

Circaseptan (Weekly) Rhythms in Smoking Cessation Considerations

Smokers' rhythms in contemplating quitting or making quit attempts are poorly understood. Tobacco control has focused on annual events (eg, New Year's Day), but circaseptan (weekly) time cycles may likewise exist. For example, many illnesses such as strokes are more common on Mondays.¹ Do cessation behaviors also have weekly rhythms?

Methods | Traditional survey-based assessments are inadequate to capture weekly cessation rhythms. However, examining how individuals search online takes surveying them to the next level by revealing both the searcher's thoughts, through the types of queries undertaken, and their actions toward behavior change, through engaging in the search behavior itself.² Global Google cessation query trends in English, French, Mandarin/Cantonese, Portuguese, Russian, and Spanish were monitored from January 2008 through 2012 (google.com/trends). In English, all queries including "quit" and "smoking" (eg, "quit smoking help") were combined into a single trend. This was repeated for "arrêter de fumer," "戒烟," "parar de fumar," "бросить курить," and "dejar de fumar." Because raw volumes are misleading (all searches may decline on Saturday), a normalized, daily ratio of cessation queries to all queries was analyzed (relative search volume [RSV]).

A continuous wavelet transform was used to isolate the weekly component of the time series.³ This is preferred over a regression because it is assumption free. The resulting series was intuitively compared as daily ratios (eg, [Monday-Tuesday]/Tuesday) after adding the mean RSV because the wavelet is mean centered. Confidence intervals ($\alpha = 0.05$) were simulated using bootstraps from the ratio's sampling distribution.

Results | Weekly, cessation queries in English peaked early, declined thereafter, then rebounded on Sunday (Figure). The trend lines neatly overlapped, with the variance between weeks less than within weeks (intraclass correlation coefficient, 0.03 vs 0.62). Patterns were similar across languages, with higher volume earlier in the week and mostly on Monday.

Monday query volumes were 25% (95% CI, 24%-26%) higher than the combined Tuesday through Sunday mean for all languages. Cessation queries in English on Monday were 1% (95% CI, -1% to 3%) greater than on Tuesday, 11% (95% CI, 9%-14%) greater than on Wednesday, 22% (95% CI, 19%-26%) greater than on Thursday, 67% (95% CI, 62%-73%) greater than on Friday, 145% (95% CI, 134%-157%) greater than on Saturday, and 59% (95% CI, 54%-64%) greater than on Sunday. For French, Portuguese, and Spanish, queries were significantly higher on Monday than on other days. Mandarin/Cantonese and Russian queries were significantly higher on Monday compared with all other days except Sunday. In total, of 36 comparisons, Monday volumes were significantly greater 33 times, indistinguishable twice, and smaller once, an unlikely finding ($P < .001e^{-5}$).

Raw search volumes were estimated by applying the mean global monthly volume for "quit smoking" and its next 100 related terms from Google Adwords (adwords.google.com) to our results. For this sample of Google queries in English, there were 153 800 more searches on Monday than the Tuesday through Sunday mean, totaling 8 000 000 each year.

Discussion | Just as illness has a weekly clock, so do cessation behaviors. The discovery of weekly rhythms in quitting contrasts with previous scientific understanding and can be harnessed to improve cessation advocacy.

Individual quitting behaviors have been described as "chaotic."⁴ A bird's-eye view of the population, however, suggests anything but chaos. Quitting behaviors are not spontaneous events but are instead an aggregate phenomenon partially governed by a weekly clock. To fully appreciate the microdecision to quit, we must begin exploring macrodynamics, such as interconnectedness,⁵ in lieu of individual psychology.

Given that most cessation contemplations do not result in successful quits, public health advocates can use these findings to facilitate quitting by providing resources (staffing smoking cessation lines) when more smokers are engaged in the quit process through day-of-the-week targeting. Hypothetically, 145% more susceptible English-speaking smokers may need resources on Monday than on Saturday.

Finally, developing research agendas and advocacy priorities around weekly rhythms in cessation is justified by our findings. Weekly clocks likely impact other behaviors, and ours are just initial steps toward a more substantial (and novel) research program to discover these patterns.

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Study concept and design: Ayers, Althouse, Johnson, Cohen.

Acquisition of data: Ayers, Althouse.

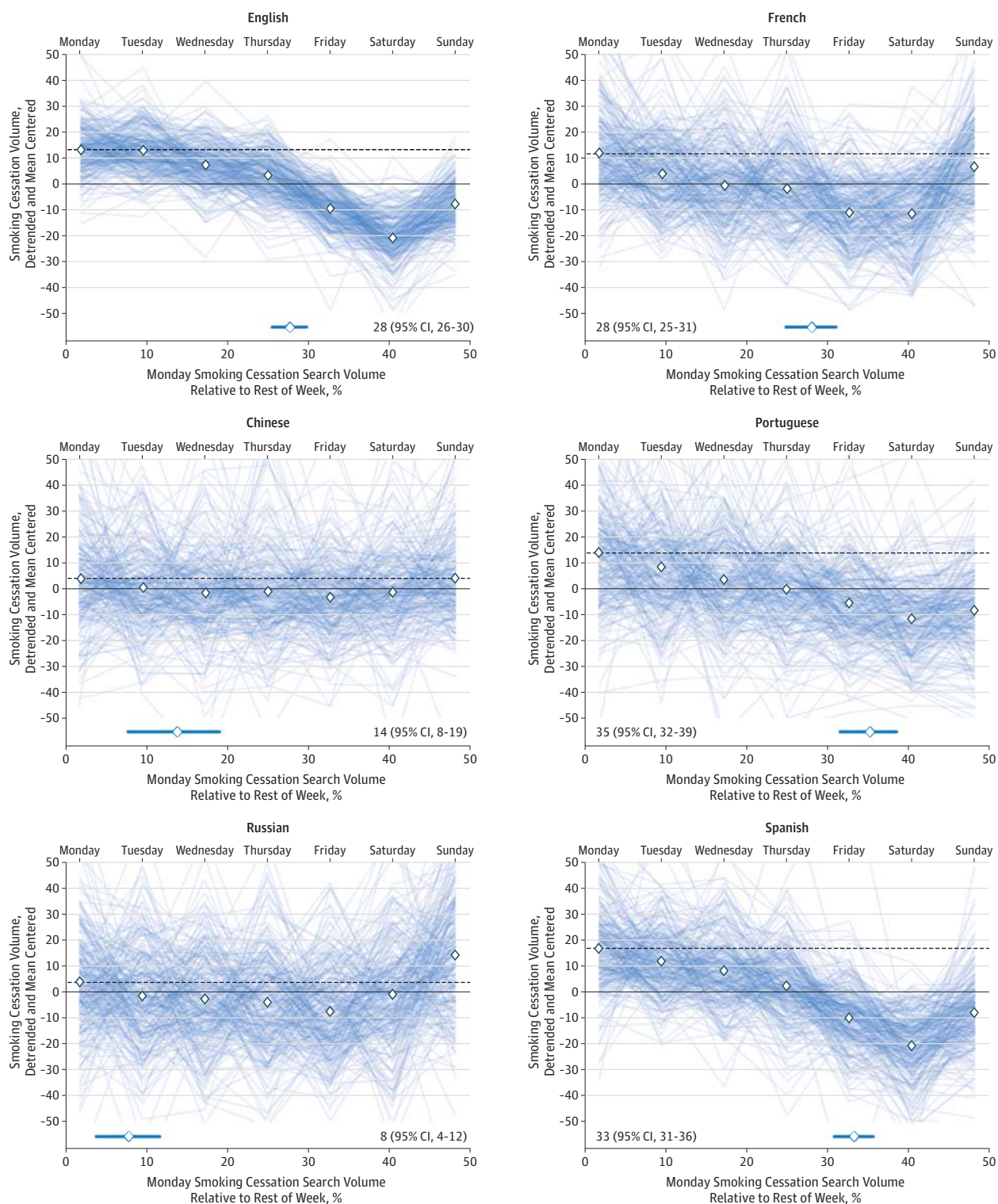
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Figure. Daily Trends in Smoking Cessation Google Queries



The main panels in each graph show segments of the weekly trend lines (light blue curves) for searches in the indicated languages from 2008 to 2012 layered over one another, with the mean for each day of the week, as estimated from the wavelet-reconstructed time series, indicated by an open diamond; reference lines (dashed lines) for the Monday means were added to aid

interpretation. In the bottom portion of each panel is illustrated the Google search volume for Monday (open diamonds) relative to the combined Tuesday through Thursday means; horizontal error bars represent the 95% CIs. Smoking cessation volume on each graph is represented as a relative search volume (ie, a normalized daily ratio of cessation queries to all queries).

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Physical Activity Profiles of Overweight and Obese Women in Rural Georgia

The value of moderate and vigorous physical activity (PA) is well-known and substantiated by a large body of research.¹ In addition, research on the value of light activity and the negative effect of sedentary behavior is starting to accumulate.^{2,3} However,



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little is known about PA in relation to time spent sedentary and the frequency and length of interruptions in sedentary behavior in overweight and obese patients of safety-net primary care practices such as federally qualified health centers (FQHCs). This study investigated the PA profiles of overweight and obese women, focusing on light activity and breaks in sedentary behavior.

Methods | We recruited women aged 35 to 65 years from FQHCs for the Healthy Home/Healthy Families Study, a randomized controlled trial for prevention of weight gain. Baseline PA was assessed using accelerometers that participants were asked to wear for 7 consecutive days. Activity levels were scored using the cut points of the National Health and Nutrition Examination Survey.⁴ The light activity category was further split into quartiles. We calculated descriptive statistics and conducted multivariate regression analysis. The Emory institutional review board approved this study, and all participants provided informed consent.

Results | Participants (N = 303) with valid data (≥4 days with ≥10 hours spent wearing the accelerometer) had a mean (SD) body mass index (calculated as weight in kilograms divided by height

in meters squared) of 38.3 (8.4 [range, 25.0-80.8]); were mostly African American (83.5%); and reported an annual household income of \$25 000 or less (62.4%). They wore the accelerometers for a mean of 13.6 h/d (Table 1). Most of the time was spent sedentary (mean [SD], 10.8 [1.8] hours) or in light activity (mean [SD], 2.8 [1.1] hours). Most of the time spent in light activity (95.9%) was spent in the lowest quartile. The women spent a mean duration of less than 1 min/d in moderate PA and none in vigorous PA. No participant met the 2008 US Department of Health and Human Services PA guideline. The participants' body mass indexes were positively associated with time spent being sedentary, and employed participants were significantly less sedentary than those who were not employed.

Participants interrupted their sedentary behavior for at least 1 minute 79 times per day (Table 2). Of those breaks, almost two-thirds lasted at least 2 minutes. However, data showed a mean of only 9.5 interruptions per day of at least 10 minutes and only 3.0 interruptions of at least 20 minutes. Those participants who were employed interrupted their sedentary behavior for more than 1 minute more often than those who were not. More overweight participants had fewer 10- and 20-minute interruptions of sedentary behavior than those with a lower body mass index.

Discussion | To our knowledge, this study is one of the first to obtain accelerometer data on PA levels among a relatively large sample of low-income, predominantly African American overweight and obese female patients of FQHCs in rural Georgia

Table 1. Descriptive Statistics on Time Spent in Different PA Levels

Study Time	Mean (SD) [Range]
Nonmonitored, h/d	10.4 (1.6) [2.3-13.6]
Sedentary, h/d	10.8 (1.8) [4.2-18.6]
Light activity, h/d	2.8 (1.1) [0.4-7.8]
Light activity quartile, min/d ^a	
1	159.8 (63.5) [23.5-415.3]
2	6.3 (6.5) [0.7-51.9]
3	0.5 (0.6) [0.1-7.0]
4	0.1 (0.1) [0-2.3]
Moderate activity, min/d	0.01 (0.03) [0-0.2]
Vigorous activity, min/d	0

Abbreviation: PA, physical activity.

^a Determined by dividing the range of light activity into 4 equal categories.

Table 2. Interruptions of Nonsedentary Activity for Different Minimum Times

Minimum Interruption Time, min	No. of Interruptions per Valid Day	
	Mean (SD) [Range]	Mode
1	79.0 (16.5) [28.0-120.3]	88.0
2	49.2 (10.1) [18.6-74.9]	50.0
5	22.4 (5.7) [5.0-37.7]	18.0
10	9.5 (3.6) [0.2-20.3]	6.3
20	3.0 (19.6) [0.0-8.8]	1.0