

SARS-CoV-2 Testing in Florida, Illinois, and Maryland: Access and Barriers

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Abstract

Objective: To characterize the SARS-CoV-2 testing cascade and associated barriers in three US states.

Methods: We recruited participants from Florida, Illinois, and Maryland (~1000/state) for an online survey September 16 – October 15, 2020. The survey covered demographics, COVID-19 symptoms, and experiences around SARS-CoV-2 PCR testing in the prior 2 weeks. Logistic regression was used to analyze associations with outcomes of interest.

Results: Overall, 316 (10%) of 3,058 respondents wanted/needed a test in the two weeks prior to the survey. Of these, 166 (53%) were able to get tested and 156 (94%) received results; 53% waited ≥ 8 days to get results from when they wanted/needed a test. There were no significant differences by state. Among those wanting/needing a test, getting tested was significantly less common among men (aOR: 0.46) and those reporting black race (aOR: 0.53) and more common in those reporting recent travel (aOR: 3.35).

Conclusions: There is an urgent need for a national communication strategy on who should get tested and where one can get tested. Additionally, measures need to be taken to improve access and reduce turn-around-time.

Introduction

While there is clear evidence supporting the need for rapid detection and isolation of SARS-CoV-2 infections,¹ testing access across the US has been uneven,^{2,3} hampered by logistics, supply chain issues, and changing recommendations.⁴ For example, on August 24, 2020, the Centers for Disease Control and Prevention (CDC) recommended that asymptomatic persons not be tested even in the setting of potential exposure but reversed their recommendation on September 18, 2020 to reinforce testing for asymptomatic persons.⁵ In this dynamic context, community-based data on testing uptake and barriers are critical to the public health response. We present the SARS-CoV-2 testing cascade and associated barriers across three US states (Florida, Illinois, and Maryland) at varying local epidemic stages in September 2020.

Methods

Study Setting

We recruited participants from Florida, Illinois, and Maryland (~1000/state) for an online survey from September 16 – October 15, 2020. The survey covered demographics, COVID-19 symptoms, and experiences around SARS-CoV-2 PCR testing in the prior 2 weeks. States were selected to represent the diversity of the pandemic with respect to daily case counts and statewide orders on non-pharmaceutical interventions. At the time of survey, there were no systematic differences in testing across these states⁵⁻⁷; all had public and private options including free testing that did not require a doctor's order. Cases counts were stable in Florida (~2,700 cases/day), rising in Illinois (~2,400 cases/day), and decreasing in Maryland (~550 cases). Florida had the fewest restrictions (no restrictions on businesses or a statewide mask mandate), Maryland was fairly open with some restrictions (establishments up to 75% capacity, statewide mask mandate), and Illinois had many establishments open at 50% capacity, indoor dining at 25% capacity, and a statewide mask mandate.

Study Sample

All participants were ≥ 18 years, provided consent, and resided in the state. Participants were recruited using Dynata (<https://www.dynata.com>), one of the largest first-party global data platforms. Dynata maintains a database of potential participants who are randomized to specific surveys if they meet the demographic targets of the survey; additionally, participants can select a survey from a list of potential options (survey topic not provided). Participants receive modest compensation. Security checks and quality verifications include digital fingerprinting and spot checking via third party verification.

In order to accrue demographically representative samples, we provided quotas for age, gender, race/ethnicity, and income based on the population composition of the states. Across states, 5,075 were routed to the survey; 714 did not start the survey, 694 started but did not complete the survey, and 609 responses were excluded for non-eligibility.

Statistical Methods

Statistical analyses were carried out using Python (v3.7.3) and R (v3.5.1). We restricted the analyses to SARS-CoV-2 PCR testing in the prior two weeks to minimize recall bias and reflect current diagnostic testing access. Residential zip code and the National Center for Health Statistics (NCHS) Urban-Rural classification scheme⁸ were used for urban-rural classification. Chi square and Mann-Whitney tests were used to compare categorical and continuous variables, respectively. Logistic regression was used to analyze associations with two outcomes: 1) self-report of wanting/needing a SARS-CoV-2 test among all sampled; and 2) receiving a test among those who wanted/needed a test. Variables were considered for inclusion in multivariable analyses if they held biologic/epidemiologic significance or were associated in univariable analysis at $p < 0.10$; age, gender, race/ethnicity, and state were included regardless of statistical significance. Additional variables considered included: household size, COVID-19 infection in a household member, education, annual household income, employment status (i.e., working outside the home), self-reported exposure and/or symptoms, report of travel, urban-rural classification, and state.

Results

Of 3,058 persons, 316 (10%) reported wanting/needing a test in the prior two weeks. Median age of participants wanting/needing a test was 36 years and 46% were female; 47% self-identified as White and 57% reported working outside the home (overall sample described in Supplementary Table S1; Figure S2). In multivariable analyses, wanting/needing a test was significantly more common among males and younger respondents, Blacks vs. Whites, and those with symptoms, self-reported exposure or both (all p -values <0.05 ; Supplementary Table S3).

Of 316 who wanted/needed a test in the prior 2 weeks, 166 (53%) were able to get tested, of whom, 156 (94%) received results with no significant differences by state (Supplementary Figure S4). In multivariate analyses, among those wanting/needing a test, getting tested was significantly less common among men (aOR: 0.46; 95% CI: 0.26 – 0.82) and those reporting black race (aOR: 0.53; 95% CI: 0.28 – 0.99) and more common in those reporting recent travel (aOR: 3.35; 95% CI: 1.79 – 6.25) (Supplementary Table S5).

The primary reasons for testing were desire to know one's status (35%) and symptoms (28%). Among those tested, 53% had to wait ≥ 8 days to get a result from when they wanted/needed a test (Table 1). Seventy-one percent reported quarantining while awaiting results. Of 146 who wanted/needed a test, but did not get tested, main reasons were not knowing where to go (36%) and distance/waiting time (33%); 21% reported fear of being tested.

Additionally, 177 (6%) participants reported symptoms, exposure or both but did not want a test. The main reasons were belief that symptoms were due to other causes (42%), no symptoms (18%), not wanting to know one's status (18%), and logistic issues, such as not knowing where to go or lack of transportation (15%).

Discussion

Of 3,058 participants surveyed, 10% reported wanting/needing a SARS-CoV-2 test in the prior two weeks, only 53% of who were able to get tested with no differences by

state. While it was encouraging that those with symptoms and potential exposure were the most likely to get tested, it is noteworthy that approximately 62% with potential exposure and/or symptoms did not get tested primarily due to logistic reasons or not knowing where to go. Moreover, among those tested, there were significant delays in accessing a test and receiving results, with over half waiting 8 or more days for results from the time they wanted/needed a test. This delay is considerable compared to estimates of the serial interval (7.5 days)⁹ and generation time (5 days)¹⁰ which have implications for community transmission. Such delays can also complicate efforts to implement contact tracing to control local epidemics and may become more pronounced as cases again surge. Onset of respiratory viruses (e.g., influenza) can further complicate existing diagnostic efforts due to similar presenting symptoms thereby, increasing demand for testing.

There are limitations of online surveys; individuals need internet access to participate and so these surveys may underrepresent lower income/less educated individuals. However, in a constantly evolving pandemic where face-to-face data collection is nearly impossible, this approach allows for the collection of individual-level data across diverse geographies and demographics in a rapid and safe manner. If anything, we are likely overestimating access to testing. Moreover, care was taken to balance targets on state demographic characteristics and estimates of flu vaccine coverage are comparable to samples based on random digit dialing.¹¹ Additionally, there is a possibility respondent misclassified the type of test.

Regardless, these data reflecting common testing barriers across three US states clearly underscore the importance of a unified national strategy with clear messaging on who, where, when, and how to get a test. Concurrently, there should be a focus on improved turn-around-time by incorporating newer approaches such as rapid lateral flow assays.

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Author Contributions

SJC, SSS, and SHM had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Concept and design:* SJC, AW, SHM, and SSS. *Acquisition, analysis, or interpretation of data:* All authors. *Drafting of the manuscript:* SJC, AW, SHM, SSS. *Critical revision of the manuscript for important intellectual content:* All authors. *Statistical analysis:* SJC. *Obtained funding:* SHM, AW. *Supervision:* SSS.

Conflict of Interest Disclosures

SHM reports personal fees from Gilead Sciences, outside the submitted work. SSS reports grants/products from Gilead Sciences and grants/products from Abbott Diagnostics, outside the submitted work.

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Table

Table 1. Demographics, barriers to testing, and wait times among persons who reported wanting/needing a SARS-CoV-2 PCR test in the prior 2 weeks across FL, IL, and MD.

	Total	FL	IL	MD
Wanted/Needed a Test	n = 316	n = 104	n = 116	n = 96
Median Age (IQR)	36 (27 – 50)	37 (29 – 49)	35 (25 – 50)	37 (28 – 53)
Median Household Size (IQR)	2 (2 – 3)	3 (2 – 4)	2 (1 – 3)	2 (2 – 3)
Gender, n (%)				
Female	144 (46%)	42 (40%)	62 (53%)	40 (42%)
Male	170 (54%)	61 (60%)	54 (47%)	55 (57%)
Race/Ethnicity, n (%)				
White/Caucasian	147 (47%)	44 (42%)	55 (47%)	48 (50%)
Black/African American	96 (30%)	33 (32%)	28 (24%)	35 (37%)
Hispanic/Latino	49 (16%)	20 (19%)	25 (22%)	4 (4%)
Asian/Pacific Islander	16 (5%)	3 (3%)	5 (4%)	8 (8%)
Other	8 (2%)	4 (4%)	3 (3%)	1 (1%)
Educational Attainment, n (%)				
High school degree or less	53 (17%)	20 (19%)	19 (16%)	14 (15%)
Associate degree	51 (33%)	12 (12%)	21 (18%)	18 (19%)
Some college (no degree)	35 (44%)	11 (11%)	19 (16%)	5 (5%)
Bachelor's degree	97 (75%)	26 (25%)	37 (32%)	34 (35%)
Graduate degree	79 (25%)	34 (33%)	20 (17%)	25 (26%)
Annual Household Income, n (%)				
< \$20,000	43 (14%)	20 (19%)	15 (13%)	8 (8%)
\$20,000 – \$39,000	59 (19%)	17 (16%)	28 (24%)	14 (15%)
\$40,000 – \$49,000	16 (4%)	5 (5%)	10 (9%)	1 (1%)
\$50,000 – \$69,000	44 (14%)	16 (15%)	17 (15%)	11 (12%)
\$70,000+	154 (49%)	46 (44%)	46 (40%)	62 (65%)
Employment Status, n (%)				
Employed, working outside the home	177 (56%)	64 (62%)	52 (64%)	61 (64%)
Employed, working from home	85 (27%)	28 (27%)	39 (34%)	18 (19%)
Unemployed	21 (7%)	2 (2%)	13 (11%)	6 (6%)
Retired	30 (10%)	9 (9%)	11 (10%)	10 (11%)
Urban-Rural Classification				
Urban	133 (42%)	51 (49%)	64 (55%)	18 (19%)
Suburban	154 (49%)	49 (47%)	28 (24%)	77 (80%)
Rural	29 (9%)	4 (4%)	24 (21%)	1 (1%)
Reported Travel for Any Purpose, n (%)	111 (35%)	49 (47%)	29 (25%)	33 (34%)
Unable to Get Tested	n = 146	n = 44	n = 63	n = 39
Reasons for Not Getting Tested				
Did not know where to go	52 (36%)	13 (30%)	24 (38%)	15 (38%)

Could not get an order from a doctor	31 (21%)	5 (11%)	15 (24%)	11 (28%)
Testing center too far away	30 (21%)	14 (32%)	10 (16%)	6 (15%)
Afraid to get tested	31 (21%)	15 (34%)	8 (13%)	8 (21%)
Too long of a line to get tested	17 (12%)	6 (14%)	5 (8%)	6 (15%)
Language barriers	7 (5%)	4 (9%)	0 (0%)	3 (8%)
No Reason Specified	8 (5%)	2 (5%)	4 (6%)	2 (5%)
Got Tested	n = 166	n = 58	n = 51	n = 57
Time from Wanting/Needing Test to Getting Tested				
Same day	52 (31%)	18 (31%)	18 (35%)	16 (28%)
1 – 2 days	21 (13%)	12 (21%)	3 (6%)	6 (11%)
3 – 5 days	51 (31%)	13 (22%)	16 (31%)	22 (39%)
6 – 7 days	21 (13%)	7 (12%)	7 (14%)	7 (12%)
More than 1 week	13 (8%)	6 (10%)	4 (8%)	3 (5%)
Received Result by Time of Survey	n = 156	n = 55	n = 48	n = 53
Time from Testing to Receiving Results				
Same day	27 (17%)	15 (27%)	7 (15%)	5 (9%)
1 – 2 days	22 (14%)	9 (17%)	5 (11%)	8 (15%)
3 – 5 days	56 (36%)	13 (24%)	19 (40%)	24 (45%)
6 – 7 days	30 (19%)	9 (17%)	11 (23%)	10 (19%)
More than 1 week	19 (12%)	8 (15%)	5 (11%)	6 (11%)
Time from Wanting/Needing a Test to Receiving Results	n = 151	n = 53	n = 45	n = 53
Same day	16 (11%)	8 (15%)	5 (11%)	3 (6%)
1 – 2 days	14 (9%)	7 (13%)	2 (4%)	5 (9%)
3 – 5 days	35 (23%)	13 (25%)	12 (27%)	10 (19%)
6 – 7 days	6 (4%)	4 (8%)	1 (2%)	1 (2%)
More than 1 week	80 (53%)	21 (40%)	25 (56%)	34 (64%)

Note: Numbers may not sum to the total if there were participants who elected not to answer a given question.

Supplemental Material

Table S1. Characteristics of overall study sample by state.

	Total n = 3,058	FL n = 998	IL n = 1,045	MD n = 1,015
Median Age (IQR)	47 (33 – 64)	48 (33 – 65)	47 (35 – 64)	46 (32 – 63)
Median Household Size (IQR)	2 (2 – 3)	2 (2 – 3)	2 (1 – 3)	2 (2 – 3)
Gender, n (%)				
Female	1,612 (53%)	537 (51%)	545 (52%)	477 (53%)
Male	1,431 (47%)	505 (49%)	502 (48%)	422 (47%)
Other	1 (0.03%)	0 (0%)	0 (0%)	1 (0.1%)
Race/Ethnicity, n (%)				
White/Caucasian	1,712 (56%)	444 (45%)	628 (61%)	640 (64%)
Black/African American	632 (21%)	223 (22%)	169 (16%)	240 (24%)
Hispanic/Latino	437 (14%)	241 (24%)	141 (14%)	55 (5%)
Asian/Pacific Islander	175 (6%)	58 (6%)	65 (6%)	52 (5%)
Other	75 (3%)	25 (3%)	33 (3%)	17 (2%)
Educational Attainment, n (%)				
High school degree or less	552 (18%)	181 (18%)	192 (18%)	179 (18%)
Associate degree	544 (18%)	167 (17%)	207 (20%)	170 (17%)
Some college (no degree)	335 (11%)	133 (13%)	122 (12%)	80 (8%)
Bachelor's degree	935 (31%)	299 (30%)	320 (31%)	316 (31%)
Graduate degree	672 (22%)	213 (22%)	198 (19%)	261 (26%)
Annual Household Income, n (%)				
< \$20,000	336 (11%)	134 (13%)	101 (10%)	101 (10%)
\$20,000 – \$39,000	481 (16%)	194 (19%)	169 (16%)	118 (12%)
\$40,000 – \$49,000	250 (8%)	103 (10%)	82 (8%)	65 (6%)
\$50,000 – \$69,000	548 (18%)	171 (17%)	215 (21%)	162 (16%)
\$70,000+	1,443 (47%)	396 (40%)	478 (46%)	569 (56%)
Employment Status, n (%)				
Employed, working outside the home	1,168 (37%)	361 (37%)	427 (41%)	380 (38%)
Employed, working from home	878 (29%)	275 (28%)	299 (29%)	304 (30%)
Unemployed	309 (10%)	102 (10%)	110 (11%)	97 (10%)
Retired	664 (22%)	245 (25%)	199 (19%)	220 (22%)
Urban-Rural Classification				
Urban	1,018 (33%)	433 (43%)	486 (47%)	99 (10%)
Suburban	1,764 (58%)	511 (51%)	385 (37%)	868 (86%)
Rural	276 (9%)	54 (5%)	174 (17%)	48 (5%)
Reported Exposure, n (%)	235 (8%)	98 (10%)	79 (8%)	58 (6%)
Reported Symptoms, n (%)	223 (7%)	92 (9%)	71 (7%)	60 (6%)
Reported Travel for Any Purpose, n (%)	494 (16%)	184 (18%)	142 (14%)	168 (17%)

Note: Numbers may not sum to the total if there were participants who elected not to answer a given question.

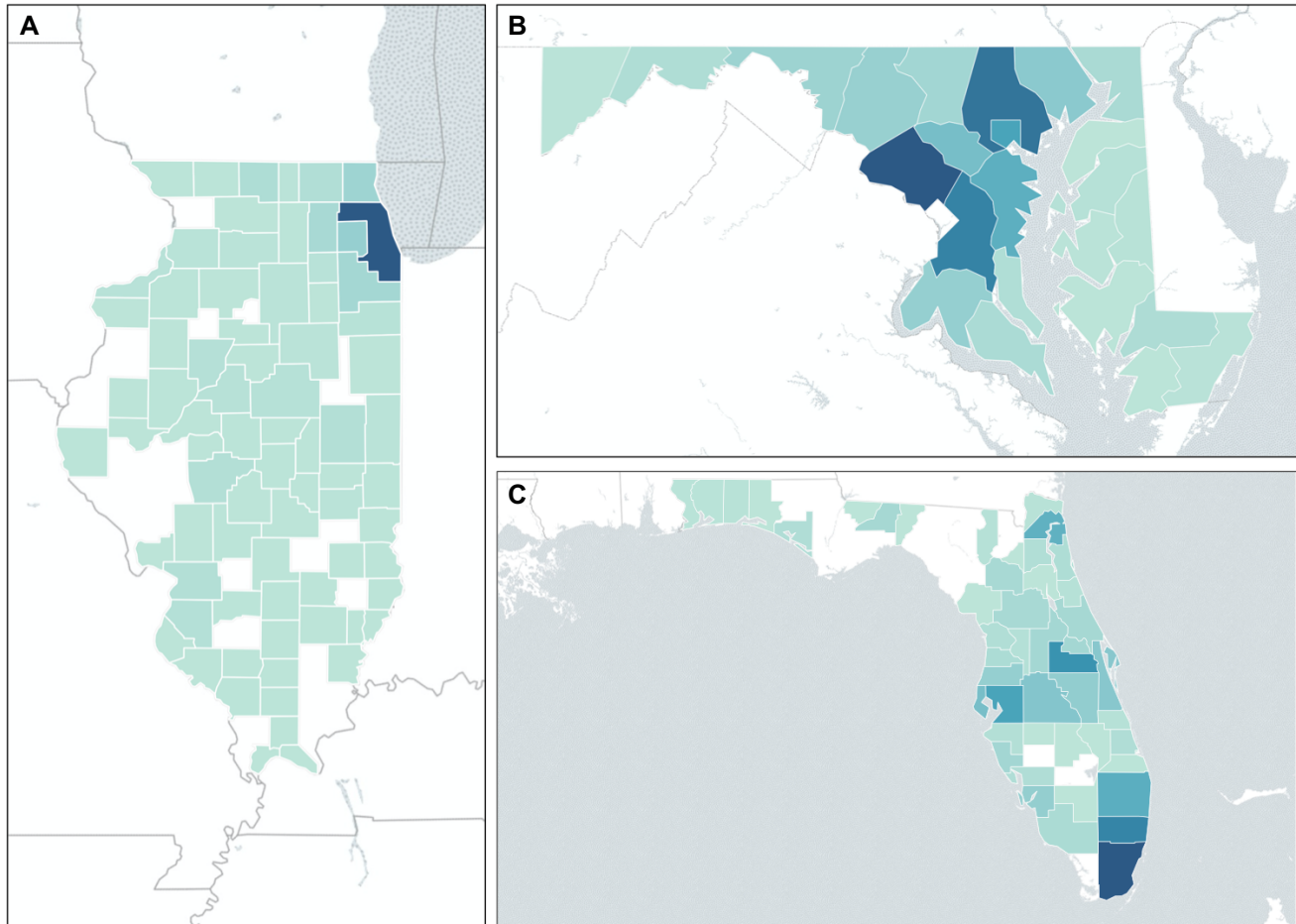


Fig S2. Distribution of study sample by county in each of the four study states: (A) Illinois, (B) Maryland, and (C) Florida. Darker shaded polygons represent a higher proportion of respondents.

Table S3. Factors associated with wanting/needing a SARS-CoV-2 PCR test in the prior 2 weeks (n=3,058). Results from univariable and multivariable regression analysis.

Variable	Unadjusted Odds Ratio	95% Confidence Interval	Adjusted Odds Ratio	95% Confidence Interval
Age (per 5-year increase)	0.84	0.81 – 0.87	0.98	0.88 – 0.98
Household Size (per 1-person increase)	1.10	1.01 – 1.19	-	-
Positive Household Member (in the prior 2 weeks)	11.04	7.93 – 15.4	-	-
Gender				
Female (ref.)	-	-	-	-
Male	1.37	1.09 – 1.74	1.52	1.14 – 2.04
Race/Ethnicity				
White (ref.)	-	-	-	-
Black/African American	1.93	1.47 – 2.54	1.85	1.29 – 2.67
Hispanic/Latino	1.35	0.96 – 1.91	1.34	0.86 – 2.07
Asian/Pacific Islander	1.07	0.62 – 1.84	1.30	0.70 – 2.42
Other	1.32	0.62 – 2.81	1.61	0.68 – 3.79
Educational Attainment				
High school degree or less (ref.)	-	-	-	-
Associate degree	0.97	0.65 – 1.46	-	-
Some college (no degree)	1.09	0.70 – 1.72	-	-
Bachelor's degree	1.08	0.76 – 1.54	-	-
Graduate degree	1.24	0.86 – 1.79	-	-
Annual Household Income				
< \$20,000 (ref.)	-	-	-	-
\$20,000 – \$39,000	0.93	0.61 – 1.41	-	-
\$40,000 – \$49,000	0.45	0.25 – 0.83	-	-
\$50,000 – \$69,000	0.58	0.37 – 0.90	-	-
\$70,000+	0.80	0.56 – 1.15	-	-
Employment Status				
Working Outside the Home (ref.)	-	-	-	-
Working from Home	0.60	0.46 – 0.79	0.91	0.65 – 1.27
Unemployed	0.41	0.26 – 0.66	0.53	0.30 – 0.92
Retired	0.26	0.18 – 0.39	0.91	0.53 – 1.56
Urban-Rural Classification				
Urban (ref.)	-	-	-	-
Suburban	0.63	0.49 – 0.81	0.79	0.57 – 1.10
Rural	0.77	0.50 – 1.18	0.79	0.45 – 1.37
State				
FL (ref.)	-	-	-	-
IL	1.07	0.81 – 1.41	1.49	1.04 – 2.14
MD	0.89	0.67 – 1.20	1.40	0.95 – 2.06
Report Exposure and/or Symptoms				
No exposure or symptoms (ref.)	-	-	-	-
Exposure only	10.5	7.07 – 15.6	8.27	5.45 – 12.6
Symptoms only	12.2	8.10 – 18.4	10.1	6.48 – 15.7
Exposure and symptoms	64.2	38.7 – 106	53.2	30.7 – 92.1
Report Travel for Any Purpose	3.29	2.55 – 4.24	1.34	0.95 – 1.90

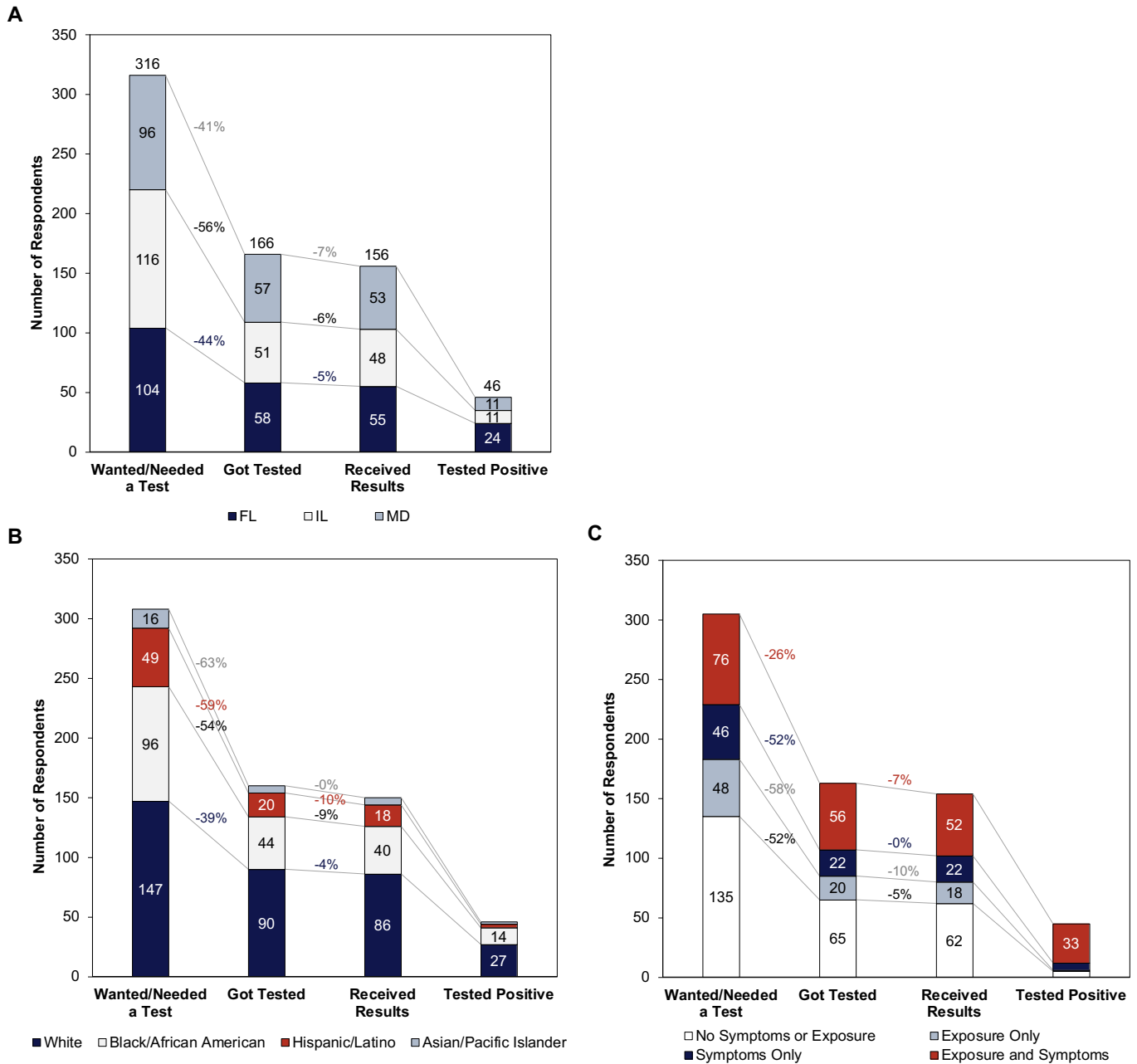


Figure S4. SARS-CoV-2 testing cascade by (A) state, (B) race/ethnicity, and (C) self-reported symptoms. Trend lines and percentages reflect the proportion lost between each step in the cascade.

Note: Numbers may not sum to the total if there were participants who elected not to answer a given question.

Table S5. Factors associated with getting a PCR test for SARS-CoV-2 among those who wanted/needed a test in the prior 2 weeks (n=316). Results from univariable and multivariable logistic regression analysis.

Variable	Unadjusted Odds Ratio	95% Confidence Interval	Adjusted Odds Ratio	95% Confidence Interval
Age (per 5-year increase)	1.00	0.94 – 1.08	1.00	0.90 – 1.10
Household Size (per 1-person increase)	0.99	0.85 – 1.14	-	-
Positive Household Member (in the prior 2 weeks)	3.13	1.79 – 5.50	-	-
Gender				
Female (ref.)	-	-	-	-
Male	0.93	0.59 – 1.45	0.46	0.26 – 0.82
Race/Ethnicity				
White (ref.)	-	-	-	-
Black/African American	0.56	0.33 – 0.94	0.53	0.28 – 0.99
Hispanic/Latino	0.45	0.23 – 0.88	0.60	0.28 – 1.28
Asian/Pacific Islander	0.42	0.14 – 1.25	0.34	0.10 – 1.13
Other	1.90	0.37 – 9.74	2.37	0.35 – 16.2
Educational Attainment				
High school degree or less (ref.)	-	-	-	-
Associate degree	0.89	0.56 – 1.41	-	-
Some college (no degree)	1.11	0.67 – 1.83	-	-
Bachelor's degree	1.36	0.93 – 2.00	-	-
Graduate degree	1.58	1.06 – 2.34	-	-
Annual Household Income				
< \$20,000 (ref.)	-	-	-	-
\$20,000 – \$39,000	0.70	0.32 – 1.56	-	-
\$40,000 – \$49,000	0.66	0.20 – 2.15	-	-
\$50,000 – \$69,000	0.43	0.18 – 1.02	-	-
\$70,000+	1.10	0.55 – 2.20	-	-
Employment Status				
Working Outside the Home (ref.)	-	-	-	-
Working from Home	0.51	0.30 – 0.86	1.54	0.83 – 2.85
Unemployed	0.25	0.09 – 0.68	0.36	0.11 – 1.22
Retired	0.55	0.25 – 1.20	1.27	0.43 – 3.69
Urban-Rural Classification				
Urban (ref.)	-	-	-	-
Suburban	1.22	0.76 – 1.95	0.68	0.37 – 1.23
Rural	1.42	0.63 – 3.20	1.72	0.64 – 4.60
State				
FL (ref.)	-	-	-	-
IL	0.61	0.36 – 1.05	0.75	0.38 – 1.46
MD	1.11	0.63 – 1.95	1.64	0.82 – 3.30
Report Exposure and/or Symptoms				
No exposure or symptoms (ref.)	-	-	-	-
Exposure only	0.75	0.38 – 1.46	0.66	0.31 – 1.38
Symptoms only	0.96	0.49 – 1.88	0.70	0.32 – 1.49
Exposure and symptoms	3.08	1.66 – 5.74	1.84	0.90 – 3.79
Report Travel for Any Purpose	3.66	2.20 – 6.09	3.35	1.79 – 6.25

Table S6. Barriers to testing by symptoms among persons who reported wanting/needing a SARS-CoV-2 PCR test in the prior 2 weeks across FL, IL, and MD.

	Total	No Symptoms	Any Symptoms
Unable to Get Tested	n = 146	n = 99	n = 45
Reasons for Not Getting Tested			
Did not know where to go	52 (36%)	31 (31%)	20 (44%)
Too long of a line to get tested	17 (12%)	12 (112%)	5 (11%)
Could not get an order from a doctor	31 (21%)	19 (19%)	12 (27%)
Testing center too far away	31 (21%)	24 (24%)	7 (16%)
Afraid to get tested	30 (21%)	17 (17%)	13 (29%)
Language barriers	7 (5%)	3 (3%)	4 (9%)