

Supplementary Online Content

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eAppendix 1. Summary of Scenarios

eAppendix 2. Comparison of Results With Multiple Imputation: Social Media and Smart Thermometer

eAppendix 3. Comparison of Results With Multiple Imputation: Apple and Google Program and Smart Phones

This supplementary material has been provided by the authors to give readers additional information about their work.

eAppendix 1. Summary of Scenarios

	Summary
1	Social media used to detect early signs of COVID-19 and share with public health officials for setting policies
2	Social media used to detect early signs of COVID-19 and share with public health officials for contact tracing
3	Smart thermometer company shares temperature data with public health officials for setting policies
4	Smart thermometer company shares temperature data with public health officials for contact tracing
5	Apple & Google contact tracing program: cell phone data used to determine if you were exposed to COVID-19
6	Apple & Google contact tracing program: data shared with public health officials to contact you after exposure
7	Apple & Google contact tracing program should require mandatory participation
8	Cell phone data used to enforce quarantines
9	Cell phone data used to identify people as high risk for COVID-19 and limit their movement

eAppendix 2. Comparison of results with multiple imputation

	Social Media						Smart Thermometer					
	Setting Policies			Contact Tracing			Setting Policies			Contact Tracing		
	Multiple Imputation	Complete Cases	Extreme Cases	Multiple Imputation	Complete Cases	Extreme Cases	Multiple Imputation	Complete Cases	Extreme Cases	Multiple Imputation	Complete Cases	Extreme Cases
	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value
Political Ideology												
Liberal	Reference											
Moderate	-0.40 -0.51, -0.29 <0.001	-0.39 -0.51, -0.28 <0.001	-0.40 -0.52, -0.29 <0.001	-0.42 -0.54, 0.31 <0.001	-0.42 -0.54, -0.30 <0.001	-0.42 -0.54, -0.30 <0.001	-0.39 -0.50, -0.27 <0.001	-0.38 -0.49, -0.27 <0.001	-0.38 -0.50, -0.27 <0.001	-0.35 -0.46, -0.24 <0.001	-0.35 -0.46, -0.23 <0.001	-0.35 -0.46, -0.24 <0.001
Conservative	-0.76 -0.88, -0.64 <0.001	-0.76 -0.88, -0.64 <0.001	-0.73 -0.85, -0.61 <0.001	-0.78 -0.90, -0.66 <0.001	-0.79 -0.92, -0.67 <0.001	-0.76 -0.88, -0.64 <0.001	-0.77 -0.89, -0.65 <0.001	-0.77 -0.89, -0.65 <0.001	-0.74 -0.86, -0.62 <0.001	-0.70 -0.82, -0.58 <0.001	-0.70 -0.83, -0.58 <0.001	-0.66 -0.78, -0.54 <0.001
Prior COVID-19												
No	-0.12 -0.40, 0.16 0.41	-0.07 -0.35, 0.22 0.65	-0.10 -0.38, 0.18 0.49	-0.03 -0.30, 0.24 0.83	-0.01 -0.30, 0.26 0.92	-0.01 -0.28, 0.26 0.93	0.14 -0.12, 0.42 0.31	0.16 -0.12, 0.44 0.27	0.17 -0.10, 0.45 0.22	0.02 -0.26, 0.30 0.89	0.06 -0.22, 0.34 0.68	0.04 -0.24, 0.32 0.77
Race												
White	Reference	Reference	Reference									
Black/African American	0.24 0.11, 0.36 <0.001	0.24 0.11, 0.37 <0.001	0.24 0.12, 0.37 <0.001	0.26 0.13, 0.38 <0.001	0.26 0.13, 0.39 <0.001	0.27 0.15, 0.40 <0.001	0.07 -0.05, 0.19 0.26	0.09 -0.03, 0.22 0.14	0.08 -0.04, 0.20 0.19	0.18 0.05, 0.30 0.005	0.20 0.07, 0.33 0.002	0.20 0.08, 0.32 0.002
Other	0.58 0.37, 0.78 <0.001	0.57 0.36, 0.78 <0.001	0.56 0.36, 0.76 <0.001	0.49 0.28, 0.71 <0.001	0.47 0.26, 0.69 <0.001	0.49 0.28, 0.70 <0.001	0.32 0.12, 0.52 0.002	0.31 0.10, 0.51 0.003	0.32 0.11, 0.52 0.002	0.35 0.13, 0.56 0.001	0.34 0.12, 0.56 0.002	0.35 0.13, 0.56 0.002
2+ Races	0.18 -0.09, 0.45 0.19	0.21 -0.07, 0.49 0.15	0.20 -0.07, 0.46 0.15	0.25 -0.02, 0.52 0.07	0.27 -0.02, 0.55 0.06	0.27 -0.01, 0.53 0.06	0.18 -0.09, 0.44 0.19	0.19 -0.08, 0.47 0.17	0.20 -0.07, 0.46 0.14	0.2 -0.07, 0.46 0.15	0.24 -0.04, 0.52 0.10	0.21 -0.05, 0.48 0.12
Ethnicity												
Hispanic	Reference											
Non-Hispanic	-0.37 -0.49, -0.26 <0.001	-0.37 -0.48, -0.25 <0.001	-0.37 -0.49, -0.25 <0.001	-0.37 -0.48, -0.25 <0.001	-0.35 -0.47, -0.23 <0.001	-0.37 -0.49, -0.25 <0.001	-0.25 -0.37, -0.14 <0.001	-0.27 -0.39, -0.15 <0.001	-0.25 -0.37, -0.14 <0.001	-0.31 -0.43, -0.20 <0.001	-0.31 -0.43, -0.20 <0.001	-0.32 -0.44, -0.20 <0.001
Household Income												
<\$24,999	Reference											
\$25,000-\$49,999	-0.04 -0.21, 0.13 0.62	-0.03 -0.20, 0.15 0.76	-0.06 -0.22, 0.11 0.52	-0.01 -0.18, 0.16 0.92	0.02 -0.15, 0.19 0.82	-0.02 -0.19, 0.15 0.82	-0.03 -0.19, 0.13 0.69	-0.01 -0.17, 0.16 0.93	-0.06 -0.22, 0.10 0.47	-0.07 -0.23, 0.10 0.43	-0.04 -0.20, 0.13 0.66	-0.08 -0.25, 0.08 0.32
\$50,000-\$99,999	-0.23 -0.38, 0.08 0.003	-0.20 -0.35, 0.04 0.01	-0.23 -0.39, -0.08 0.003	-0.18 -0.33, -0.04 0.02	-0.15 -0.30, 0.00 0.06	-0.19 -0.34, 0.03 0.02	-0.16 -0.30, -0.01 0.03	-0.14 -0.28, -0.01 0.07	-0.18 -0.33, -0.03 0.02	-0.21 -0.36, -0.07 0.004	-0.19 -0.34, -0.04 0.01	-0.23 -0.38, -0.08 0.002
>\$100,000	-0.05 -0.20, 0.10 0.52	-0.02 -0.18, 0.13 0.80	-0.06 -0.22, 0.09 0.42	-0.01 -0.16, 0.14 0.92	0.02 -0.13, 0.17 0.81	0.02 -0.73, 0.13 0.77	-0.1 -0.25, 0.05 0.19	-0.08 -0.23, 0.07 0.32	-0.13 -0.28, 0.02 0.09	-0.15 -0.29, 0.00 0.05	-0.12 -0.27, 0.03 0.12	-0.16 -0.31, 0.01 0.03
Age												
18-29	Reference	Reference	Reference									
30-44	0.09 -0.06, 0.24 0.24	0.09 -0.07, 0.24 0.27	0.10 -0.05, 0.25 0.21	0.07 -0.08, 0.21 0.37	0.07 -0.84, 0.22 0.39	0.08 -0.07, 0.23 0.29	0.03 -0.12, 0.18 0.70	0.03 -0.12, 0.18 0.67	0.05 -0.10, 0.20 0.55	0 -0.15, 0.16 0.96	0 -0.16, 0.15 0.99	0.02 -0.14, 0.17 0.85
45-59	0.01 -0.14, 0.15 0.95	0 -0.15, 0.15 0.98	-0.01 -0.16, 0.14 0.89	0.01 -0.13, 0.17 0.80	0.02 -0.13, 0.17 0.79	0 -0.15, 0.15 0.98	-0.09 -0.24, 0.05 0.22	-0.08 -0.23, 0.07 0.28	-0.1 -0.25, 0.05 0.18	-0.09 -0.24, 0.06 0.24	-0.09 -0.24, 0.07 0.26	-0.10 -0.25, 0.05 0.20
60+	0.06 -0.08, 0.21 0.41	0.07 -0.08, 0.22 0.37	0.05 -0.09, 0.20 0.49	0.15 0.01, 0.29 0.04	0.15 0.01, 0.30 0.04	0.14 -0.01, 0.28 0.06	-0.04 -0.19, 0.10 0.55	-0.03 -0.17, 0.12 0.71	-0.01 -0.20, 0.01 0.45	-0.01 -0.15, 0.14 0.93	0 -0.15, 0.15 0.96	-0.01 -0.16, 0.13 0.85
COVID-19 Incidence												
<48 per 10,000 Cases	Reference	Reference	Reference									
48-95 per 10,000 Cases	-0.12 -0.28, 0.04 0.13	-0.10 -0.26, 0.05 0.20	-0.13 -0.28, 0.03 0.10	-0.10 -0.26, 0.05 0.18	-0.08 -0.24, 0.07 0.30	-0.12 -0.28, 0.03 0.12	-0.05 -0.21, 0.10 0.50	-0.03 -0.19, 0.13 0.69	-0.03 -0.19, 0.13 0.69	-0.05 -0.21, 0.11 0.51	-0.05 -0.21, 0.12 0.58	-0.05 -0.21, 0.11 0.55
95-186 per 10,000 Cases	-0.19 -0.35, -0.02 0.03	-0.17 -0.34, -0.03 0.06	-0.20 -0.37, -0.04 0.02	-0.20 -0.37, -0.04 0.02	-0.17 -0.34, 0.00 0.05	-0.22 -0.39, -0.06 0.009	-0.21 -0.38, -0.35 0.02	-0.17 -0.35, 0.00 0.05	-0.20 -0.37, 0.03 0.03	-0.18 -0.35, 0.00 0.05	-0.15 -0.33, 0.03 0.09	-0.17 -0.34, 0.00 0.06
>186 per 10,000 Cases	-0.02 -0.20, 0.15 0.79	-0.01 -0.19, 0.16 0.90	-0.02 -0.19, 0.14 0.78	-0.10 -0.27, 0.07 0.27	-0.08 -0.25, 0.09 0.37	-0.11 -0.27, 0.06 0.21	-0.06 -0.24, 0.12 0.51	-0.05 -0.24, 0.13 0.56	-0.03 -0.21, 0.14 0.70	-0.04 -0.22, 0.14 0.67	-0.05 -0.23, 0.14 0.63	-0.02 -0.20, 0.16 0.81

eAppendix 3. Comparison of results with multiple imputation

	Apple & Google Program									Smart Phones								
	Identify Exposure			Contact Tracing			Mandatory Participation			Enforce Quarantines			Limit Movement					
	Multiple Imputation	Complete Cases	Extreme Cases	Multiple Imputation	Complete Cases	Extreme Cases	Multiple Imputation	Complete Cases	Extreme Cases	Multiple Imputation	Complete Cases	Extreme Cases	Multiple Imputation	Complete Cases	Extreme Cases			
	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value	Coefficient 95% CI p value			
Political Ideology																		
Liberal	Reference																	
Moderate	-0.54 -0.65, -0.43 <0.001	-0.54 -0.65, -0.43 <0.001	-0.53 -0.64, -0.42 <0.001	-0.59 -0.69, -0.48 <0.001	-0.59 -0.70, -0.48 <0.001	-0.59 -0.70, -0.48 <0.001	-0.42 -0.53, -0.30 <0.001	-0.40 -0.52, -0.29 <0.001	-0.42 -0.53, -0.31 <0.001	-0.49 -0.61, -0.38 <0.001	-0.48 -0.60, -0.37 <0.001	-0.50 -0.61, -0.39 <0.001	-0.39 -0.50, -0.28 <0.001	-0.38 -0.49, -0.27 <0.001	-0.38 -0.50, -0.27 <0.001			
Conservative	-0.95 -1.10, -0.83 <0.001	-0.97 -1.10, -0.84 <0.001	-0.91 -1.03, -0.79 <0.001	-0.99 -1.11, -0.87 <0.001	-0.10 -1.13, -0.87 <0.001	-0.96 -1.08, -0.85 <0.001	-0.91 -1.03, -0.79 <0.001	-0.91 -1.02, -0.79 <0.001	-0.87 -0.98, -0.75 <0.001	-0.97 -1.10, -0.85 <0.001	-0.97 -1.09, -0.85 <0.001	-0.93 -1.05, -0.81 <0.001	-0.80 -0.92, -0.69 <0.001	-0.80 -0.92, -0.68 <0.001	-0.75 -0.86, -0.63 <0.001			
Prior COVID-19																		
No	0.02 -0.27, 0.30 0.91	0.07 -0.22, 0.37 0.62	0.05 -0.24, 0.33 0.75	-0.03 -0.32, 0.26 0.84	-0.03 -0.27, 0.33 0.86	-0.01 -0.29, 0.30 0.99	-0.03 -0.32, 0.26 0.86	0.01 -0.29, 0.31 0.93	0.01 -0.31, 0.28 0.91	0.15 -0.13, 0.43 0.29	0.21 -0.07, 0.49 0.15	0.18 -0.10, 0.46 0.21	-0.01 -0.29, 0.27 0.97	-0.05 -0.24, 0.33 0.75	0.02 -0.26, 0.30 0.88			
Race																		
White	Reference																	
Black/African American	0.07 -0.06, 0.19 0.30	0.08 -0.05, 0.21 0.23	0.09 -0.04, 0.22 0.17	0.20 0.07, 0.32 0.002	0.22 0.09, 0.34 0.001	0.20 0.08, 0.33 0.001	0.32 0.19, 0.44 <0.001	0.34 0.22, 0.47 <0.001	0.34 0.22, 0.46 <0.001	0.33 0.20, 0.46 <0.001	0.33 0.20, 0.46 <0.001	0.35 0.22, 0.49 <0.001	0.31 0.19, 0.44 <0.001	0.31 0.18, 0.44 <0.001	0.33 0.21, 0.46 <0.001			
Other	0.47 0.27, 0.67 <0.001	0.48 0.27, 0.68 <0.001	0.50 0.30, 0.70 <0.001	0.42 0.22, 0.63 <0.001	0.45 0.24, 0.65 <0.001	0.42 0.22, 0.62 <0.001	0.61 0.39, 0.82 <0.001	0.64 0.42, 0.86 <0.001	0.60 0.38, 0.81 <0.001	0.73 0.53, 0.93 <0.001	0.73 0.52, 0.94 <0.001	0.73 0.53, 0.94 <0.001	0.79 0.58, 0.99 <0.001	0.78 0.57, 0.99 <0.001	0.80 0.60, 1.00 <0.001			
2+ Races	0.24 -0.05, 0.52 0.10	0.26 -0.04, 0.55 0.09	0.26 -0.03, 0.55 0.08	0.26 -0.02, 0.53 0.07	0.30 -0.01, 0.59 0.04	0.27 -0.03, 0.54 0.05	0.33 0.07, 0.60 0.01	0.37 0.10, 0.65 0.008	0.35 0.08, 0.61 0.01	0.23 -0.04, 0.50 0.10	0.26 -0.02, 0.54 0.07	0.23 -0.04, 0.50 0.09	0.22 -0.02, 0.47 0.07	0.26 0.00, 0.51 0.05	0.26 0.01, 0.50 0.04			
Ethnicity																		
Hispanic	Reference																	
Non-Hispanic	-0.30 -0.42, -0.19 <0.001	-0.30 -0.42, -0.18 <0.001	-0.31 -0.43, -0.19 <0.001	-0.26 -0.38, -0.14 <0.001	-0.26 -0.38, -0.14 <0.001	-0.25 -0.37, -0.13 <0.001	-0.55 -0.67, -0.43 <0.001	-0.56 -0.68, -0.44 <0.001	-0.57 -0.69, -0.45 <0.001	-0.54 -0.66, -0.42 <0.001	-0.53 -0.65, -0.41 <0.001	-0.55 -0.67, -0.43 <0.001	-0.46 -0.57, -0.34 <0.001	-0.45 -0.57, -0.33 <0.001	-0.46 -0.58, -0.35 <0.001			
Household Income																		
<\$24,999	Reference																	
\$25,000-\$49,999	-0.07 -0.24, 0.09 0.39	-0.06 -0.23, 0.11 0.51	-0.09 -0.26, 0.08 0.29	0 -0.16, 0.17 0.98	0.03 -0.14, 0.20 0.75	0.01 -0.17, 0.16 0.95	-0.06 -0.22, 0.10 0.47	-0.03 -0.19, 0.13 0.70	-0.08 -0.24, 0.08 0.33	-0.10 -0.27, 0.07 0.26	-0.08 -0.26, 0.09 0.35	-0.10 -0.27, 0.07 0.26	0.03 -0.13, 0.19 0.70	0.05 -0.11, 0.21 0.55	0.01 -0.15, 0.17 0.8			
\$50,000-\$99,999	-0.24 -0.39, -0.09 0.002	-0.20 -0.36, -0.05 0.01	-0.25 -0.40, -0.10 0.001	-0.19 -0.34, -0.04 0.01	-0.16 -0.31, 0.00 0.04	-0.19 -0.35, -0.04 0.01	-0.30 -0.44, -0.16 <0.001	-0.28 -0.42, -0.13 <0.001	-0.32 -0.47, -0.18 <0.001	-0.32 -0.47, -0.17 <0.001	-0.31 -0.46, -0.15 <0.001	-0.34 -0.49, -0.19 <0.001	-0.21 -0.35, -0.06 0.005	-0.19 -0.34, -0.05 0.009	-0.23 -0.38, -0.08 0.002			
>\$100,000	-0.05 -0.20, 0.10 0.50	-0.01 -0.17, 0.14 0.86	-0.07 -0.22, 0.08 0.37	-0.06 -0.21, 0.09 0.42	-0.03 -0.18, 0.13 0.72	-0.07 -0.23, 0.08 0.34	-0.14 -0.29, 0.00 0.05	-0.11 -0.26, 0.04 0.14	-0.17 -0.31, -0.02 0.02	-0.20 -0.35, -0.05 0.009	-0.19 -0.34, -0.03 0.02	-0.22 -0.37, -0.07 0.004	-0.10 -0.25, 0.04 0.17	-0.09 -0.24, 0.06 0.25	-0.12 -0.27, 0.03 0.11			
Age																		
18-29	Reference																	
30-44	0.06 -0.09, 0.21 0.45	0.06 -0.10, 0.21 0.47	0.07 -0.08, 0.23 0.34	0.09 -0.06, 0.25 0.22	0.09 -0.06, 0.25 0.24	0.11 -0.04, 0.26 0.16	0.01 -0.15, 0.16 0.93	0 -0.15, 0.16 0.97	0.01 -0.14, 0.16 0.88	0.15 0.00, 0.30 0.05	0.15 0.00, 0.31 0.05	0.15 -0.01, 0.31 0.06	0.10 -0.05, 0.24 0.20	0.10 -0.05, 0.25 0.21	0.11 -0.40, 0.26 0.15			
45-59	0.03 -0.12, 0.18 0.72	0.03 -0.12, 0.18 0.70	0.02 -0.13, 0.17 0.79	0.09 -0.06, 0.24 0.24	0.10 -0.05, 0.25 0.21	0.09 -0.06, 0.24 0.26	0.04 -0.11, 0.19 0.61	0.04 -0.12, 0.19 0.64	0.03 -0.12, 0.18 0.70	0.16 0.01, 0.31 0.04	0.16 0.01, 0.32 0.04	0.15 0.00, 0.30 0.06	0.06 -0.08, 0.21 0.41	0.07 -0.08, 0.22 0.37	0.05 -0.10, 0.20 0.52			
60+	0.14 -0.01, 0.28 0.07	0.14 -0.01, 0.29 0.06	0.12 -0.02, 0.27 0.10	0.28 0.14, 0.43 <0.001	0.29 0.14, 0.44 <0.001	0.26 0.11, 0.41 0.001	0.10 -0.04, 0.25 0.16	0.11 -0.04, 0.26 0.15	0.09 -0.06, 0.23 0.25	0.29 0.14, 0.44 <0.001	0.30 0.15, 0.45 <0.001	0.26 0.11, 0.41 0.001	0.16 0.02, 0.30 0.02	0.17 0.03, 0.31 0.02	0.14 0.00, 0.28 0.05			
COVID-19 Incidence																		
<48 per 10,000 Cases	Reference																	
48-95 per 10,000 Cases	-0.02 -0.18, 0.14 0.80	0.00 -0.16, 0.16 0.10	-0.02 -0.17, 0.14 0.84	-0.06 -0.21, 0.10 0.48	-0.04 -0.19, 0.12 0.66	-0.04 -0.19, 0.11 0.61	-0.06 -0.21, 0.09 0.41	-0.06 -0.21, 0.10 0.46	-0.08 -0.23, 0.07 0.31	-0.16 -0.32, -0.01 0.04	-0.14 -0.30, -0.02 0.08	-0.18 -0.33, -0.02 0.03	-0.08 -0.23, 0.07 0.32	-0.04 -0.20, 0.11 0.58	-0.09 -0.25, 0.06 0.24			
95-186 per 10,000 Cases	-0.16 -0.33, 0.01 0.07	-0.12 -0.30, 0.01 0.18	-0.16 -0.33, 0.01 0.07	-0.15 -0.32, 0.02 0.08	-0.13 -0.30, 0.04 0.14	-0.14 -0.31, 0.03 0.10	-0.07 -0.23, 0.09 0.40	-0.05 -0.22, 0.11 0.52	-0.09 -0.25, 0.07 0.28	-0.24 -0.41, -0.07 0.006	-0.20 -0.37, -0.03 0.02	-0.25 -0.42, -0.09 0.003	-0.16 -0.32, 0.01 0.06	-0.11 -0.28, 0.06 0.19	-0.16 -0.33, 0.00 0.05			
>186 per 10,000 Cases	0.02 -0.16, 0.20 0.85	0.04 -0.14, 0.23 0.65	0.03 -0.14, 0.21 0.70	-0.03 -0.20, 0.15 0.77	-0.02 -0.20, 0.16 0.84	0.00 -0.17, 0.17 1.0	0.1 -0.07, 0.27 0.26	0.10 -0.08, 0.27 0.28	0.08 -0.08, 0.25 0.33	-0.08 -0.25, 0.10 0.38	-0.06 -0.24, 0.12 0.50	-0.08 -0.25, 0.09 0.35	0.06 -0.11, 0.24 0.48	0.09 -0.08, 0.27 0.30	0.06 -0.11, 0.24 0.48			