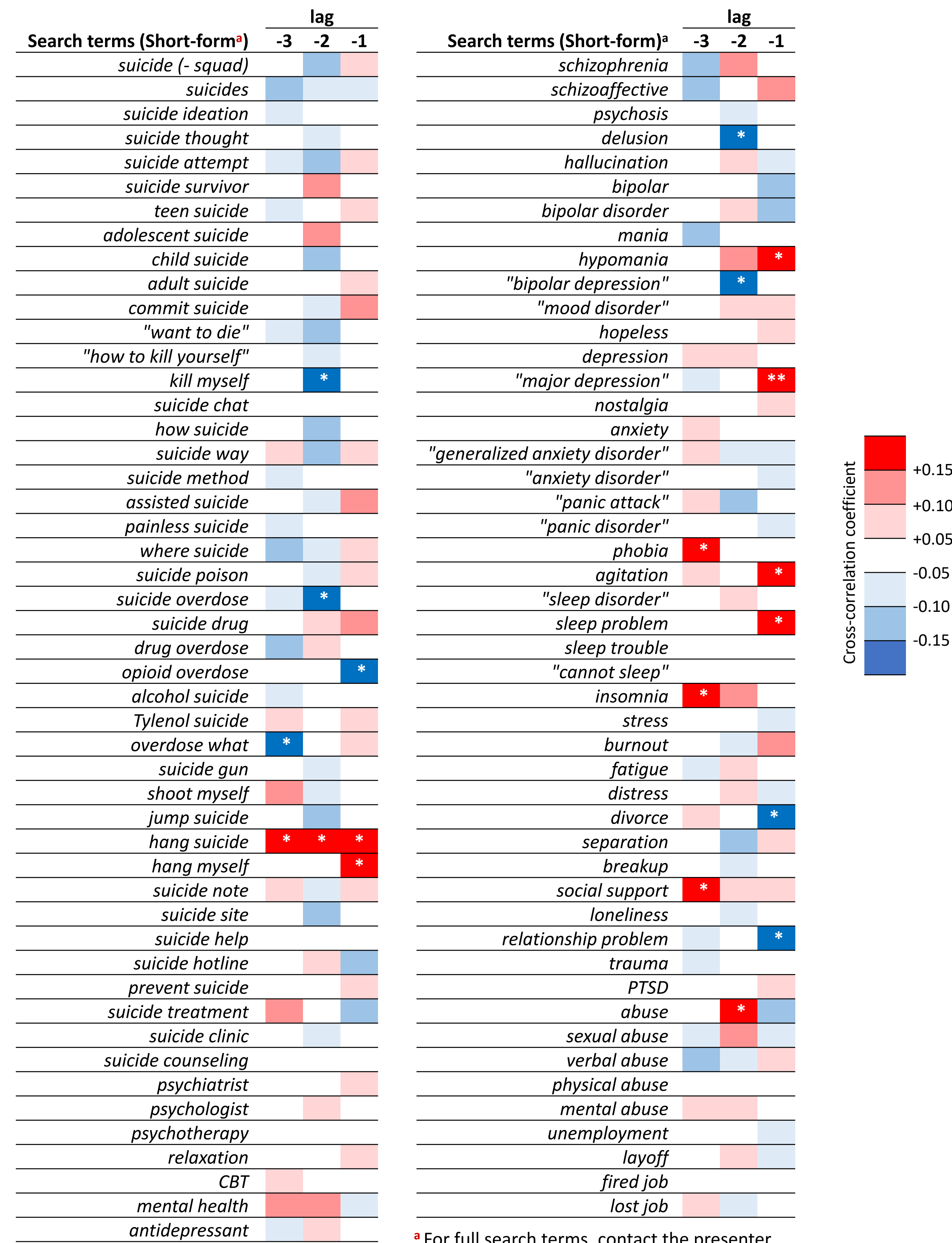


Figure 2. Heatmap of cross-correlation of monthly Google search volumes and suicide rates



## Results

- MSRs between 01/2004 -12/2017 ranged between 0.144-0.368 per 100,000 individuals with age 0-19 in the USA (Figure 1)
- When Benjamini-Hochberg procedure was applied, MGSVs of only one term ("major depression" + "major depressive disorder" + "unipolar depression" + "MDD") retained a significant correlation with MSRs at lag -1 (Figure 2)

"An increase in depression-related Google searches precedes an increase in child-adolescent suicides by 1 month"

## Discussion

- Our result contrasts with the previous finding that MGSVs of anxiety-, sleep-, and unemployment-related—but not depression-related—terms correlated MSRs of the total U.S. population with a 1- to 3-month lag<sup>3</sup>
- Depression-related Internet search-result screens need to be prioritized as a deployment site for child-adolescent-targeted suicide-prevention campaigns
- **Limitations**
  - Age- or gender-specific search volumes, lags outside the 1- to 3-month range, non-English searches, and possible confounding factors (e.g., media coverage) of MGSV and MSR were not explored
  - Child-adolescent-specific search terms (e.g., ADHD or autism) were not covered
- MGSVs of the term "major depression" may be incorporated in the development of a newer prediction model for child and adolescent suicides

## References

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