

The Impact of the COVID-19 Pandemic on RDD Cell Phone Response in the National Immunization Surveys

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Abstract

The COVID-19 pandemic upended the lives of millions of Americans in 2020. The public health crisis, stay-at-home orders, and economic upheaval have had far-reaching impacts on the attitudes and behaviors of the public. One surprising change during 2020 was the increased willingness of respondents to participate in telephone surveys. In this paper, we demonstrate this effect by tracing respondent participation rates over time in the National Immunization Surveys (NIS). The NIS are random-digit-dial (RDD) cell-phone surveys sponsored by the U.S. Centers for Disease Control and Prevention that are used to assess vaccination coverage in the United States among children age 19-35 months (NIS-Child) and adolescents age 13-17 years (NIS-Teen), and influenza vaccination coverage among children age 6 months-17 years (NIS-Flu).

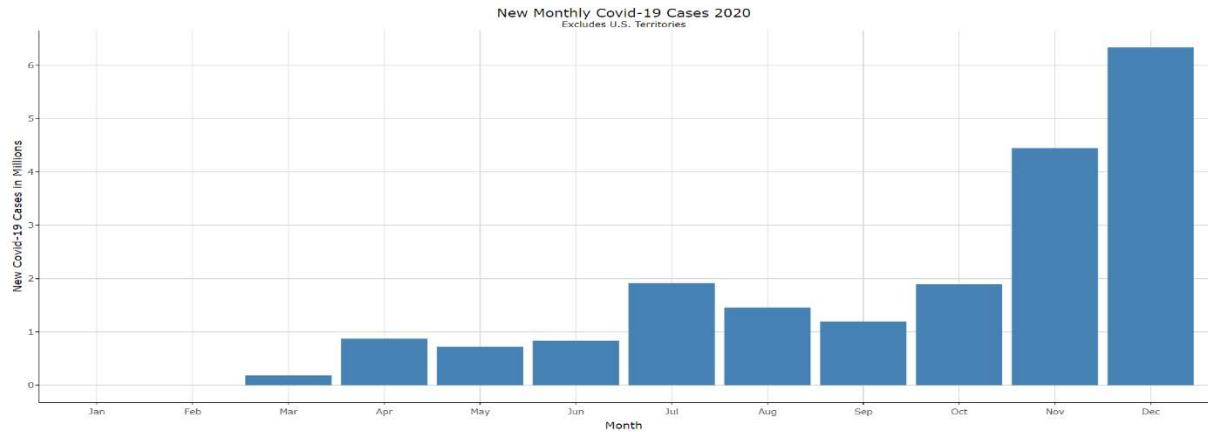
To examine the effect of the pandemic on survey participation, we present a weekly time series of the NIS-Child contact and cooperation rates from Spring 2019 to Spring 2020. We observe a substantial increase in respondent cooperation rate in March and April 2020 compared to March and April 2019, followed by a leveling off of the cooperation rate in the months following April 2020. We also examine whether the impact on NIS-Child cooperation rate differed among Census divisions of the country and among demographic subpopulations and whether the increase in respondent participation resulted in a more representative sample before weighting adjustments.

Keywords: National Immunization Surveys, COVID-19, Response Rates

1. Background

In January of 2020, the World Health Organization announced a novel coronavirus-related pneumonia in Wuhan, China. In late January, the first U.S. cases of COVID-19 were being reported. By March of 2020, President Trump declared COVID-19 a national emergency. States began issuing stay-at-home orders, requesting citizens to stay inside and limit the amount of contact they had with others to prevent further spread of the virus.

Although the first COVID-19 cases in the U.S. were reported in January, cases didn't start drastically increasing until March of 2020, and they quickly spiked in April. This was followed by some variance in new cases throughout the year, with another spike at the end of the year (Figure 1).



Created using data from the Centers for Disease Control and Prevention, COVID-19 Response, COVID-19 Case Surveillance Public Data Access, Summary, and Limitations.

Figure 1: New Monthly COVID-19 Cases 2020, United States.

If the COVID-19 pandemic is linked to changes in contact and cooperation rates, there is reason to believe that it would affect the NIS more strongly than other telephone surveys. Specifically:

1. The CDC is prominently featured in the introduction text as the sponsor for the NIS.
2. The introduction text highlights that the survey is about health and vaccinations and stresses the survey's importance.

Thus, someone who is concerned about the pandemic or interested in learning more may be more willing to participate in the survey. The NIS introductory text can be found below, with the pertinent items in bold.

NIS Introduction Text:

“Hi, my name is _____, and I’m calling on behalf of the **Centers for Disease Control and Prevention**. How are you today?”

The CDC is conducting an important study about the **health and vaccinations** of children and teens, which will **provide crucial information about the risk of diseases in our communities**. Just to let you know my call will be recorded or monitored for quality purposes.”

2. Methodology

The NIS uses quarterly, stratified samples of cell-phone numbers in each state, the District of Columbia, and select local geographic areas. To assess the impact of the COVID-19 pandemic on the NIS surveys, we first base-weight the first dial contact and cooperation rates by month to account for differences in number of dials in each stratum and geographic area for 2019 and 2020. This allows us to compare the aggregate rates across these months without concern for the possible changes to the rates caused by the underlying differences in sampling.

As the survey approaches the end of each quarterly field period, sample release is curtailed in strata for which enough sample has already been released to hit the target number of completed interviews. As a result, some months do not include first dials in all sampling strata, and therefore the first dials made in that month are not fully representative of the entire U.S. In these cases, if the first dials for a month provide less than 90% representation of the U.S., we opted to remove that month from the analysis. Notably, most of the graphs displayed have December 2019 missing due to the removal of this month.

After comparing the base-weighted first dial cooperation and contact rate between 2019 and 2020, we then compare contact and cooperation rate between 2019 and 2020 by census region. During 2020, geographic areas of the U.S. suffered disproportionately from the COVID-19 pandemic at different times of the year. As a result, we would expect to see larger changes in our contact and cooperation rate in regions where there was a higher incidence of COVID infections if the pandemic was a driving cause of change in the contact and cooperation rate.

Finally, we examine the base-weighted distributions of mother's education and race/ethnicity among NIS-Child respondents by month in 2019 and 2020 to assess whether the pandemic caused a change in the distribution of the demographics of respondents.

In this analysis, we define the contact rate as the proportion of calls to working cell-phone numbers that were answered by a human being. We define the cooperation rate as the proportion of calls that resulted in a completed NIS screening interview on that call among the calls that were answered by a human being.

To further assess whether the pandemic was a factor in any observed change in the cooperation rate, we normalized counts on terms searched for on Google from the U.S. that we felt would be related to the pandemic such that they were on a similar scale to the cooperation rate. We then graphed them against each other to assess whether the trends were similar.

3. Results

Contact Rate

Due to the stay-at-home orders, we expected potential respondents to be more likely to answer their phone, leading to an increase in contact rate after the stay-at-home orders began going into effect in March 2020. Figure 2 presents the first dial base-weighted contact rate among working numbers for 2019 vs. 2020. We see that the contact rate was mostly consistent throughout both 2019 and 2020, staying between 20 and 25%. The contact rate was slightly higher in 2020 than in 2019 for many months, but the difference is small, and the deviation did not begin until May 2020. This could be due to stay-at-home orders occurring at different points in the year for different geographic areas of the U.S. as the pandemic evolved.

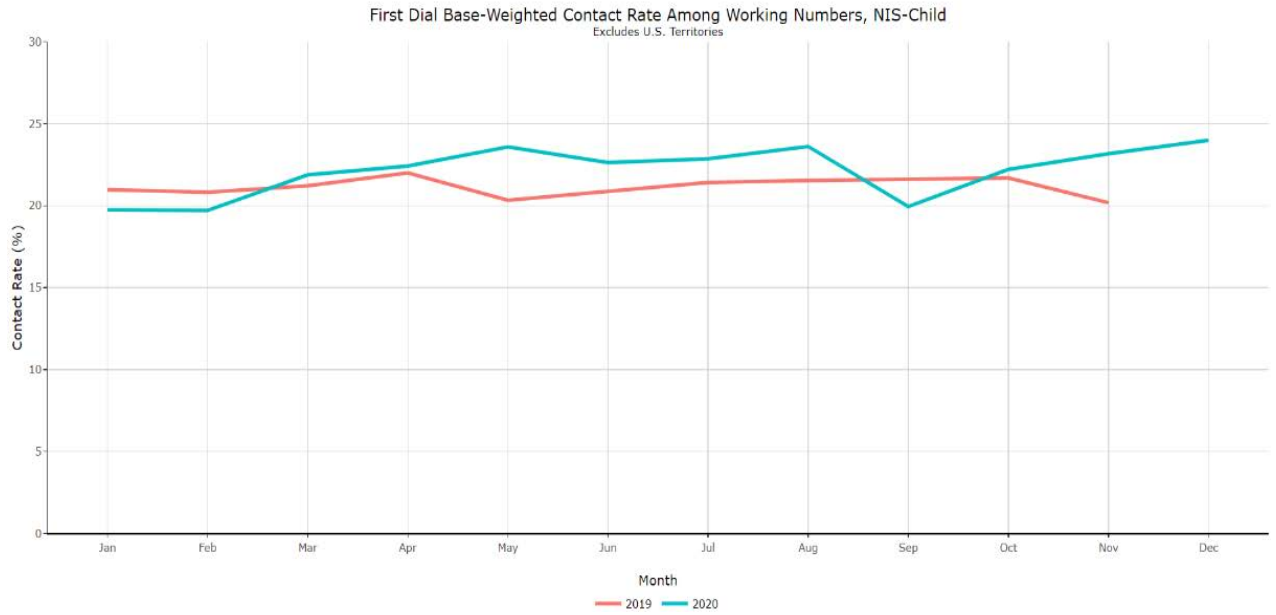


Figure 2: First Dial Base-Weighted Contact Rate Among Working Numbers, NIS-Child

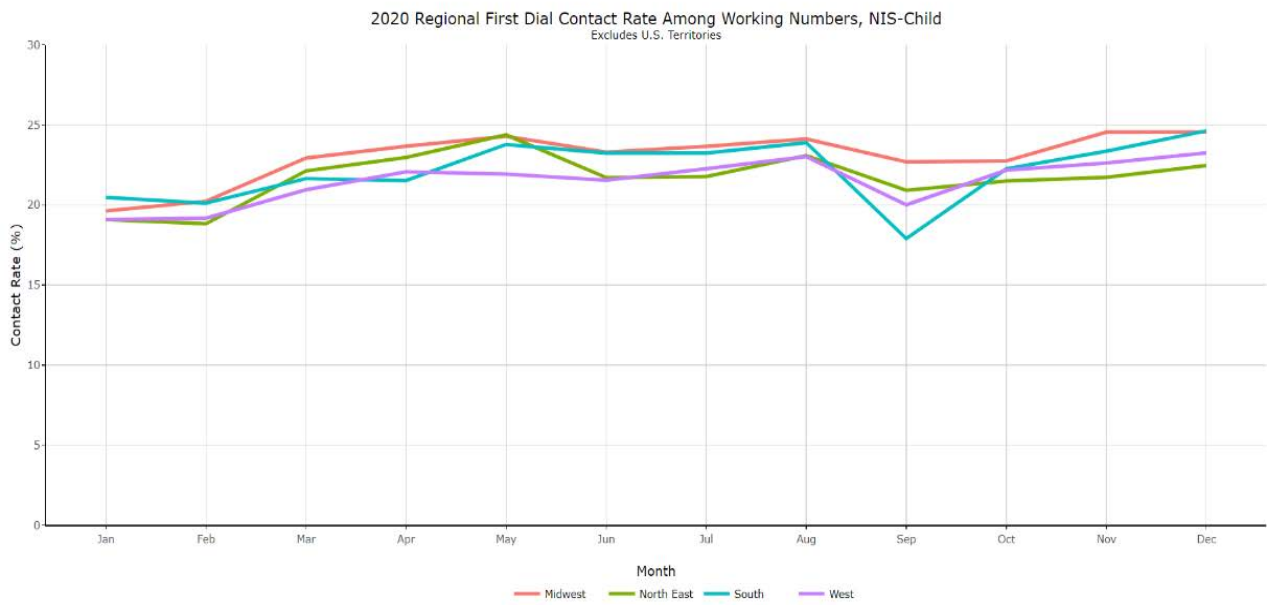


Figure 3: 2020 First Dial Base-Weighted Contact Rate Among Working Numbers by Census Region, NIS-Child

To test this hypothesis, in Figure 3 we examine the 2020 contact rate by census region. Surprisingly, the first dial contact rate among working numbers looks very similar to Figure 2 for each census region. While there is some variance throughout 2020, we generally see the four census regions moving in a similar pattern. If the stay-at-home orders and increased severity of the pandemic had a localized effect on the NIS contact rate, we would have expected to see more variability between the census regions throughout the year when the pandemic impacted one region more heavily than the others.

Cooperation Rate

Figure 4 presents the first dial base-weighted cooperation rate among contacts for 2019 vs. 2020. In 2019, we see that the cooperation rate is extremely flat, staying at or near 15% for the entire year. In comparison, the 2020 screener completion rate starts off very similar, but increases slightly in February, and jumps up to 25% in March. This is a 67% increase in the cooperation rate from the 2019 baseline. The cooperation rate then peaks at around 27% in April, before dropping off but remaining elevated at about 22%, or about 50% above 2019 levels for the rest of the year. These are huge year over year increases that we do not commonly see, and the trend in March and April follows closely the increase in new COVID-19 cases occurring at that time. This strongly suggests that the observed increase in the cooperation rate in 2020 compared to 2019 could be due to factors related to the COVID-19 pandemic.

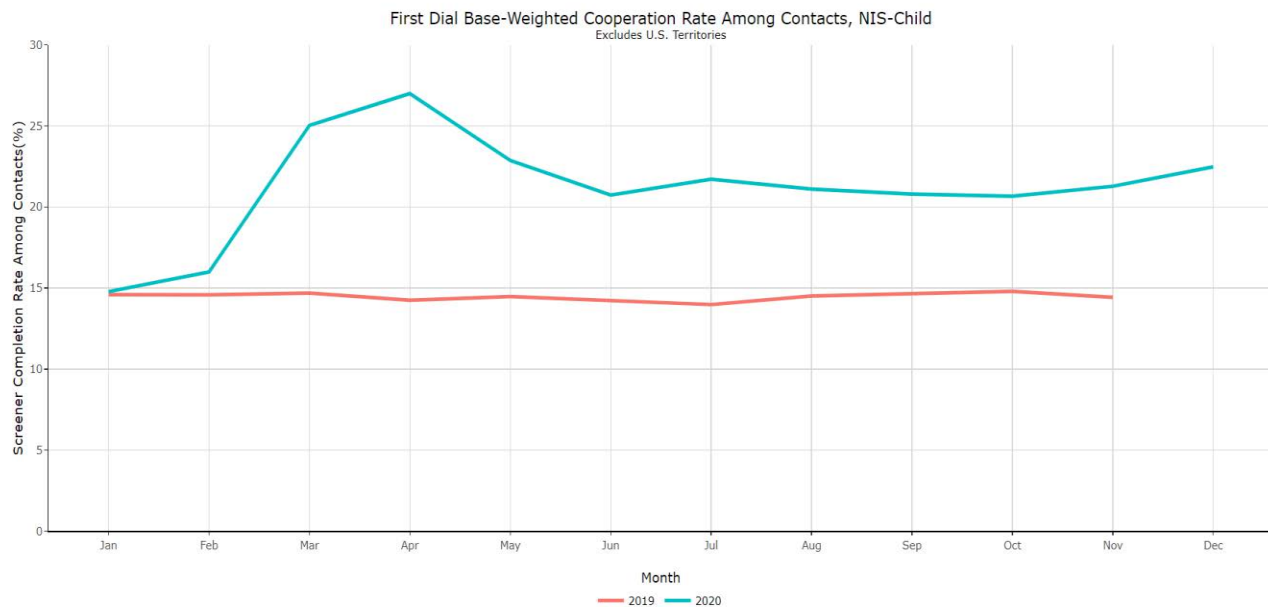


Figure 4: First Dial Base-Weighted Cooperation Rate Among Contacts, NIS-Child

Because we observe an effect of the pandemic on the cooperation rate, we would expect to see differences in cooperation rates by region for the same reasons mentioned previously for the contact rate. Instead, we see in Figure 5 that the cooperation rates in the four census regions seems to move together, mirroring the trend that was observed in the overall cooperation rate. This implies that whatever is impacting the cooperation rate is impacting each of the census regions equally, regardless of local stay-at-home orders or how strongly the pandemic is hitting a specific region. This could also be interpreted as respondents acting based on a more national rather than local narrative of the pandemic, despite the impacts of the pandemic varying at the local level.

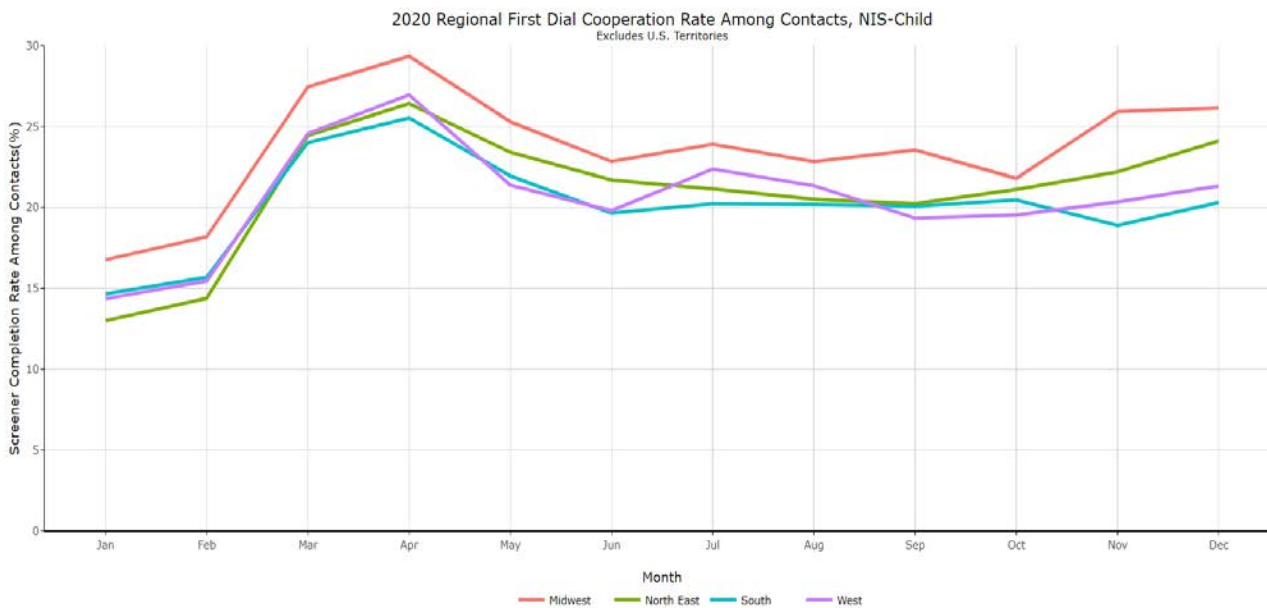


Figure 5: 2020 First Dial Cooperation Rate Among Contacts by Census Region, NIS-Child

As we were surprised that the trends in the contact and cooperation rates did not vary by census region, we decided to evaluate these rates at a more local level, comparing contact and cooperation rates for New York to the North East Census region. Despite New York being one of the first states heavily impacted by the pandemic, cooperation and contact rates did not vary from the overall trend for the North East. This served as further evidence that these rates did not differ from the national trend at more local levels.

Demographics

It is possible that different demographic groups responded to the pandemic differently, or that the pandemic affected them differently, and that this could lead to a change in how they respond to the NIS. Figure 6 presents trends in the base-weighted distribution of mother's education among first dial respondents. While there is some variation in the distribution of mother's education throughout both 2019 and 2020, there is not any evidence that the increase in NIS response in 2020 was driven by a particular education group.

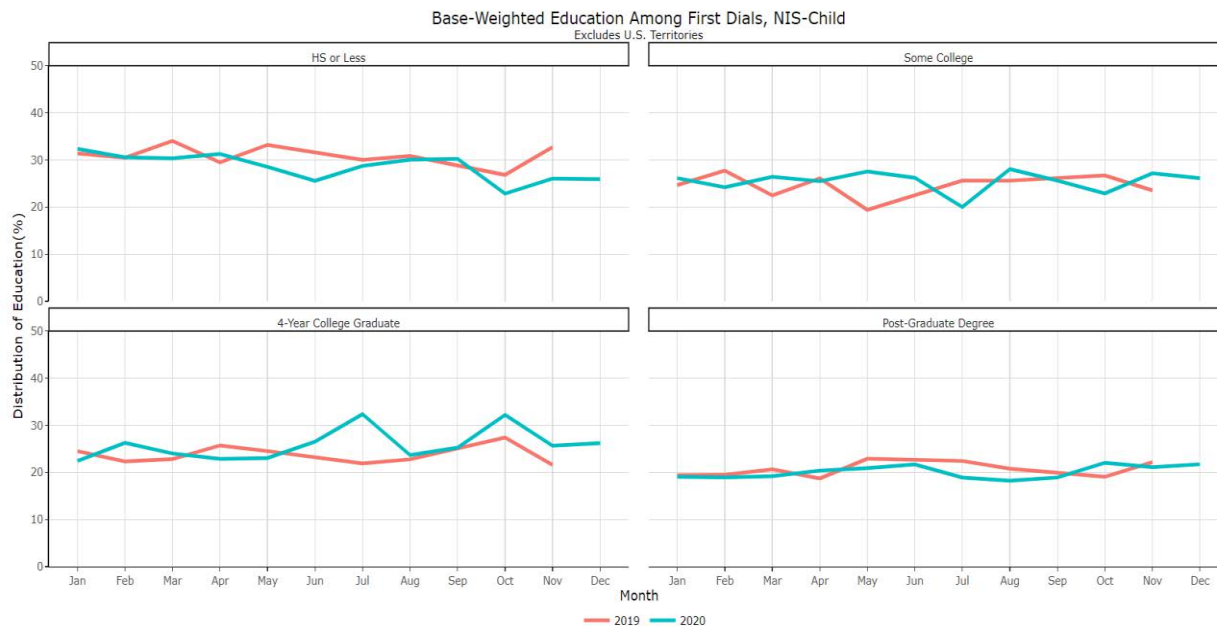


Figure 6: Base-Weighted Distribution of Mother’s Education Among First Dial Respondents, NIS-Child

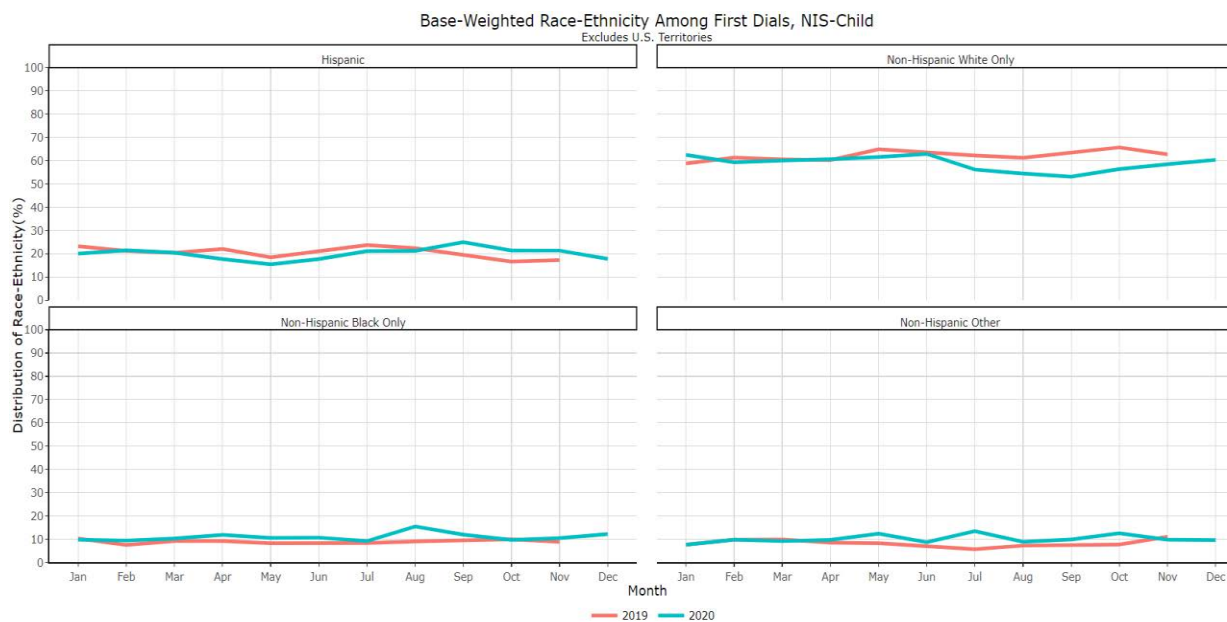


Figure 7: Base-Weighted Distribution of Child Race-Ethnicity Among First-Dial Respondents, NIS-Child

Next, we examine the base-weighted distribution of the mother’s race-ethnicity among first-dial respondents. In Figure 7, we observe that the race-ethnicity distribution appears relatively flat in both 2019 and 2020. There does appear to be a slight drop in non-Hispanic white only respondents for July to November of 2020, with the other three groups increasing slightly. However, the overall change is small. Similar to the education demographic, this variance could be due to random chance. Thus, while we did observe an increase in cooperation in 2020 compared to 2019, it appears the increase in

cooperation was consistent across these education and race-ethnicity demographic groups.

Google Trends

While the pandemic caused major changes and disruptions to daily lives, it is possible that the observed changes in cooperation could be due to interest in the COVID-19 pandemic itself. Figure 8 shows the cooperation rate along with Google search trends for the terms “CDC”, “CORONAVIRUS”, “COVID”, and “PANDEMIC”. Our expectation was that if interest in the pandemic was a cause of the increase in cooperation rate, we would see the general trend of the Google search terms mirror the change in cooperation, with the search trends being a measure of people’s overall interest or concern in the pandemic.

In Figure 8, we observe that both our measure of cooperation and all 4 search trends were relatively flat for 2019. Both the cooperation and the search trends then increase slightly in February of 2020, with a large increase in March when the COVID-19 cases began to dramatically increase in the U.S. In April the cooperation rate peaked, while the counts of searches began to decline. After April, both the cooperation rate and the “COVID” search term remained elevated for the rest of the year, with the “COVID” search time peaking in November of 2020. Overall, the trend for the “COVID” search term mirrored the cooperation rate extremely closely, with the other search trends mirroring the early trend we saw in cooperation. This strongly suggests that interest in the pandemic was a driver of the increase in NIS cooperation rate.

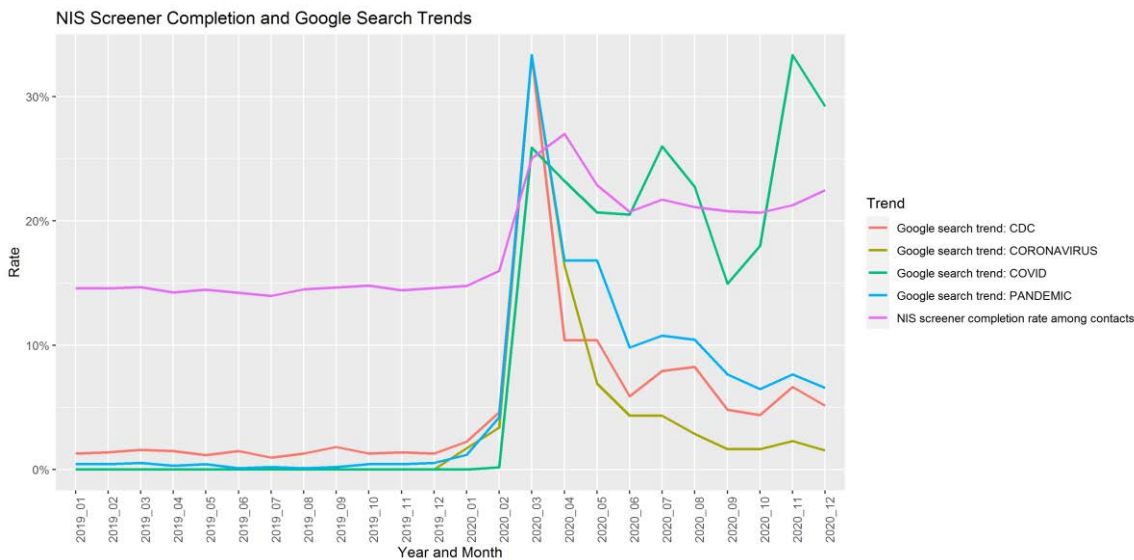


Figure 8: NIS Cooperation Rate and Google Search Trends

4. Conclusion & Next Steps

Our initial expectation was that we would see an increase in both the contact rate and the cooperation rate as a result of factors surrounding the pandemic. In particular, we hypothesized that stay-at-home orders would result in an increase in people's ability and willingness to answer the phone and participate in surveys. Instead, while we observed a very large increase in the cooperation rate, we saw that the contact rate remained essentially flat between 2019 and 2020, even when looking by census region.

One potential reason for the lack of difference in contact rate between 2019 and 2020 is that the NIS is a cell-phone survey, and therefore it is not necessary to be at home to receive our calls. Another potential reason is that we cannot control what is displayed on the cell-phone's Caller ID; most respondents do not know who is calling unless they answer the phone, and therefore CDC sponsorship can have little or no impact on the contact rate.

While we did expect to see an increase in cooperation as a result of the pandemic, we were surprised at the extent of the increase. In 2019 cooperation remained essentially flat throughout the year, but cooperation increased dramatically in March and April 2020, peaking nearly 80% higher than the 2019 cooperation rate. In the months following the peak in 2020, cooperation remained elevated by around 50% relative to 2019. These are extremely abnormal year over year increases for a rate that was essentially flat, and such large changes are not normally observed. We suspect the prominent featuring of CDC and highlighting that the survey was about vaccinations and diseases in introductory text may have prompted respondents to participate at higher rates, particularly given the results from our Google trend analysis.

We also examined whether this increase in cooperation was driven by a particular demographic increasing their participation. However, we did not observe changes in the demographic distributions of mother's education or child's race-ethnicity over time, indicating that the increase in cooperation was consistent across education and race-ethnicity groups.

One of the more surprising results was that the contact and cooperation rates did not appear to vary by census region. Instead, the rates observed at the census region level generally mirrored the aggregate national trends, indicating that people may have been responding more to a national narrative on the pandemic than a local one.

Going forward, we intend to continue monitoring these rates throughout 2021 as the pandemic hopefully comes to a close. We will also examine vaccination coverage rate estimates by month of interview to determine whether the increase in cooperation had any impact as the provider-reported vaccination history data becomes available for the 2020 NIS; that is, we will look for evidence of a change in nonresponse bias in vaccination coverage rate estimates caused by the increase in cooperation. We also plan to assess changes in cooperation relative to Google search trends for other pandemic related news, such as vaccines, and to determine if there was a change in the distribution of respondents during the pandemic along other demographic dimensions, such as income and mother's age.

References

AJMC Staff. "A Timeline of COVID-19 Developments in 2020." *The American Journal of Managed Care*, January 01, 2021, <https://www.ajmc.com/view/a-timeline-of-covid19-developments-in-2020>

Centers for Disease Control and Prevention, COVID-19 Response. COVID-19 Case Surveillance Public Data Access, Summary, and Limitations

Google Trends. <https://trends.google.com/trends/?geo=US>