Social Networks Shape Beliefs and Behavior: Evidence from Social Distancing During the COVID-19 Pandemic

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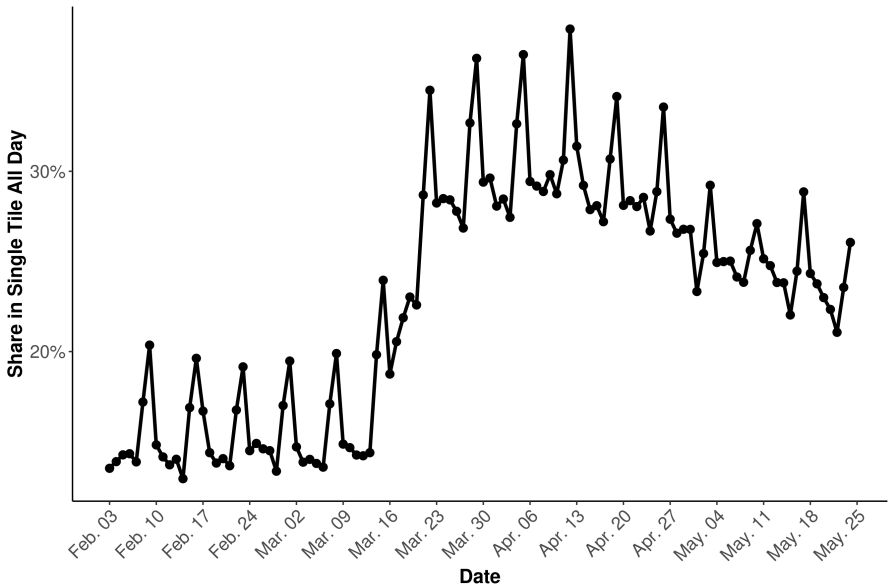
Introduction

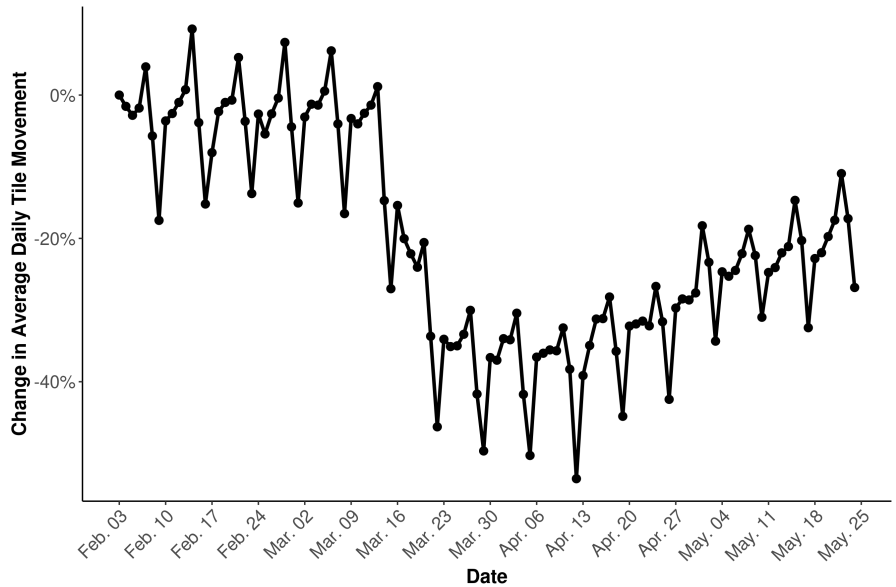
- Global COVID-19 Pandemic
  - Persistent appeals for people to social distance to contain pandemic
  - Differences in compliance with and support for distancing policies
- What shapes beliefs about pandemic and social distancing behavior?
- $\rightarrow$ Focus on the role of social networks
- Use individual level de-identified data on social networks and mobility from Facebook to show that
  1. social network exposure to COVID-19 shapes social distancing
  2. social network exposure to COVID-19 shapes beliefs about pandemic

Data

- Anonymized network data from Facebook on U.S. users
  - Friendship links, location of friends
  - Individual level location and characteristics
- Proxy for Social Distancing: mobility behavior
  - Users with location history settings Summary Statistics
  - Two measures of mobility
    - Staying in home tile (600m square) on given day
    - Numbers of tiles visited on given day
- Public posting behavior and group memberships

Mobility Over Time





- Substantial reduction in mobility starting in mid-March
- Focus on staying in home tile but all results consistent for both

Friend Exposure and Social Distancing Behavior

- Higher friend exposure to COVID cases $\rightarrow$ More social distancing?

Friend Exposure and Social Distancing Behavior

- Higher friend exposure to COVID cases $\rightarrow$ More social distancing?
- Friend Exposure to COVID-19
  - Measured as of March 15 when President Trump declared national emergency

$$FriendExposure_i^{Mar15} = \sum_{j=1}^{J} FracFriends_{ij}^{Mar15} \times COVID19Cases_j^{Mar15}.$$

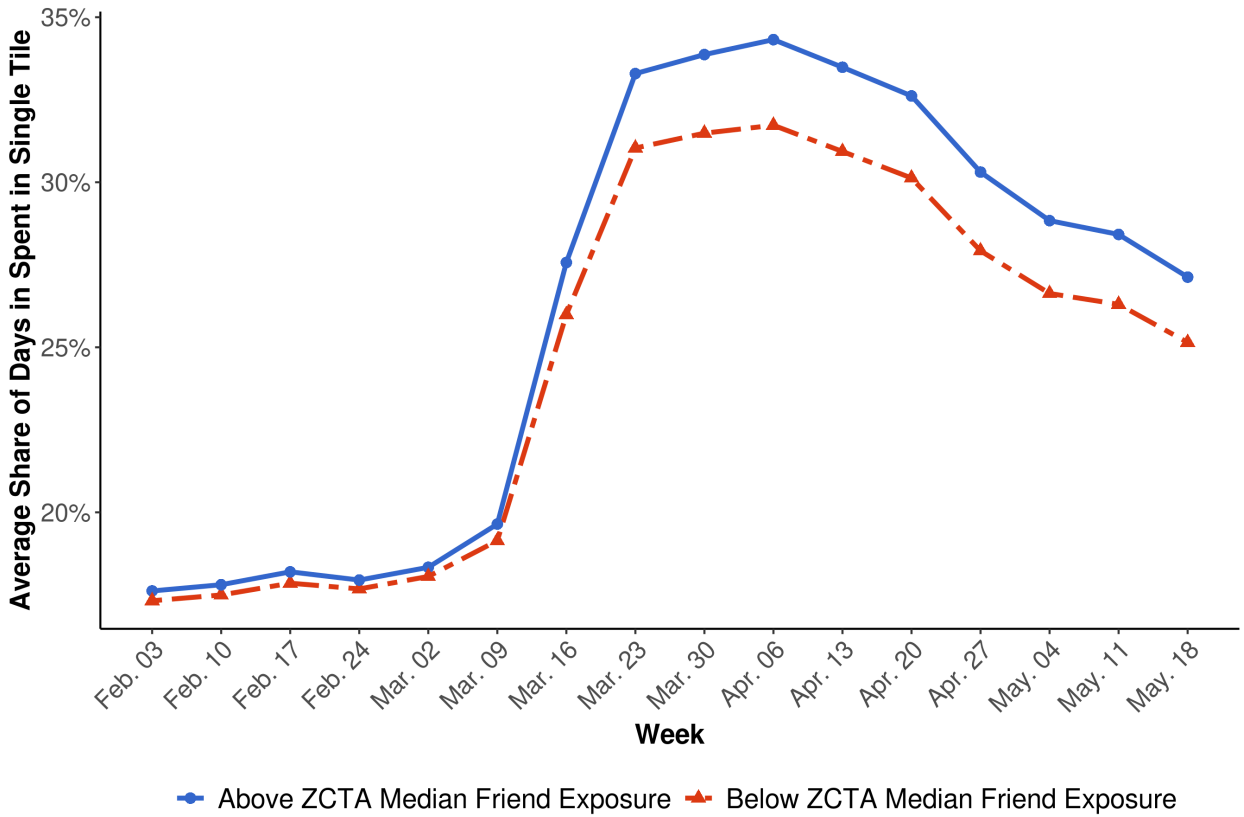
  - Concern: Correlated with other characteristics

    $\rightarrow$ For now: Within ZCTA

    $\rightarrow$ Later:
    - Control for observables
    - Changes on changes specification

Friend Exposure and Social Distancing Behavior

- Two groups: Above and below median friend exposure within ZCTA

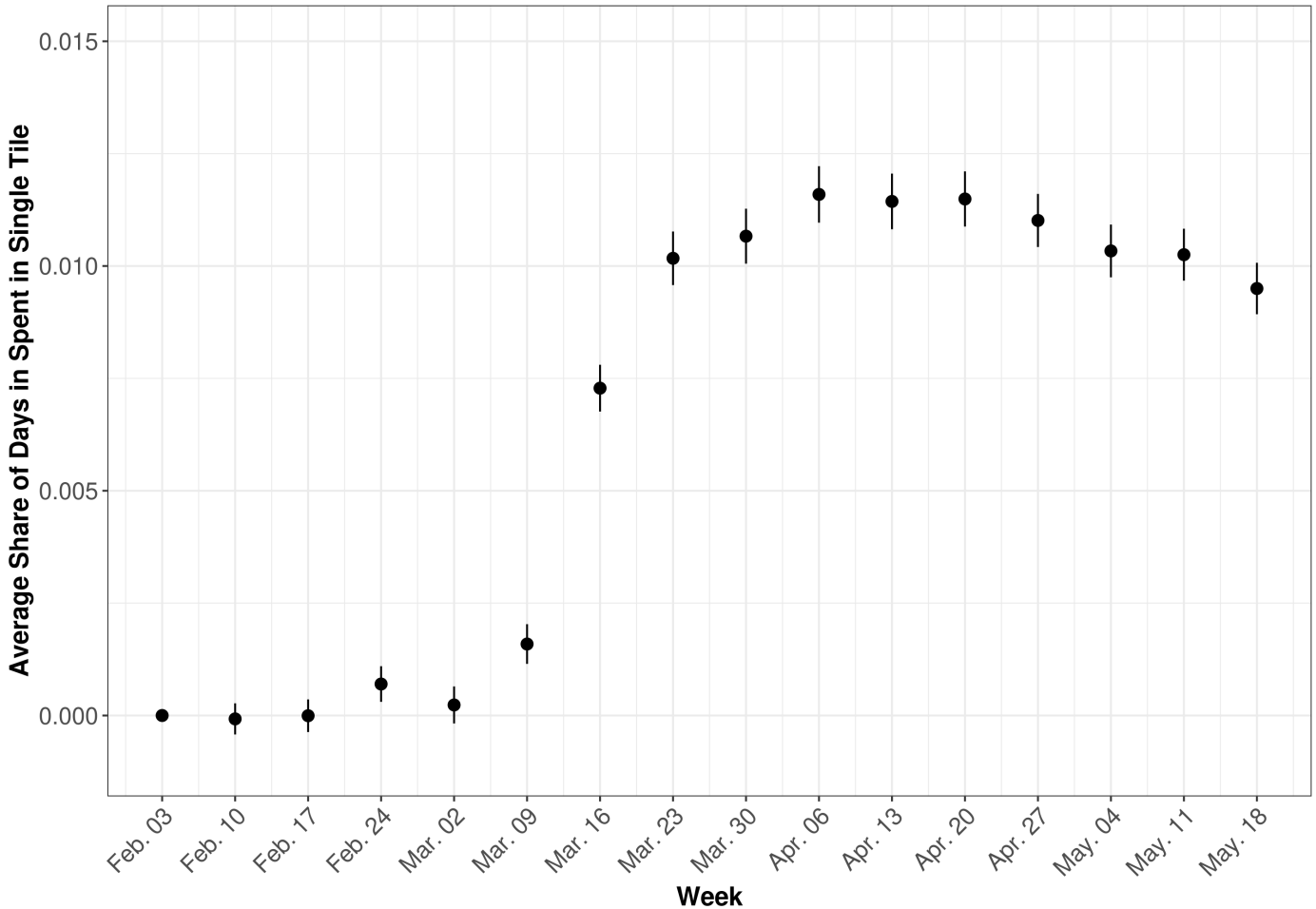


- Identical baseline of 18%
- Above median friend exposure $\rightarrow$ 35% stay home in April
- Below median friend exposure $\rightarrow$ less than 32%

Friend Exposure and Social Distancing Behavior

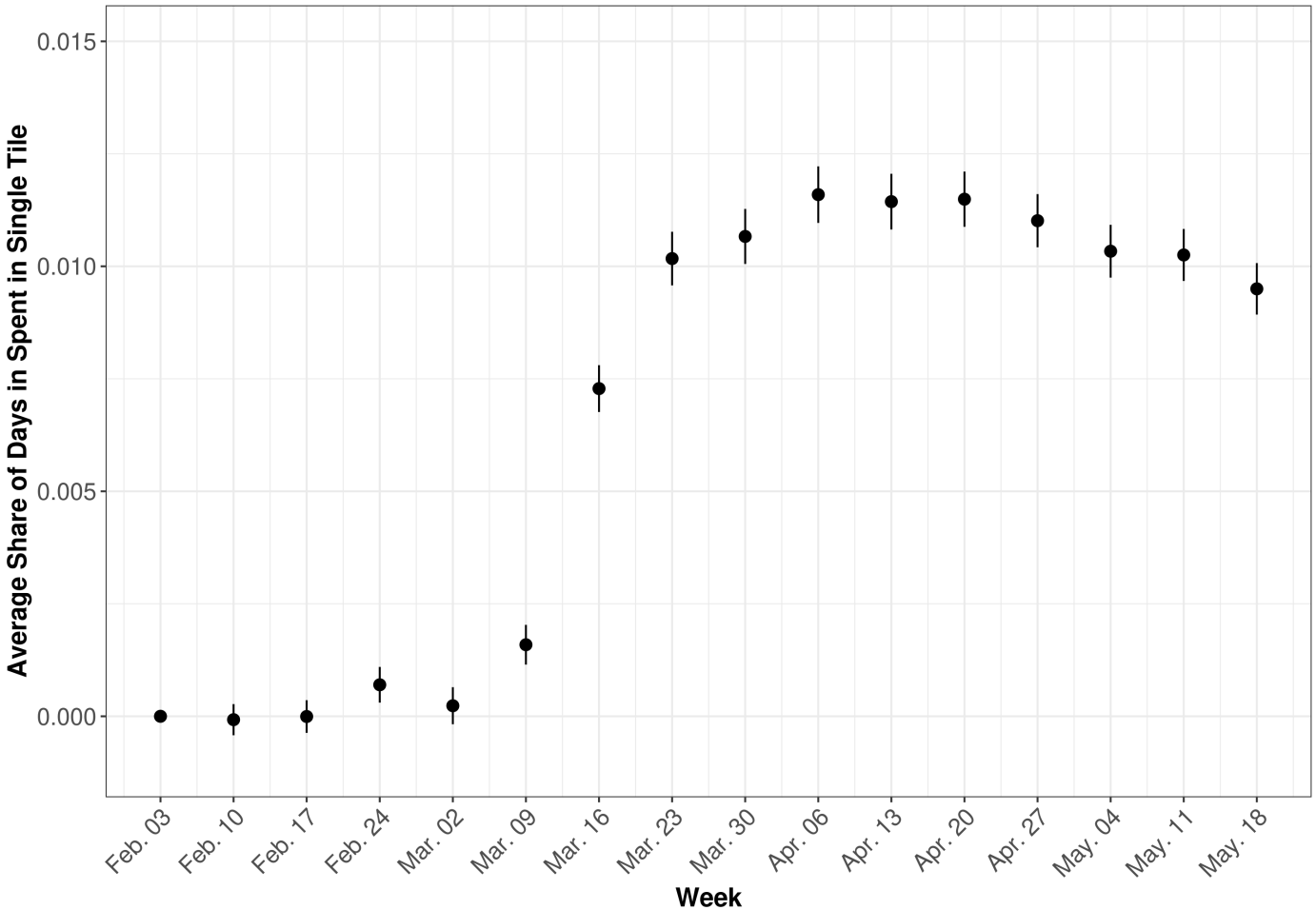
- So far: Raw averages
- Concern: Differences between high and low exposure individuals
- Now: Include controls
  - Individual FE
  - Time varying effects of individual and location characteristics
    - College, age, gender, iPhone, tablet, ZCTA
  - Time varying effects of network characteristics
    - Friend weighted median HH income, population density, share urban

Friend Exposure and Social Distancing Behavior



- Above median friend exposure $\rightarrow$ Staying home $\uparrow$ 1.2 ppt (3.8% increase relative to below median average of 32%)
- One SD friend exposure $\uparrow$ Staying home $\uparrow \approx \frac{1}{2}$ college degree
- Heterogeneity

Friend Exposure and Social Distancing Behavior



- Differential ability to work from home?
  - Same patterns on weekdays and weekends Click here
  - Controlling for exact college (in addition to other demographics) Click here

Changes in Friend Exposure

- So far: Friend exposure at onset of pandemic
- Concern: Friend exposure at onset correlated with unobservables
- Now: *Changes* in friend exposure and distancing
  - Early and subsequent hotspots very different
  - Correlation of observables with friend exposure varies over time
    - Onset of pandemic: Friend exposure *positively* correlated with college
    - Later: Friend exposure *negatively* correlated with college

  $\rightarrow$ Unlikely that effect of unobservable characteristics changes over time in the same way as geographic spread of pandemic
- Maps
- Correlation Table

Changes in Friend Exposure and Social Distancing Behavior

$$\Delta Y_{it} = \sigma_0 + \sum_{j=1}^{t} \sigma_{1j} ChangeFriendExposure_{ij} + \sigma_2 X_i + \sigma_3 N_i + \epsilon_{it}$$

	Monthly Change in Δ Stay at Home						
	All months	All months	March	April	May	June	July
Δ log(Friend Exposure + 1), All Months	0.206***	0.261***					
	(0.029)	(0.032)					
Δ log(Friend Exposure + 1), March			0.207***	0.006	-0.076**	0.097	0.037
			(0.046)	(0.040)	(0.048)	(0.054)	(0.064)
Δ log(Friend Exposure + 1), April				0.035	0.096	0.329***	0.069**
				(0.052)	(0.056)	(0.061)	(0.071)
Δ log(Friend Exposure + 1), May					0.379***	0.044	-0.057
					(0.082)	(0.078)	(0.094)
Δ log(Friend Exposure + 1), June						0.854***	-0.329*
						(0.114)	(0.127)
Δ log(Friend Exposure + 1), July							0.323**
							(0.138)
Other Network Exposure FE	Y x Month	Y x Month	Y	Y	Y	Y	Y
Zip Code x Age Group x Gender x Has College x Has Tablet x Has iPhone	Y x Month	Y x Month	Y	Y	Y	Y	Y
User FE		Y					
R-Squared	0.211	0.287	0.174	0.141	0.150	0.146	0.145
Sample Mean	1.611	1.456	14.214	-0.923	-5.989	-1.068	0.679
N	30,742,008	29,777,929	6,688,448	6,579,359	6,169,176	5,848,722	5,456,303

- Increase in friend exposure $\rightarrow$ Increase in staying home

Changes in Friend Exposure and Social Distancing Behavior

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- Changes in friend exposure affect change in behavior in *same* month

Friend Exposure and Beliefs about COVID-19

- So far: Individuals with higher friend exposure engage in more social distancing. Why?
- Now: Effect of friend exposure on beliefs about COVID-19

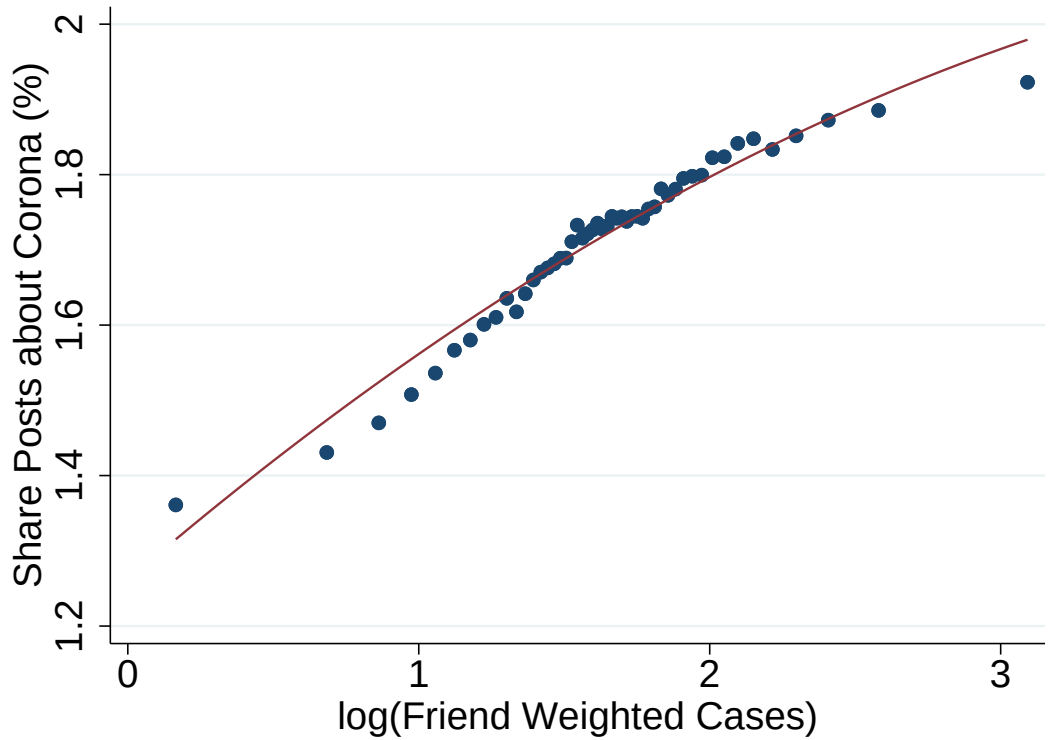
Friend Exposure and Beliefs about COVID-19

$$Y_i = \delta_0 + \delta_1 \log(\mathit{FriendExposure}_i) + \delta_2 Z_i + \delta_3 C_i + \epsilon_i$$

- Outcomes
  - Posting about COVID-19
  - Oppose or support social distancing
  - General sentiment of posts (positive vs. negative)
  - Membership in reopen groups
- Controls
  - Other network exposure FE
  - Interaction of location and individual characteristics (Zip Code * Age Group * Gender * Has College * Has Tablet * Has iPhone)

Friend Exposure and Beliefs about COVID-19

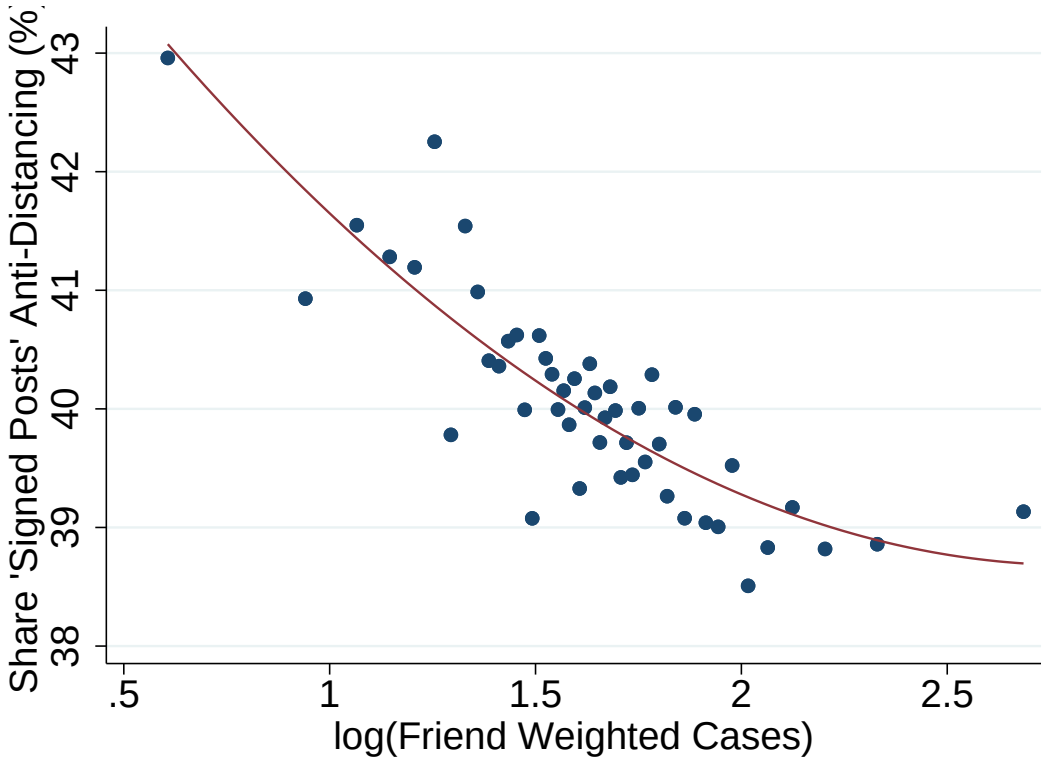
$$ShareOfPosts\_COVID_i = \delta_0 + \delta_1 \log(FriendExposure_i) + \delta_2 Z_i + \delta_3 C_i + \epsilon_i$$



- Higher friend exposure $\rightarrow$ More posts about COVID-19
- Doubling of friend exposure $\rightarrow$ Share of posts about COVID $\uparrow$ 17.2pp or 9.8% of baseline

Friend Exposure and Beliefs about COVID-19

$$ShareOfPosts\_Oppose_i = \delta_0 + \delta_1 \log(FriendExposure_i) + \delta_2 Z_i + \delta_3 C_i + \epsilon_i$$



- Posts opposing restrictions among all opposing or supporting
- Higher friend exposure $\rightarrow$ Fewer posts opposing social distancing
- Doubling of friend exposure $\rightarrow$ Share opposing social distancing $\downarrow$ 1.3pp or 3.7% of baseline

Friend Exposure and Beliefs about COVID-19

$$Y_i = \delta_0 + \delta_1 \log(\mathit{FriendExposure}_i) + \delta_2 Z_i + \delta_3 C_i + \epsilon_i$$

- Higher friend exposure (doubling) to COVID-19 cases:
  - More posts about COVID-19
  - Fewer posts opposing social distancing measures
  - **General sentiment decrease**
    - General sentiment $\downarrow$ 3.5% of baseline
  - Lower likelihood of being part of reopen group

Friend Exposure and Beliefs about COVID-19

$$Y_i = \delta_0 + \delta_1 \log(\mathit{FriendExposure}_i) + \delta_2 Z_i + \delta_3 C_i + \epsilon_i$$

- Higher friend exposure (doubling) to COVID-19 cases:
  - More posts about COVID-19
  - Fewer posts opposing social distancing measures
  - General sentiment decrease
  - **Lower likelihood of being part of reopen group**
    - Prob(Reopen Group) $\downarrow$ 0.09 pp or 7.35% of baseline

ZCTA Friend Exposure: Establishments Visited and Spending

- ZCTA level analysis
  - Safegraph mobility and transaction data
  - Social Connectedness Index (SCI)

  $\rightarrow$ More evidence on mechanism

  $\rightarrow$ But: Higher potential for confounds

- Behavioral response $\rightarrow$ reduce physical interactions
- Establishments visited
  - Less visits if non-essential (arts, entertainment, food & drinks)
  - No difference if essential or low contact (health care, social assistance, parks)
- Type of spending
  - Reduced spending at Starbucks
  - No differential spending at Amazon

Conclusion

- Higher friend exposure to COVID-19 cases $\rightarrow$ More social distancing
  - Exposure at onset of pandemic affects social distancing for months
  - Not driven by ability to work from home
  - Changes in friend exposure affect changes in mobility

  $\rightarrow$ Friends influence health behavior

- Higher friend exposure to COVID-19 cases
  - More posts about COVID-19
  - Post less likely to oppose social distancing measures
  - Less likely to be member of reopen group

  $\rightarrow$ Friends influence beliefs about current events

Appendix

Summary Statistics - Mobility Sample

	Mean	SD	P10	P25	P50	P75	P90
Age	43.58	14.93	26	32	42	54	63
Female	0.53	0.50	0	0	1	1	1
Has College	0.53	0.50	0	0	1	1	1
Has iPhone	0.25	0.43	0	0	0	0	1
Has Tablet	0.53	0.50	0	0	1	1	1
Zip Code Income	$58,792	$21,961	$36,160	$43,648	$54,000	$69,203	$88,096
Number of Friends	532.80	326.61	193	276	441	718	1047
Friend Exposure to Cases	10.35	19.34	0.74	1.77	4.49	11.12	26.31
Staying at home (Feb)							
- All	18.33	29.35	0	0	0	28.57	66.67
- Weekend	19.39	34.44	0	0	0	50.00	100.00
- Weekday	16.83	29.80	0	0	0	20.00	66.67
Bing tiles visited (Feb)							
- All	10.96	9.07	1.57	3.43	9.00	15.86	23.43
- Weekend	10.57	9.79	1.00	3.00	7.50	15.50	24.50
- Weekday	11.34	9.77	1.50	3.40	9.00	16.20	24.60

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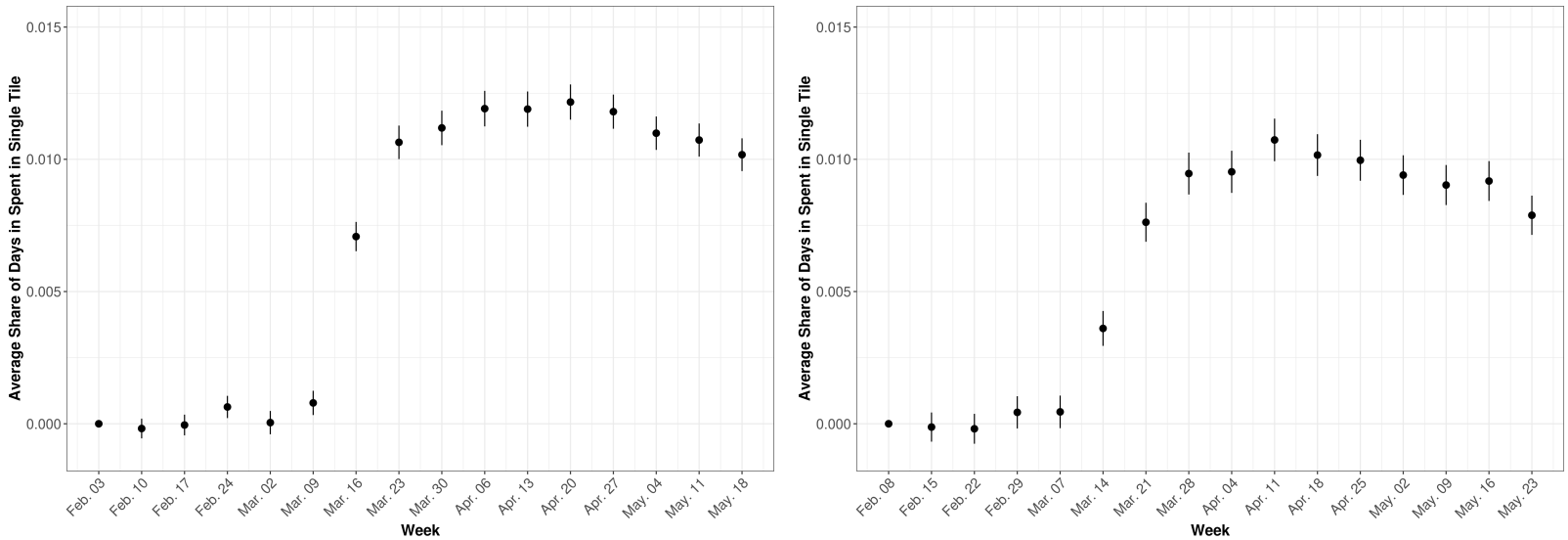
Friend Exposure and Social Distancing - Heterogeneity

	%Δ Stay at Home					
log(Friend Exposure) x I(Age < 35)	1.241***					
	(0.042)					
log(Friend Exposure) x I(Age 35-55)	0.960***					
	(0.033)					
log(Friend Exposure) x I(Age > 55)	0.412***					
	(0.038)					
log(Friend Exposure) x Female		0.949***				
		(0.032)				
log(Friend Exposure) x Male		0.796***				
		(0.033)				
log(Friend Exposure) x College			1.321***			
			(0.034)			
log(Friend Exposure) x No College			0.443***			
			(0.031)			
log(Friend Exposure) x Zip Income First Tertile				0.386***		
				(0.037)		
log(Friend Exposure) x Zip Income Second Tertile				0.794***		
				(0.036)		
log(Friend Exposure) x Zip Income Third Tertile				1.608***		
				(0.045)		
log(Friend Exposure) x County Cases First Tertile					0.676***	
					(0.030)	
log(Friend Exposure) x County Cases Second Tertile					1.384***	
					(0.058)	
log(Friend Exposure) x County Cases Third Tertile					1.245***	
					(0.055)	
log(Friend Exposure - Rank 1 - 25)						0.204***
						(0.017)
log(Friend Exposure - Rank 26 - 50)						0.112***
						(0.017)
log(Friend Exposure - Rank 51 - 75)						0.082***
						(0.017)
log(Friend Exposure - Rank 76 - 100)						0.098***
						(0.017)
Other Network Exposure FE	Y	Y	Y	Y	Y	Y
Zip Code x Age Group x Gender x Has College x Has Tablet x Has iPhone	Y	Y	Y	Y	Y	Y
R-Squared	0.175	0.175	0.175	0.175	0.175	0.177
Sample Mean	13.800	13.800	13.800	13.800	13.800	14.488
F Test (Rank 1-25 = Rank 76-100)						17.328***
N	6,400,738	6,400,738	6,400,738	6,400,738	6,400,738	5,684,469

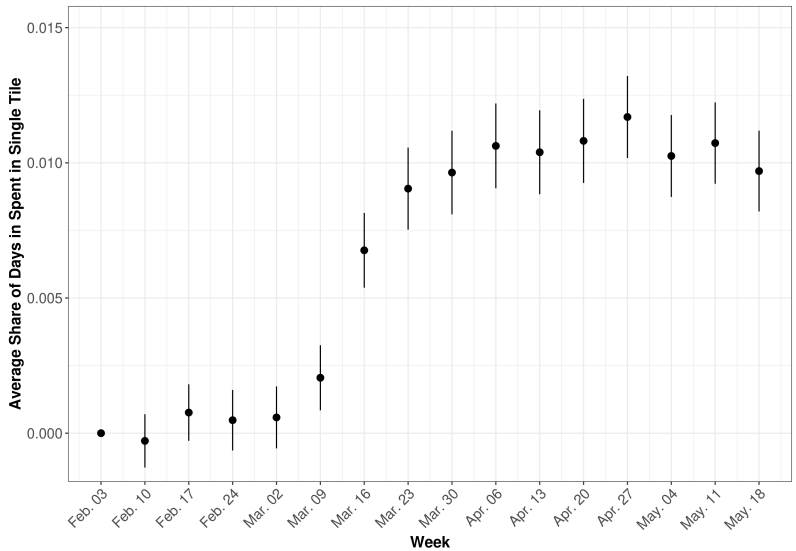
Back

Friend Exposure and Social Distancing Behavior - Weekdays and Weekends



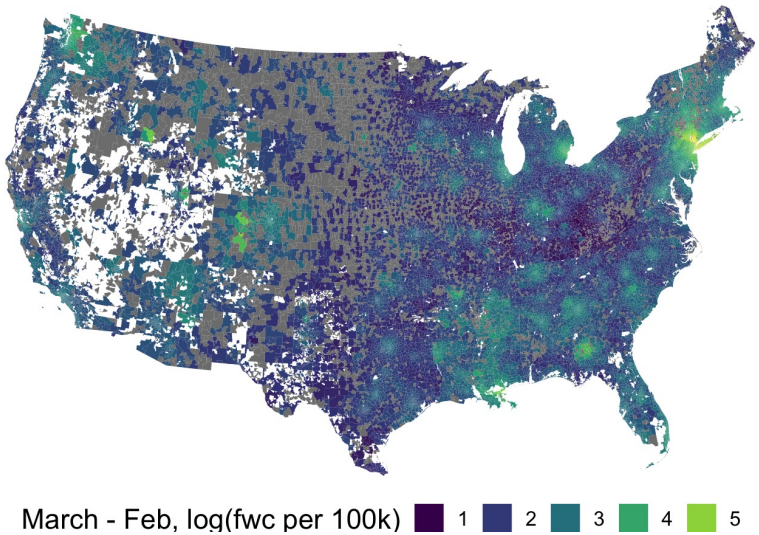
- Same pattern on weekdays and weekends
- $\rightarrow$ evidence against differences in ability to work from home being driving force behind observed patterns
- Back

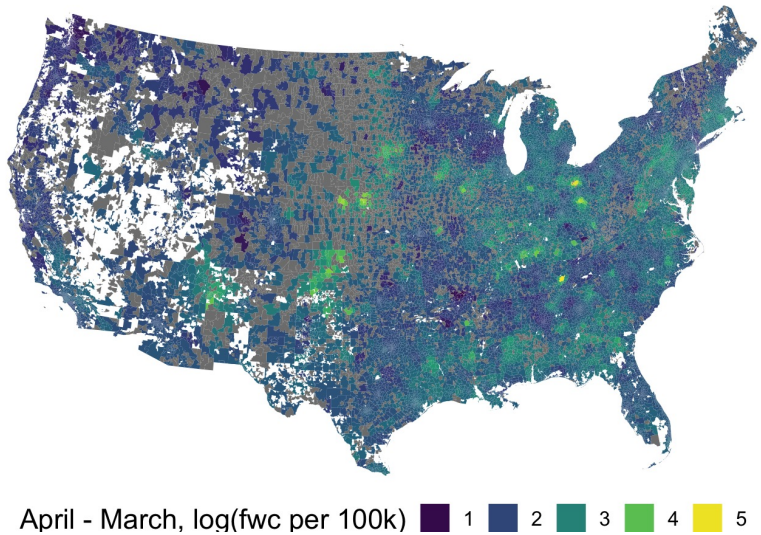
Friend Exposure and Social Distancing Behavior - Controlling for Exact College

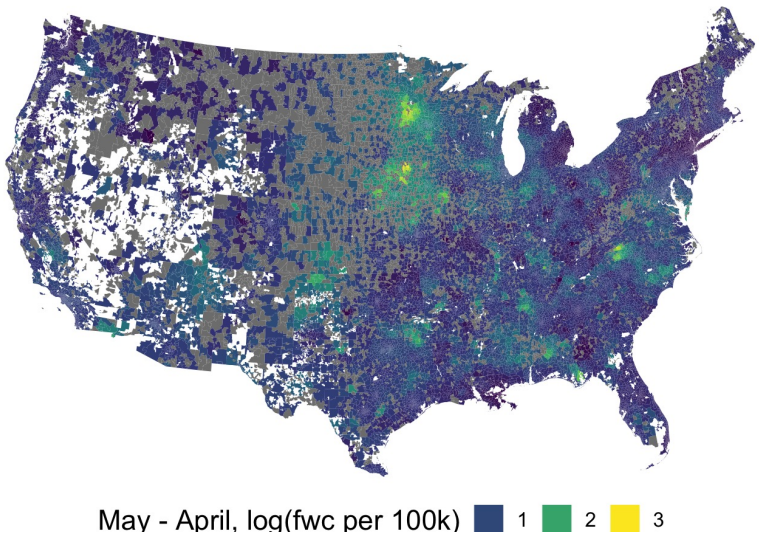


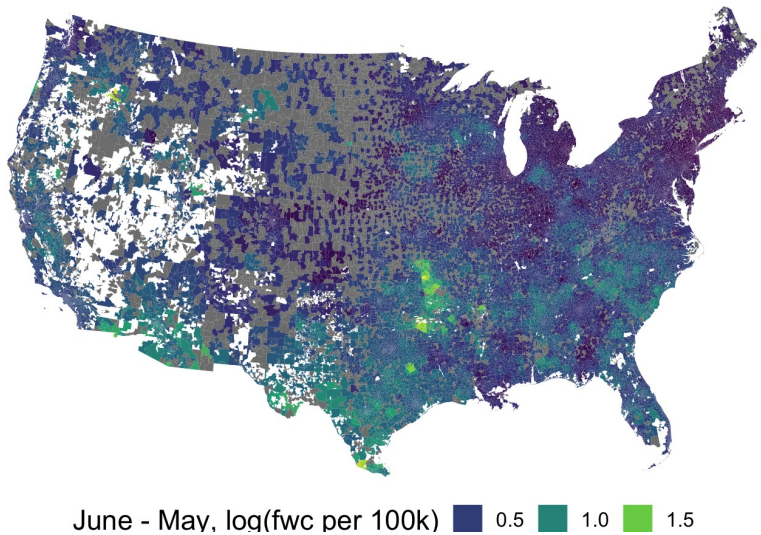
- Same pattern when controlling for exact college
- $\rightarrow$ evidence against differences in ability to work from home being driving force behind observed patterns
- Back

Changes in Friend Exposure









Determinants of Changes in Friend-Exposure to COVID-19

	Monthly Change in log(Friend Exposure + 1)									
	March	April	May	June	July	March	April	May	June	July
Age Group										
35-54	0.040***	0.014***	-0.013***	-0.008***	-0.001**	0.015***	0.005***	-0.004***	-0.003***	0.001***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
55+	0.076***	0.015***	-0.026***	-0.018***	-0.004***	0.024***	0.007***	-0.006***	-0.006***	0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Female	-0.021***	0.006***	0.003***	0.006***	0.004***	-0.004***	0.002***	0.001***	0.000**	-0.000***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has College	0.039***	-0.031***	-0.007***	-0.008***	-0.004***	0.003***	-0.013***	-0.003***	0.002***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has iPhone	0.011***	0.005***	-0.007***	0.008***	0.013***	0.002***	-0.002***	-0.000	0.002***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has Tablet	0.005***	-0.009***	-0.008***	-0.001***	0.002***	0.003***	-0.002***	-0.002***	-0.000***	0.001***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Network-Exposure Median HH Income ($k)	0.015***	-0.004***	0.001***	-0.009***	-0.013***					
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)					
Network-Exposure Population Density	349.495***	-34.302***	-65.142***	-71.383***	-88.601***					
$(\text{residents}/\text{meter}^2)$	(5.622)	(1.527)	(1.280)	(1.582)	(1.764)					
Network-Exposure Fraction of Pop. Urban	1.112***	-0.076**	-0.263***	0.319***	0.456***					
	(0.035)	(0.019)	(0.016)	(0.014)	(0.016)					
Zip Code Income										
Middle Tertile	-0.034***	-0.017**	0.007	-0.011**	-0.004					
	(0.011)	(0.008)	(0.006)	(0.005)	(0.006)					
Top Tertile	0.002	-0.026***	-0.008	-0.006	0.005					
	(0.011)	(0.008)	(0.005)	(0.005)	(0.006)					
Zip Code FE						Y	Y	Y	Y	Y
Other Network Exposure FE						Y	Y	Y	Y	Y
R-Squared	0.560	0.044	0.117	0.215	0.281	0.877	0.680	0.728	0.781	0.822
Sample Mean	2.800	2.303	0.810	0.476	0.615	2.800	2.303	0.810	0.476	0.615
N	7,090,255	6,981,142	6,571,618	6,251,614	5,859,728	7,090,254	6,981,141	6,571,617	6,251,614	5,859,728

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