

# Lexicocalorimeter: Real-time health measurement

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Complex Networks | @networksvox  
CSYS/MATH 303, Spring, 2018

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Dept. of Mathematics & Statistics | Vermont Complex Systems Center  
Vermont Advanced Computing Core | University of Vermont



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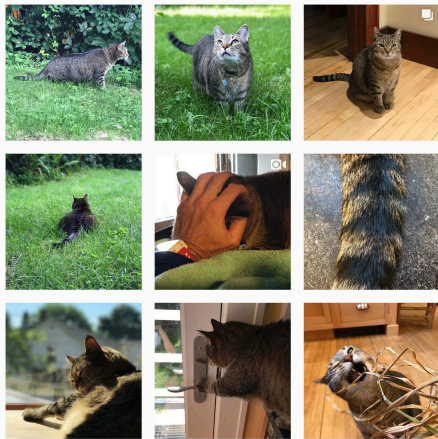
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 On Instagram at [pratchett\\_the\\_cat](https://www.instagram.com/pratchett_the_cat) 





# Outline

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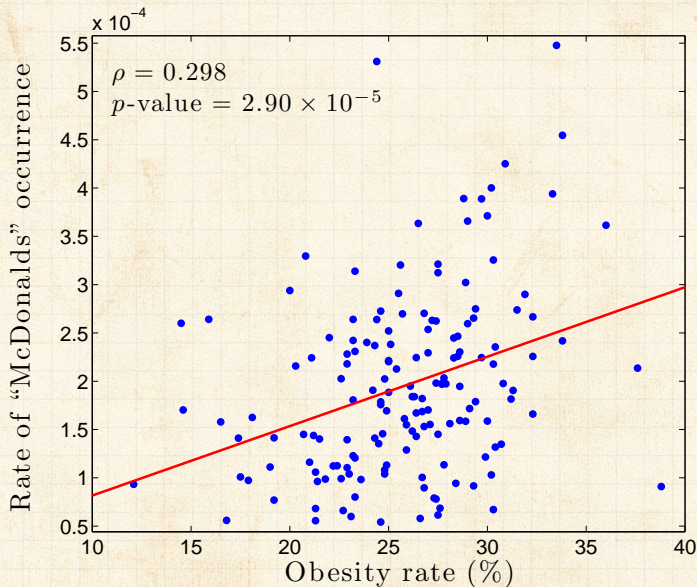


# Panometer.org

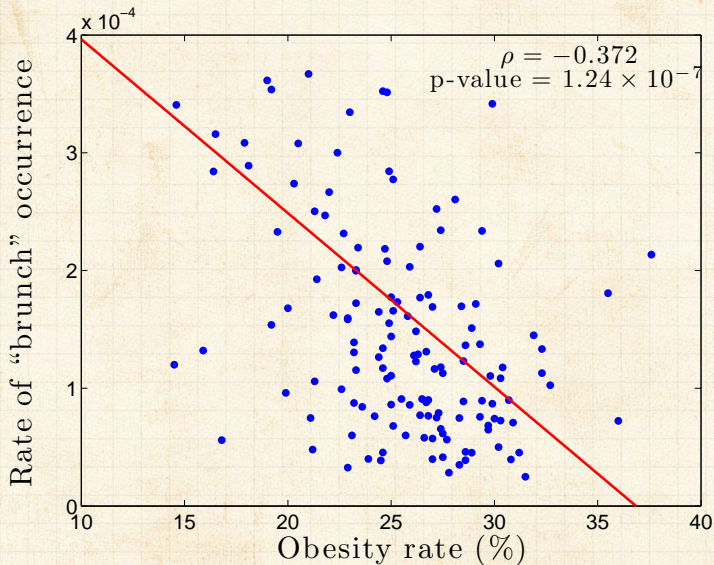
Measuring everything

Coming soon

# Obesity and tweets—"McDonalds":



# Obesity and tweets—"Brunch":





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References

Word	$\rho$	$p$ -value
cafe	-0.509	$6.07 \times 10^{-14}$
sushi	-0.487	$9.93 \times 10^{-13}$
brewery	-0.469	$8.67 \times 10^{-12}$
restaurant	-0.448	$8.93 \times 10^{-11}$
bar	-0.435	$3.59 \times 10^{-10}$
banana	-0.434	$3.77 \times 10^{-10}$
apple	-0.408	$5.22 \times 10^{-9}$
fondue	-0.403	$8.34 \times 10^{-9}$
wine	-0.400	$1.08 \times 10^{-8}$
delicious	-0.392	$2.17 \times 10^{-8}$
dinner	-0.386	$3.85 \times 10^{-8}$
coffee	-0.384	$4.51 \times 10^{-8}$
bakery	-0.383	$5.12 \times 10^{-8}$
bean	-0.378	$7.88 \times 10^{-8}$
espresso	-0.377	$8.47 \times 10^{-8}$
cuisine	-0.376	$8.82 \times 10^{-8}$
foods	-0.374	$1.07 \times 10^{-7}$
tofu	-0.372	$1.27 \times 10^{-7}$
brunch	-0.368	$1.79 \times 10^{-7}$
veggie	-0.364	$2.46 \times 10^{-7}$
organic	-0.361	$3.13 \times 10^{-7}$
booze	-0.360	$3.34 \times 10^{-7}$
grill	-0.354	$5.4 \times 10^{-7}$
chocolate	-0.351	$6.77 \times 10^{-7}$
#vegan	-0.350	$7.47 \times 10^{-7}$

mcdonalds	0.246	$6.18 \times 10^{-4}$
eat	0.241	$8.22 \times 10^{-4}$
wings	0.222	$2.13 \times 10^{-3}$
hungry	0.210	$3.65 \times 10^{-3}$
heartburn	0.194	$7.37 \times 10^{-3}$
ham	0.177	$1.45 \times 10^{-2}$



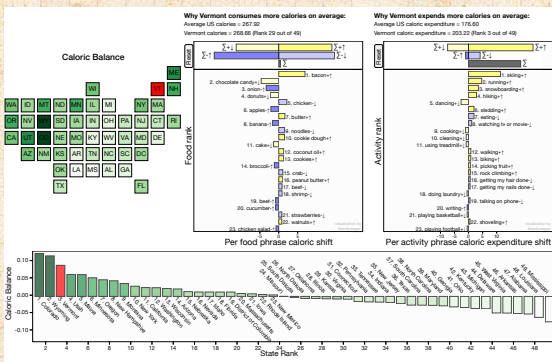


# "The Lexicocalorimeter: Gauging public health through caloric input and output on social media"

Alajajian, Williams, Reagan, Alajajian, Frank, Mitchell, Lahne, Danforth, and Dodds. PLoS ONE, 12, e0168893, 2017. [1]

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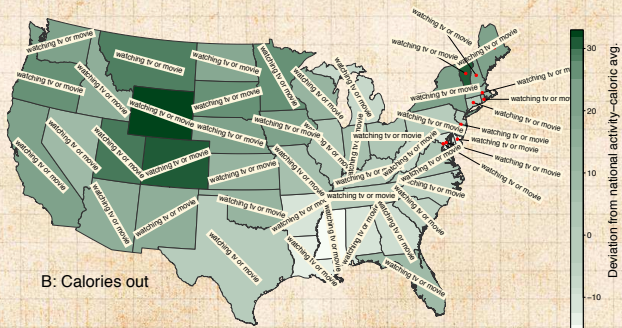
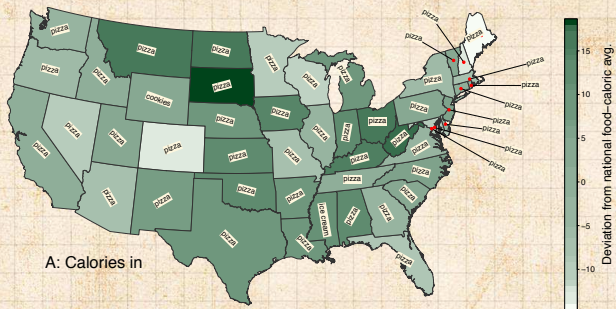
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<http://panometer.org/instruments/lexicocalorimeter/>

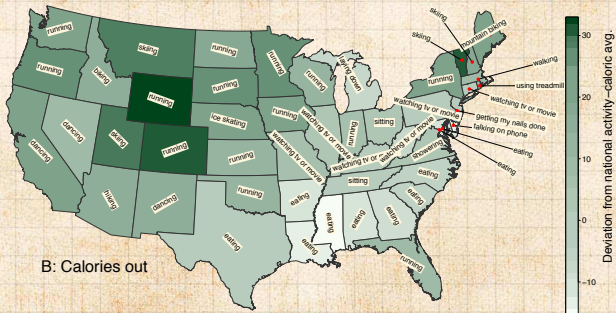
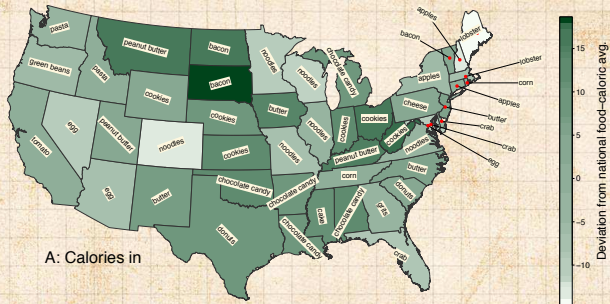


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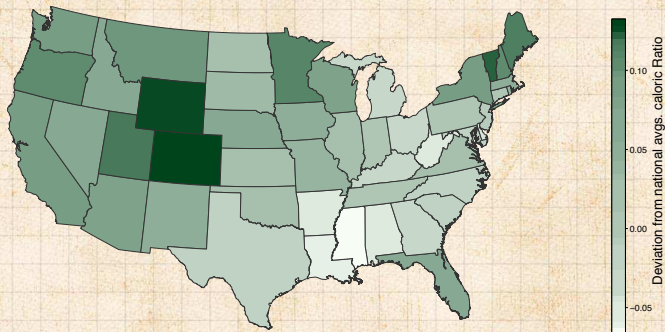


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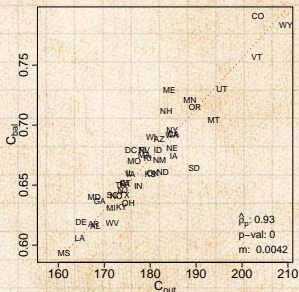
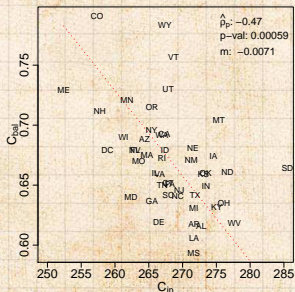
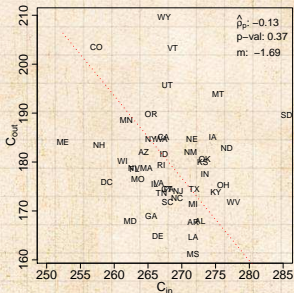
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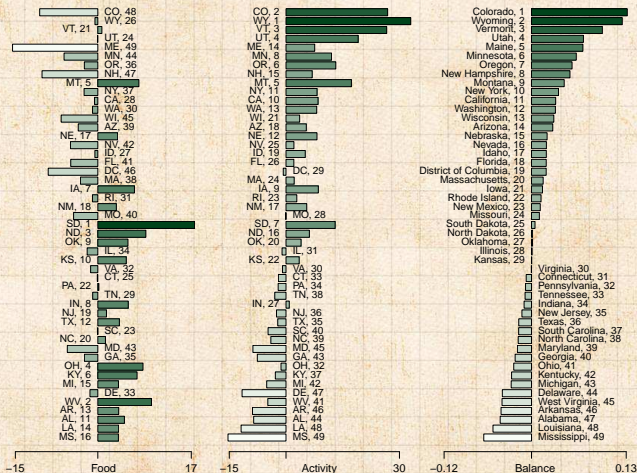
References





# The Lexicocalorimeter:

Deviations from national averages



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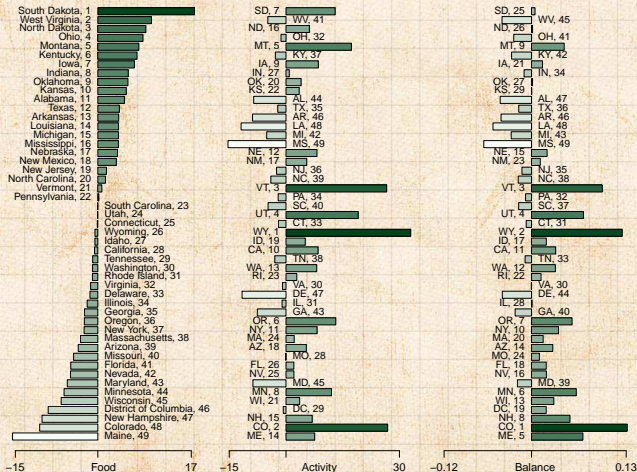
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# The Lexicocalorimeter:

Deviations from national averages



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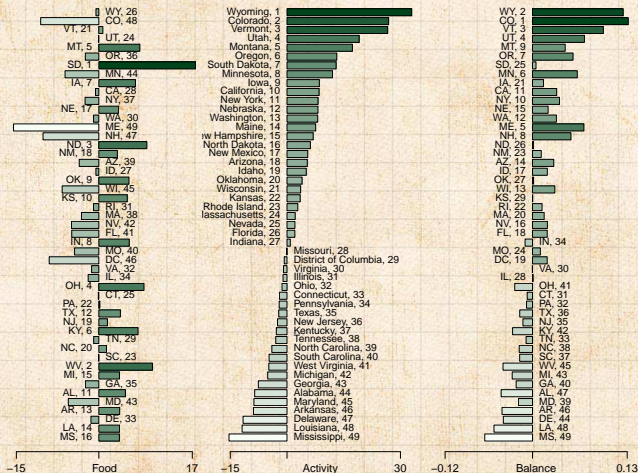
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## Deviations from national averages



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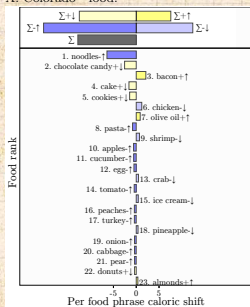
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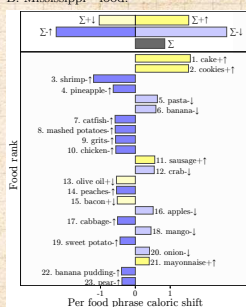


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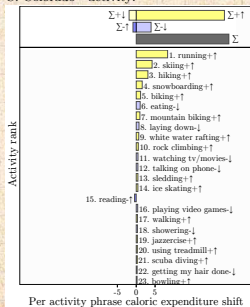
A. Colorado—food:



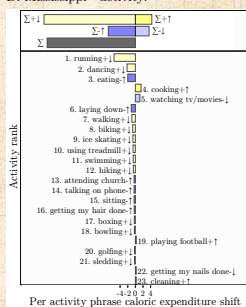
B. Mississippi—food:



C. Colorado—activity:



D. Mississippi—activity:



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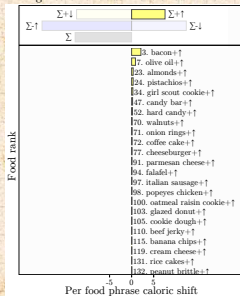
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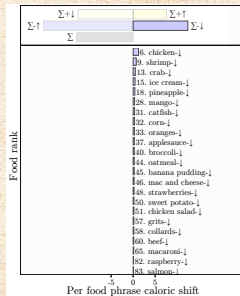
# The Lexicocalorimeter:

## Four views of food phrase shifts for Colorado

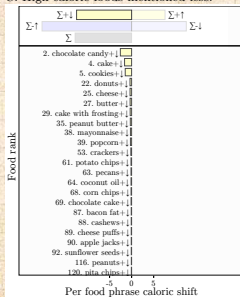
A. High calorie foods mentioned more:



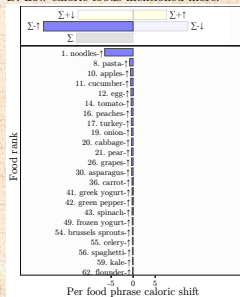
B. Low calorie foods mentioned less:



C. High calorie foods mentioned less:



D. Low calorie foods mentioned more:



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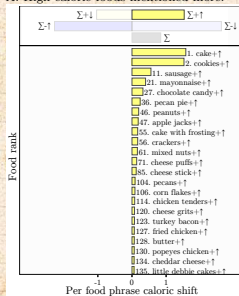
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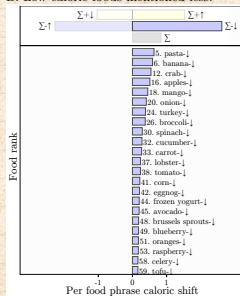
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## Four views of food phrase shifts for Mississippi

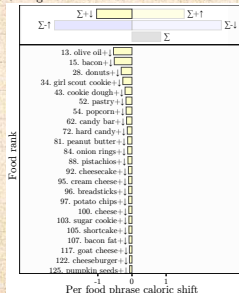
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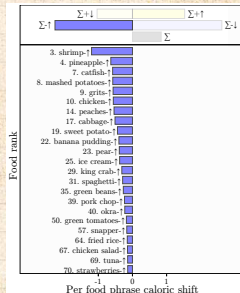
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C. High calorie foods mentioned less:



D. Low calorie foods mentioned more:



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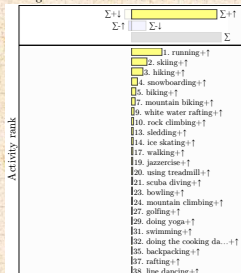




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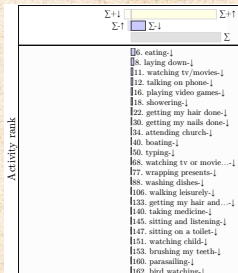
## Four views of activity phrase shifts for Colorado

A. High calorie activities mentioned more:



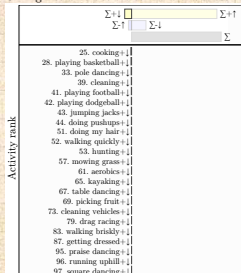
Per activity phrase caloric expenditure shift

B. Low calorie activities mentioned less:



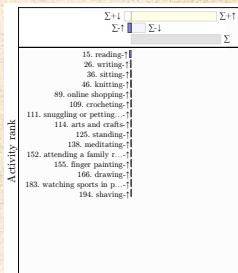
Per activity phrase caloric expenditure shift

C. High calorie activities mentioned less:



Per activity phrase caloric expenditure shift

D. Low calorie activities mentioned more:



Per activity phrase caloric expenditure shift

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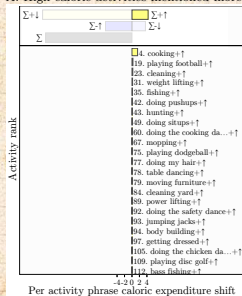
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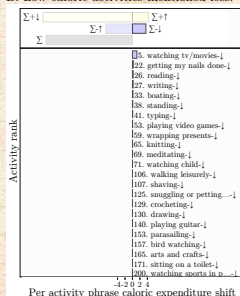
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## Four views of activity phrase shifts for Mississippi

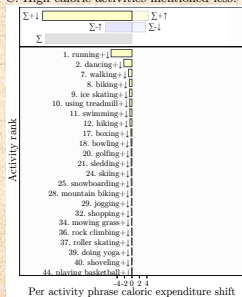
A. High calorie activities mentioned more:



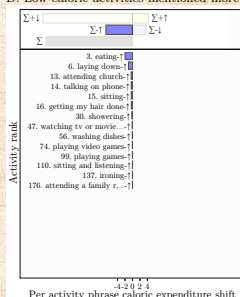
B. Low calorie activities mentioned less:



C. High calorie activities mentioned less:



D. Low calorie activities mentioned more:



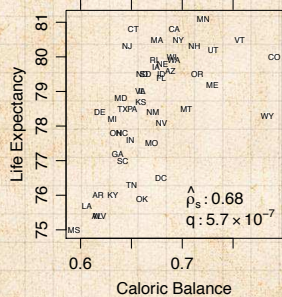
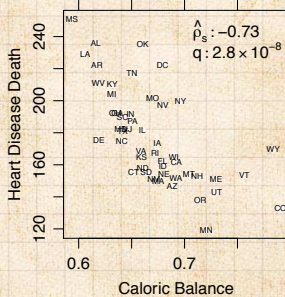
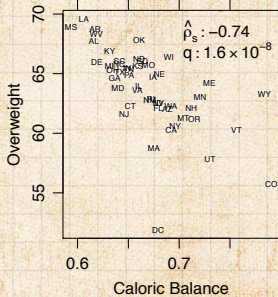
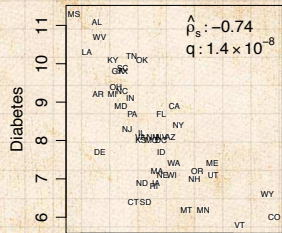
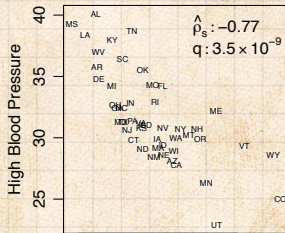
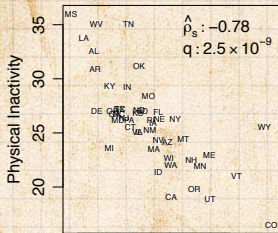
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Health and/or well-being quantity	$\hat{\rho}_s$ for $C_{rat}$	q-val	$\hat{\rho}_s$ for $C_{in}$	q-val	$\hat{\rho}_s$ for $C_{out}$	q-val
1. % no physical activity in past 30 days [24]	-0.78	$2.73 \times 10^{-09}$	0.58	$5.67 \times 10^{-05}$	-0.66	$1.51 \times 10^{-06}$
2. % have been physically active in past 30 days [24]	0.78	$2.73 \times 10^{-09}$	-0.57	$6.53 \times 10^{-05}$	0.67	$1.24 \times 10^{-06}$
3. % high blood pressure [24]	-0.77	$2.73 \times 10^{-09}$	0.32	$4.05 \times 10^{-02}$	-0.78	$2.73 \times 10^{-09}$
4. Adult diabetes rate [25]	-0.76	$5.44 \times 10^{-09}$	0.29	$6.09 \times 10^{-02}$	-0.77	$2.73 \times 10^{-09}$
5. CNBC quality of life ranking [26]	-0.76	$6.75 \times 10^{-09}$	0.28	$7.34 \times 10^{-02}$	-0.77	$3.60 \times 10^{-09}$
6. % adult overweight/obesity [27]	-0.73	$3.16 \times 10^{-08}$	0.55	$1.41 \times 10^{-04}$	-0.59	$3.07 \times 10^{-05}$
7. Heart disease death rate [27]	-0.73	$2.50 \times 10^{-08}$	0.34	$2.80 \times 10^{-02}$	-0.73	$2.30 \times 10^{-08}$
8. % adult obesity [25]	-0.72	$4.30 \times 10^{-08}$	0.53	$2.26 \times 10^{-04}$	-0.59	$2.96 \times 10^{-05}$
9. Gallup Wellbeing score [4]	0.72	$4.69 \times 10^{-08}$	-0.31	$4.43 \times 10^{-02}$	0.73	$3.99 \times 10^{-08}$
10. America's Health Rankings, overall [24]	-0.72	$4.10 \times 10^{-07}$	0.43	$4.74 \times 10^{-03}$	-0.67	$2.77 \times 10^{-06}$
11. Life expectancy at birth [27]	0.68	$5.81 \times 10^{-07}$	-0.4	$6.91 \times 10^{-03}$	0.65	$2.64 \times 10^{-06}$
12. % who eat fruit less than once a day [28]	-0.67	$1.20 \times 10^{-06}$	0.61	$1.39 \times 10^{-05}$	-0.51	$5.35 \times 10^{-04}$
13. % child overweight/obesity [27]	-0.64	$3.53 \times 10^{-06}$	0.27	$7.55 \times 10^{-02}$	-0.64	$3.20 \times 10^{-06}$
14. % who eat vegetables less than once a day [28]	-0.61	$1.39 \times 10^{-05}$	0.51	$5.33 \times 10^{-04}$	-0.46	$1.57 \times 10^{-03}$
15. Median daily intake of fruits [28]	0.6	$1.98 \times 10^{-05}$	-0.62	$8.33 \times 10^{-06}$	0.41	$5.37 \times 10^{-03}$
16. Smoking rate [27]	-0.59	$2.96 \times 10^{-05}$	0.51	$5.26 \times 10^{-04}$	-0.48	$1.08 \times 10^{-03}$
17. Median household income [27]	0.51	$5.55 \times 10^{-04}$	-0.53	$3.27 \times 10^{-04}$	0.4	$8.38 \times 10^{-03}$
18. Median daily intake of vegetables [28]	0.5	$6.10 \times 10^{-04}$	-0.56	$7.44 \times 10^{-05}$	0.31	$4.36 \times 10^{-02}$
19. % high cholesterol [24]	-0.49	$8.11 \times 10^{-04}$	0.23	$1.45 \times 10^{-01}$	-0.48	$9.05 \times 10^{-04}$
20. Brain health ranking [29] (lower is better)	-0.49	$8.11 \times 10^{-04}$	0.62	$1.39 \times 10^{-05}$	-0.29	$5.70 \times 10^{-02}$
21. % with bachelor's degree or higher [6]	0.46	$1.57 \times 10^{-03}$	-0.54	$1.66 \times 10^{-04}$	0.33	$2.82 \times 10^{-02}$
22. Colorectal cancer rate [25]	-0.44	$4.09 \times 10^{-03}$	0.53	$3.59 \times 10^{-04}$	-0.27	$8.25 \times 10^{-02}$
23. US Census Gini index score [30] (lower is better)	-0.42	$5.37 \times 10^{-03}$	-0.03	$8.42 \times 10^{-01}$	-0.5	$5.55 \times 10^{-04}$
24. Avg # poor mental health days, past 30 days [24]	-0.42	$5.37 \times 10^{-03}$	0.12	$4.80 \times 10^{-01}$	-0.48	$1.06 \times 10^{-03}$
25. Neuroticism Big Five personality trait [31]	-0.38	$1.09 \times 10^{-02}$	0.2	$2.03 \times 10^{-01}$	-0.37	$1.44 \times 10^{-02}$
26. Binge drinking rate [24]	0.37	$1.46 \times 10^{-02}$	-0.15	$3.56 \times 10^{-01}$	0.41	$5.84 \times 10^{-03}$
27. Avg # poor physical health days, past 30 days [24]	-0.35	$2.34 \times 10^{-02}$	0.19	$2.19 \times 10^{-01}$	-0.38	$1.13 \times 10^{-02}$
28. Farmers markets per 100,000 in pop. [28]	0.34	$2.72 \times 10^{-02}$	0.06	$7.17 \times 10^{-01}$	0.42	$5.14 \times 10^{-03}$
29. Strolling of the Heifers locavore score (lower is better) [32]	-0.29	$5.86 \times 10^{-02}$	-0.3	$5.41 \times 10^{-02}$	-0.45	$2.94 \times 10^{-03}$
30. Extraversion Big Five personality trait [31]	-0.28	$6.94 \times 10^{-02}$	0.03	$8.42 \times 10^{-01}$	-0.29	$5.63 \times 10^{-02}$
31. % schools offering fruit/veg at celebrations [28]	0.24	$1.31 \times 10^{-01}$	-0.46	$1.96 \times 10^{-03}$	0.05	$7.90 \times 10^{-01}$
32. Openness Big Five personality trait [31]	0.23	$1.31 \times 10^{-01}$	-0.5	$6.11 \times 10^{-04}$	0.04	$8.10 \times 10^{-01}$
33. % cropland harvested for fruits/veg [28]	0.19	$2.34 \times 10^{-01}$	-0.62	$1.37 \times 10^{-05}$	-0.04	$8.10 \times 10^{-01}$
34. Conscientiousness Big Five personality trait [31]	-0.12	$4.81 \times 10^{-01}$	0.2	$2.10 \times 10^{-01}$	-0.05	$7.93 \times 10^{-01}$
35. % census tracts, healthy food retailer within 1/2 mile [28]	-0.03	$8.44 \times 10^{-01}$	-0.52	$3.68 \times 10^{-04}$	-0.24	$1.31 \times 10^{-01}$
36. George Mason overall freedom ranking [33] (lower is freer)	-0.03	$8.42 \times 10^{-01}$	-0.11	$5.15 \times 10^{-01}$	-0.1	$5.64 \times 10^{-01}$
37. Agreeableness Big Five personality trait [31]	-0.01	$9.61 \times 10^{-01}$	0.22	$1.50 \times 10^{-01}$	0.08	$6.47 \times 10^{-01}$

TABLE I. Spearman correlation coefficients,  $\hat{\rho}_s$ , and Benjamini-Hochberg  $q$ -values for caloric input  $C_{in}$ , caloric output  $C_{out}$ , and caloric ratio  $C_{rat} = C_{out}/C_{in}$ , and demographic, data related to food and physical activity, Big Five personality traits [31], health and well-being rankings by state, and socioeconomic status, correlated, ordered from strongest to weakest Spearman correlations with caloric ratio. The two breaks in the table indicate significance levels of 0.01 and 0.05 for the Benjamini-Hochberg  $q$  of  $C_{rat}$ , corresponding to the first 24 health and/or well-being quantities and then the next four, numbers 25 to 28. The bottom 9 quantities were not significantly correlated with  $C_{rat}$  according to our tests. Tabs. S1, S2, and S3 present the same analysis for caloric measures including phrases representing liquids, and for the difference  $C_{diff}(\alpha) = \alpha C_{out} - (1 - \alpha)C_{in}$ , both without and with liquids included.



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## Other lexical meters

## References

Health and/or well-being quantity	$\hat{\rho}_s$ for $C_{rat}$	q-val	$\hat{\rho}_s$ for $C_{in}$	q-val	$\hat{\rho}_s$ for $C_{out}$	q-val
1. % no physical activity in past 30 days [24]	-0.78	$3.07 \times 10^{-09}$	0.58	$4.91 \times 10^{-05}$	-0.66	$1.59 \times 10^{-06}$
2. % have been physically active in past 30 days [24]	0.78	$3.07 \times 10^{-09}$	-0.58	$5.50 \times 10^{-05}$	0.67	$1.31 \times 10^{-06}$
3. % high blood pressure [24]	-0.77	$3.07 \times 10^{-09}$	0.39	$1.16 \times 10^{-02}$	-0.78	$3.07 \times 10^{-09}$
4. Heart disease death rate [27]	-0.75	$1.02 \times 10^{-08}$	0.38	$1.24 \times 10^{-02}$	-0.73	$2.07 \times 10^{-08}$
5. Adult diabetes rate [25]	-0.74	$1.17 \times 10^{-08}$	0.34	$2.77 \times 10^{-02}$	-0.77	$3.07 \times 10^{-09}$
6. CNBC quality of life ranking [26]	-0.74	$1.87 \times 10^{-08}$	0.33	$3.22 \times 10^{-02}$	-0.77	$3.60 \times 10^{-09}$
7. % adult overweight/obesity [27]	-0.71	$1.33 \times 10^{-07}$	0.53	$3.14 \times 10^{-04}$	-0.59	$3.56 \times 10^{-05}$
8. Gallup Wellbeing score [4]	0.7	$3.17 \times 10^{-07}$	-0.33	$3.38 \times 10^{-02}$	0.73	$4.35 \times 10^{-08}$
9. % adult obesity [25]	-0.69	$3.10 \times 10^{-07}$	0.52	$4.11 \times 10^{-04}$	-0.59	$3.56 \times 10^{-05}$
10. America's Health Rankings, overall [24]	-0.69	$1.31 \times 10^{-06}$	0.4	$9.14 \times 10^{-03}$	-0.67	$2.65 \times 10^{-06}$
11. Life expectancy at birth [27]	0.67	$7.92 \times 10^{-07}$	-0.36	$1.59 \times 10^{-02}$	0.65	$2.58 \times 10^{-06}$
12. % child overweight/obesity [27]	-0.65	$2.58 \times 10^{-06}$	0.34	$2.82 \times 10^{-02}$	-0.64	$3.06 \times 10^{-06}$
13. % who eat fruit less than once a day [28]	-0.65	$2.58 \times 10^{-06}$	0.57	$7.45 \times 10^{-05}$	-0.51	$5.89 \times 10^{-04}$
14. % who eat vegetables less than once a day [28]	-0.61	$1.32 \times 10^{-05}$	0.53	$3.14 \times 10^{-04}$	-0.46	$1.72 \times 10^{-03}$
15. Median daily intake of fruits [28]	0.59	$3.56 \times 10^{-05}$	-0.59	$3.56 \times 10^{-05}$	0.41	$5.73 \times 10^{-03}$
16. Smoking rate [27]	-0.59	$3.81 \times 10^{-05}$	0.47	$1.60 \times 10^{-03}$	-0.48	$1.24 \times 10^{-03}$
17. Median daily intake of vegetables [28]	0.5	$7.25 \times 10^{-04}$	-0.56	$1.03 \times 10^{-04}$	0.31	$4.09 \times 10^{-02}$
18. Median household income [27]	0.48	$1.37 \times 10^{-03}$	-0.5	$8.58 \times 10^{-04}$	0.4	$9.07 \times 10^{-03}$
19. % high cholesterol [24]	-0.48	$1.26 \times 10^{-03}$	0.24	$1.16 \times 10^{-01}$	-0.48	$1.05 \times 10^{-03}$
20. Colorectal cancer rate [25]	-0.47	$1.72 \times 10^{-03}$	0.56	$1.37 \times 10^{-04}$	-0.27	$8.35 \times 10^{-02}$
21. Brain health ranking [29] (lower is better)	-0.46	$1.95 \times 10^{-03}$	0.55	$1.74 \times 10^{-04}$	-0.29	$5.43 \times 10^{-02}$
22. US Census Gini index score [30] (lower is better)	-0.44	$3.60 \times 10^{-03}$	0.11	$5.12 \times 10^{-01}$	-0.5	$6.22 \times 10^{-04}$
23. % with bachelor's degree or higher [6]	0.42	$4.86 \times 10^{-03}$	-0.43	$4.21 \times 10^{-03}$	0.33	$2.82 \times 10^{-02}$
24. Avg # poor mental health days, past 30 days [24]	-0.39	$9.87 \times 10^{-03}$	0.1	$5.31 \times 10^{-01}$	-0.48	$1.23 \times 10^{-03}$
25. Neuroticism Big Five personality trait [31]	-0.37	$1.33 \times 10^{-02}$	0.23	$1.35 \times 10^{-01}$	-0.37	$1.42 \times 10^{-02}$
26. Binge drinking rate [24]	0.34	$2.91 \times 10^{-02}$	-0.12	$4.88 \times 10^{-01}$	0.41	$6.23 \times 10^{-03}$
27. Farmers markets per 100,000 in pop. [28]	0.33	$2.96 \times 10^{-02}$	-0.01	$9.59 \times 10^{-01}$	0.42	$5.41 \times 10^{-03}$
28. Extraversion Big Five personality trait [31]	-0.33	$2.83 \times 10^{-02}$	0.13	$4.13 \times 10^{-01}$	-0.29	$5.36 \times 10^{-02}$
29. Avg # poor physical health days, past 30 days [24]	-0.32	$3.81 \times 10^{-02}$	0.16	$3.32 \times 10^{-01}$	-0.38	$1.16 \times 10^{-02}$
30. Strolling of the Heifers locavore score (lower is better) [32]	-0.31	$4.59 \times 10^{-02}$	-0.16	$3.32 \times 10^{-01}$	-0.45	$3.16 \times 10^{-03}$
31. % schools offering fruit/veg at celebrations [28]	0.25	$1.16 \times 10^{-01}$	-0.38	$1.36 \times 10^{-02}$	0.05	$7.75 \times 10^{-01}$
32. Openness Big Five personality trait [31]	0.23	$1.31 \times 10^{-01}$	-0.42	$5.43 \times 10^{-03}$	0.04	$7.95 \times 10^{-01}$
33. % cropland harvested for fruits/veg [28]	0.18	$2.53 \times 10^{-01}$	-0.53	$2.90 \times 10^{-04}$	-0.04	$7.95 \times 10^{-01}$
34. Conscientiousness Big Five personality trait [31]	-0.1	$5.31 \times 10^{-01}$	0.14	$3.97 \times 10^{-01}$	-0.05	$7.78 \times 10^{-01}$
35. % census tracts, healthy food retailer within 1/2 mile [28]	-0.06	$7.47 \times 10^{-01}$	-0.39	$1.09 \times 10^{-02}$	-0.24	$1.28 \times 10^{-01}$
36. George Mason overall freedom ranking [33] (lower is freer)	-0.02	$8.90 \times 10^{-01}$	-0.05	$7.73 \times 10^{-01}$	-0.1	$5.58 \times 10^{-01}$
37. Agreeableness Big Five personality trait [31]	0	$9.95 \times 10^{-01}$	0.24	$1.26 \times 10^{-01}$	0.08	$6.41 \times 10^{-01}$

TABLE S1. Identical to Tab. I but with liquids included. Spearman correlation coefficients,  $\hat{\rho}_s$ , and Benjamin-Hochberg q-values for caloric input  $C_{in}$ , caloric output  $C_{out}$ , and caloric ratio  $C_{rat} = C_{out}/C_{in}$  and demographic data related to food and physical activity, Big Five personality traits [31], health and well-being rankings by state, and socioeconomic status, correlated, ordered from strongest to weakest Spearman correlations with caloric ratio.



# The Lexicocalorimeter:

## The LCM

Other lexical  
meters

References

Health and/or well-being quantity	$\hat{\rho}_s$ for $C_{rat}$	q-val	$\hat{\rho}_s$ for $C_{in}$	q-val	$\hat{\rho}_s$ for $C_{out}$	q-val
1. % no physical activity in past 30 days [24]	-0.78	$3.07 \times 10^{-09}$	0.58	$4.91 \times 10^{-05}$	-0.66	$1.59 \times 10^{-06}$
2. % have been physically active in past 30 days [24]	0.78	$3.07 \times 10^{-09}$	-0.58	$5.50 \times 10^{-05}$	0.67	$1.31 \times 10^{-06}$
3. % high blood pressure [24]	-0.77	$3.07 \times 10^{-09}$	0.39	$1.16 \times 10^{-02}$	-0.78	$3.07 \times 10^{-09}$
4. Heart disease death rate [27]	-0.75	$1.02 \times 10^{-08}$	0.38	$1.24 \times 10^{-02}$	-0.73	$2.07 \times 10^{-08}$
5. Adult diabetes rate [25]	-0.74	$1.17 \times 10^{-08}$	0.34	$2.77 \times 10^{-02}$	-0.77	$3.07 \times 10^{-09}$
6. CNBC quality of life ranking [26]	-0.74	$1.87 \times 10^{-08}$	0.33	$3.22 \times 10^{-02}$	-0.77	$3.60 \times 10^{-09}$
7. % adult overweight/obesity [27]	-0.71	$1.33 \times 10^{-07}$	0.53	$3.14 \times 10^{-04}$	-0.59	$3.56 \times 10^{-05}$
8. Gallup Wellbeing score [4]	0.7	$3.17 \times 10^{-07}$	-0.33	$3.38 \times 10^{-02}$	0.73	$4.35 \times 10^{-08}$
9. % adult obesity [25]	-0.69	$3.10 \times 10^{-07}$	0.52	$4.11 \times 10^{-04}$	-0.59	$3.56 \times 10^{-05}$
10. America's Health Rankings, overall [24]	-0.69	$1.31 \times 10^{-06}$	0.4	$9.14 \times 10^{-03}$	-0.67	$2.65 \times 10^{-06}$
11. Life expectancy at birth [27]	0.67	$7.92 \times 10^{-07}$	-0.36	$1.59 \times 10^{-02}$	0.65	$2.58 \times 10^{-06}$
12. % child overweight/obesity [27]	-0.65	$2.58 \times 10^{-06}$	0.34	$2.82 \times 10^{-02}$	-0.64	$3.06 \times 10^{-06}$
13. % who eat fruit less than once a day [28]	-0.65	$2.58 \times 10^{-06}$	0.57	$7.45 \times 10^{-05}$	-0.51	$5.89 \times 10^{-04}$
14. % who eat vegetables less than once a day [28]	-0.61	$1.32 \times 10^{-05}$	0.53	$3.14 \times 10^{-04}$	-0.46	$1.72 \times 10^{-03}$
15. Median daily intake of fruits [28]	0.59	$3.56 \times 10^{-05}$	-0.59	$3.56 \times 10^{-05}$	0.41	$5.73 \times 10^{-03}$
16. Smoking rate [27]	-0.59	$3.81 \times 10^{-05}$	0.47	$1.60 \times 10^{-03}$	-0.48	$1.24 \times 10^{-03}$
17. Median daily intake of vegetables [28]	0.5	$7.25 \times 10^{-04}$	-0.56	$1.03 \times 10^{-04}$	0.31	$4.09 \times 10^{-02}$
18. Median household income [27]	0.48	$1.37 \times 10^{-03}$	-0.5	$8.58 \times 10^{-04}$	0.4	$9.07 \times 10^{-03}$
19. % high cholesterol [24]	-0.48	$1.26 \times 10^{-03}$	0.24	$1.16 \times 10^{-01}$	-0.48	$1.05 \times 10^{-03}$
20. Colorectal cancer rate [25]	-0.47	$1.72 \times 10^{-03}$	0.56	$1.37 \times 10^{-04}$	-0.27	$8.35 \times 10^{-02}$
21. Brain health ranking [29] (lower is better)	-0.46	$1.95 \times 10^{-03}$	0.55	$1.74 \times 10^{-04}$	-0.29	$5.43 \times 10^{-02}$
22. US Census Gini index score [30] (lower is better)	-0.44	$3.60 \times 10^{-03}$	0.11	$5.12 \times 10^{-01}$	-0.5	$6.22 \times 10^{-04}$
23. % with bachelor's degree or higher [6]	0.42	$4.86 \times 10^{-03}$	-0.43	$4.21 \times 10^{-03}$	0.33	$2.82 \times 10^{-02}$
24. Avg # poor mental health days, past 30 days [24]	-0.39	$9.87 \times 10^{-03}$	0.1	$5.31 \times 10^{-01}$	-0.48	$1.23 \times 10^{-03}$
25. Neuroticism Big Five personality trait [31]	-0.37	$1.33 \times 10^{-02}$	0.23	$1.35 \times 10^{-01}$	-0.37	$1.42 \times 10^{-02}$
26. Binge drinking rate [24]	0.34	$2.91 \times 10^{-02}$	-0.12	$4.88 \times 10^{-01}$	0.41	$6.23 \times 10^{-03}$
27. Farmers markets per 100,000 in pop. [28]	0.33	$2.96 \times 10^{-02}$	-0.01	$9.59 \times 10^{-01}$	0.42	$5.41 \times 10^{-03}$
28. Extraversion Big Five personality trait [31]	-0.33	$2.83 \times 10^{-02}$	0.13	$4.13 \times 10^{-01}$	-0.29	$5.36 \times 10^{-02}$
29. Avg # poor physical health days, past 30 days [24]	-0.32	$3.81 \times 10^{-02}$	0.16	$3.32 \times 10^{-01}$	-0.38	$1.16 \times 10^{-02}$
30. Strolling of the Heifers locavore score (lower is better) [32]	-0.31	$4.59 \times 10^{-02}$	-0.16	$3.32 \times 10^{-01}$	-0.45	$3.16 \times 10^{-03}$
31. % schools offering fruit/veg at celebrations [28]	0.25	$1.16 \times 10^{-01}$	-0.38	$1.36 \times 10^{-02}$	0.05	$7.75 \times 10^{-01}$
32. Openness Big Five personality trait [31]	0.23	$1.31 \times 10^{-01}$	-0.42	$5.43 \times 10^{-03}$	0.04	$7.95 \times 10^{-01}$
33. % cropland harvested for fruits/veg [28]	0.18	$2.53 \times 10^{-01}$	-0.53	$2.90 \times 10^{-04}$	-0.04	$7.95 \times 10^{-01}$
34. Conscientiousness Big Five personality trait [31]	-0.1	$5.31 \times 10^{-01}$	0.14	$3.97 \times 10^{-01}$	-0.05	$7.78 \times 10^{-01}$
35. % census tracts, healthy food retailer within 1/2 mile [28]	-0.06	$7.47 \times 10^{-01}$	-0.39	$1.09 \times 10^{-02}$	-0.24	$1.28 \times 10^{-01}$
36. George Mason overall freedom ranking [33] (lower is freer)	-0.02	$8.90 \times 10^{-01}$	-0.05	$7.73 \times 10^{-01}$	-0.1	$5.58 \times 10^{-01}$
37. Agreeableness Big Five personality trait [31]	0	$9.95 \times 10^{-01}$	0.24	$1.26 \times 10^{-01}$	0.08	$6.41 \times 10^{-01}$

TABLE S1. Identical to Tab. I but with liquids included. Spearman correlation coefficients,  $\hat{\rho}_s$ , and Benjamin-Hochberg  $q$ -values for caloric input  $C_{in}$ , caloric output  $C_{out}$ , and caloric ratio  $C_{rat} = C_{out}/C_{in}$  and demographic data related to food and physical activity, Big Five personality traits [31], health and well-being rankings by state, and socioeconomic status, correlated, ordered from strongest to weakest Spearman correlations with caloric ratio.





# The Lexicocalorimeter:

Health and/or well-being quantity	$\beta_s$ for $C_{diff}$	q-val	$\beta_s$ for $C_{in}$	q-val	$\beta_s$ for $C_{out}$	q-val
1. % no physical activity in past 30 days [24]	-0.78	$3.42 \times 10^{-09}$	0.58	$4.91 \times 10^{-05}$	-0.66	$1.59 \times 10^{-06}$
2. % have been physically active in past 30 days [24]	0.78	$3.42 \times 10^{-09}$	-0.58	$5.50 \times 10^{-05}$	0.67	$1.39 \times 10^{-06}$
3. % high blood pressure [24]	-0.77	$3.60 \times 10^{-09}$	0.39	$1.16 \times 10^{-02}$	-0.78	$3.42 \times 10^{-09}$
4. Heart disease death rate [27]	-0.75	$1.09 \times 10^{-08}$	0.38	$1.24 \times 10^{-02}$	-0.73	$2.07 \times 10^{-08}$
5. Adult diabetes rate [25]	-0.74	$1.25 \times 10^{-08}$	0.34	$2.77 \times 10^{-02}$	-0.77	$3.42 \times 10^{-09}$
6. CNBC quality of life ranking [26]	-0.74	$2.07 \times 10^{-08}$	0.33	$3.22 \times 10^{-02}$	-0.77	$3.60 \times 10^{-09}$
7. % adult overweight/obesity [27]	-0.7	$1.48 \times 10^{-07}$	0.53	$3.14 \times 10^{-04}$	-0.59	$3.56 \times 10^{-05}$
8. Gallup Wellbeing score [4]	0.7	$3.08 \times 10^{-07}$	-0.33	$3.38 \times 10^{-02}$	0.73	$4.35 \times 10^{-08}$
9. % adult obesity [25]	-0.69	$3.40 \times 10^{-07}$	0.52	$4.11 \times 10^{-04}$	-0.59	$3.56 \times 10^{-05}$
10. America's Health Rankings, overall [24]	-0.69	$1.39 \times 10^{-06}$	0.4	$9.14 \times 10^{-03}$	-0.67	$2.77 \times 10^{-06}$
11. Life expectancy at birth [27]	0.67	$9.05 \times 10^{-07}$	-0.36	$1.59 \times 10^{-02}$	0.65	$2.67 \times 10^{-06}$
12. % who eat fruit less than once a day [28]	-0.65	$2.67 \times 10^{-06}$	0.57	$7.45 \times 10^{-06}$	-0.51	$5.89 \times 10^{-04}$
13. % child overweight/obesity [27]	-0.64	$3.06 \times 10^{-06}$	0.34	$2.78 \times 10^{-02}$	-0.64	$3.06 \times 10^{-06}$
14. % who eat vegetables less than once a day [28]	-0.61	$1.54 \times 10^{-05}$	0.53	$3.14 \times 10^{-04}$	-0.46	$1.69 \times 10^{-03}$
15. Median daily intake of fruits [28]	0.59	$3.56 \times 10^{-05}$	-0.59	$3.56 \times 10^{-05}$	0.41	$5.73 \times 10^{-03}$
16. Smoking rate [27]	-0.59	$3.77 \times 10^{-05}$	0.47	$1.60 \times 10^{-03}$	-0.48	$1.24 \times 10^{-03}$
17. Median daily intake of vegetables [28]	0.5	$7.64 \times 10^{-04}$	-0.56	$1.03 \times 10^{-04}$	0.31	$4.09 \times 10^{-02}$
18. Median household income [27]	0.48	$1.38 \times 10^{-03}$	-0.5	$8.58 \times 10^{-04}$	0.4	$9.07 \times 10^{-03}$
19. % high cholesterol [24]	-0.48	$1.28 \times 10^{-03}$	0.24	$1.15 \times 10^{-01}$	-0.48	$1.05 \times 10^{-03}$
20. Colorectal cancer rate [25]	-0.47	$1.68 \times 10^{-03}$	0.56	$1.37 \times 10^{-04}$	-0.27	$8.35 \times 10^{-02}$
21. Brain health ranking [29] (lower is better)	-0.46	$1.91 \times 10^{-03}$	0.55	$1.74 \times 10^{-04}$	-0.29	$5.43 \times 10^{-02}$
22. US Census Gini index score [30] (lower is better)	-0.44	$3.41 \times 10^{-03}$	0.11	$5.12 \times 10^{-01}$	-0.5	$6.22 \times 10^{-04}$
23. % with bachelor's degree or higher [6]	0.42	$4.99 \times 10^{-03}$	-0.43	$4.21 \times 10^{-03}$	0.33	$2.78 \times 10^{-02}$
24. Avg # poor mental health days, past 30 days [24]	-0.39	$1.05 \times 10^{-02}$	0.1	$5.31 \times 10^{-01}$	-0.48	$1.23 \times 10^{-03}$
25. Neuroticism Big Five personality trait [31]	-0.37	$1.30 \times 10^{-02}$	0.23	$1.35 \times 10^{-01}$	-0.37	$1.42 \times 10^{-02}$
26. Extraversion Big Five personality trait [31]	-0.34	$2.78 \times 10^{-02}$	0.13	$4.13 \times 10^{-01}$	-0.29	$5.36 \times 10^{-02}$
27. Farmers markets per 100,000 in pop. [28]	0.33	$2.88 \times 10^{-02}$	-0.01	$9.59 \times 10^{-01}$	0.42	$5.41 \times 10^{-03}$
28. Binge drinking rate [24]	0.33	$2.88 \times 10^{-02}$	-0.12	$4.88 \times 10^{-01}$	0.41	$6.23 \times 10^{-03}$
29. Avg # poor physical health days, past 30 days [24]	-0.32	$3.83 \times 10^{-02}$	0.16	$3.32 \times 10^{-01}$	-0.38	$1.16 \times 10^{-02}$
30. Strolling of the Heifers locavore score (lower is better) [32]	-0.31	$4.52 \times 10^{-02}$	-0.16	$3.32 \times 10^{-01}$	-0.45	$3.16 \times 10^{-03}$
31. % schools offering fruit/veg at celebrations [28]	0.25	$1.13 \times 10^{-01}$	-0.38	$1.36 \times 10^{-02}$	0.05	$7.75 \times 10^{-01}$
32. Openness Big Five personality trait [31]	0.23	$1.30 \times 10^{-01}$	-0.42	$5.43 \times 10^{-03}$	0.04	$7.95 \times 10^{-01}$
33. % cropland harvested for fruits/veg [28]	0.18	$2.58 \times 10^{-01}$	-0.53	$2.90 \times 10^{-04}$	-0.04	$7.95 \times 10^{-01}$
34. Conscientiousness Big Five personality trait [31]	-0.1	$5.31 \times 10^{-01}$	0.14	$3.97 \times 10^{-01}$	-0.05	$7.78 \times 10^{-01}$
35. % census tracts, healthy food retailer within 1/2 mile [28]	-0.06	$7.41 \times 10^{-01}$	-0.39	$1.09 \times 10^{-02}$	-0.24	$1.28 \times 10^{-01}$
36. George Mason overall freedom ranking [33] (lower is freer)	-0.02	$8.82 \times 10^{-01}$	-0.05	$7.73 \times 10^{-01}$	-0.1	$5.58 \times 10^{-01}$
37. Agreeableness Big Five personality trait [31]	0	$9.85 \times 10^{-01}$	0.24	$1.26 \times 10^{-01}$	0.08	$6.41 \times 10^{-01}$

TABLE S3. Identical to Tab. 1 but including liquids and using a caloric difference rather than caloric ratio. Spearman correlation coefficients,  $\beta_s$ , and Benjamin-Hochberg q-values for caloric input  $C_{in}$ , caloric output  $C_{out}$ , and caloric difference  $C_{diff}(\alpha) = \alpha C_{out} + (1 - \alpha)C_{in}$  and demographic data related to food and physical activity. Big Five personality traits [31], health and well-being rankings by state, and socioeconomic status, correlated, ordered from strongest to weakest Spearman correlations with caloric ratio. We chose  $\alpha$  so that the average of  $C_{out}$  matched the average of  $C_{in}$ .

## The LCM

Other lexical meters

References

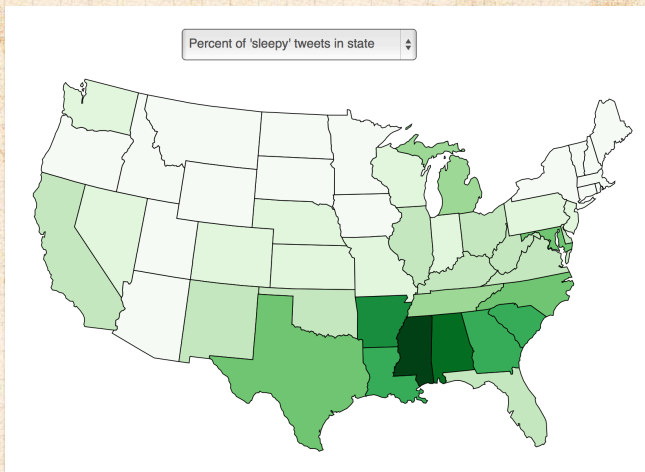


# The Insomniometer:

The LCM

Other lexical  
meters

References



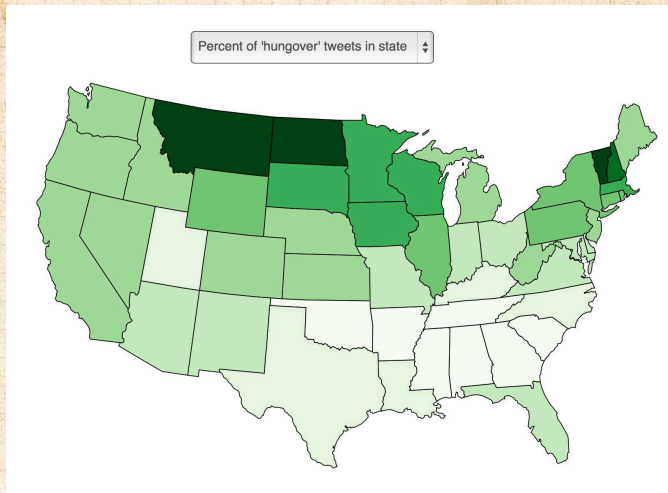
Correlation with CDC's Sleep Insufficiency measure [↗](#):

$$r_s = .48, p = 5.3 \times 10^{-4}.$$



# The Hangoverometer:

COcoNuTS  
@networksvox  
Lexicalcalorimeter



The LCM

Other lexical meters

References



Correlation with Binge drinking estimates:  $r_s = .72$ ,  
 $p = 5.8 \times 10^{-9}$ .





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