COVID-19 Impacts on the Post-Enumeration Survey

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Abstract

During the implementation of the 2020 Post-Enumeration Survey (PES), the world experienced the COVID-19 pandemic. Due to health and safety concerns, the PES implemented both schedule and operational changes so that it could protect the public and its staff. In general, the PES schedule was delayed, clerical matching operations were modified, contact strategies were updated, and hiring and training modifications were implemented to protect both field representatives and respondents. Some local governments implemented safety restrictions and lockdowns that limited our ability to conduct face-to-face interviews and prevented field workers from carrying out the interviews initially. People also refused in-person interviews due to concerns of catching or spreading COVID-19. Unit and item nonresponse were greater than expected causing concerns of undercoverage in the PES. Response and measurement error were also a concern given higher than expected proxy rates. In this paper we provide an overview of the operational changes and impacts to response and measurement error in the PES. While we cannot always precisely measure the impacts of COVID-19, we describe many of the effects that COVID-19 had on the survey.

Key Words: COVID-19, Post-Enumeration Survey, census, nonresponse, measurement error

1. Introduction

Post-enumeration surveys have been used in the United States to study the results of the census since 1950. The goal of the 2020 Post-Enumeration Survey (PES)[1] was to measure the coverage of the household population and housing units in the 2020 Decennial Census. We did this by implementing a sample survey that conducted in-person interviews and by producing estimates of net coverage error and components of coverage. Net coverage error refers to the difference between the census count and the true population size. To estimate the true population size, the 2020 PES used a technique called "dual-system estimation," with the two systems being the survey and the correctly enumerated people and housing units in the census. The PES sample, also known as the Population (P) sample, was a probability sample of about 160,000 housing units in approximately 10,000 blocks across the country, and data collection was done independently of the census. The census sample was an independent sample of census enumerations known as the Enumeration (E) sample.

For components of coverage, we broke census enumerations into three groups:

- Correct enumerations. These referred to people and housing units that were correctly counted in the census as of April 1, 2020 (Census Day).
- Erroneous enumerations. These included duplicate records of people or housing units that were already counted in the 2020 Census as well as people and addresses that were counted but should not have been (e.g., a fictious person or an address for a business or a housing unit that was built after Census Day).
- Omissions. These refer to people or housing units that were missed by the 2020 Census

To estimate the rates of correct enumeration and erroneous enumeration, we used the E sample and a design-based estimator[2].

Finally, for data collection and processing, we began by visiting the housing units located in sample blocks and creating an independent list of housing units. Once we created this list and performed additional sampling procedures, we conducted in-person interviews at each in-sample housing unit. The goal of these interviews was to roster the people in the households and collect information about where they were living on April 1, 2020, also known as Census Day. We then compared both person and housing unit information collected in the PES to the data from the census. This helped us to determine what housing units and people were missed by the census or counted in error. Information provided from the PES is used to improve future censuses and contribute to our understanding of census quality.

When the COVID-19 pandemic struck the world in early 2020, initial phases of PES operations were already underway. The pandemic presented numerous logistical challenges, prompting several operational adjustments made to ensure the safety of PES staff and the public. These adjustments included schedule pauses and delays, modifications to clerical matching operations, updates to contact strategies, an additional person interview period, and modifications to hiring and training. Although difficult to specify

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[1] The Census Bureau's Disclosure Review Board has reviewed this product for unauthorized disclosure of confidential information and has approved the disclosure avoidance practices applied to this release. CBDRB-FY22-216, CBDRB-FY22-136, and CBDRB-FY22-137

[2] A design-based estimator uses sampling weights to make inferences.

with confidence in every case, several potential impacts to survey results stemming from these changes, as well as from the implications of the pandemic itself, were identifiable. The PES used a robust estimation methodology, attempting to minimize the potential for bias.

2. Operational Challenges and Changes

There were several challenges presented by the COVID-19 pandemic. We made many operational changes in response to these challenges and, while we can not directly measure the impact of COVID-19, we can describe these changes and the effect they had on the survey. Changes included things like schedule changes and adjustments to business practices and operations. Ultimately, our goal was to deliver a high-quality survey while also ensuring the health and safety of our staff and respondents.

2.1 COVID-19 Effect on PES Field Schedule

Table 1 shows the planned and actual dates for PES field milestone operations. Field operations, of which there were initially five planned, were set to begin in January 2020 and conclude in June 2021. The first operation, Independent Listing, was designed to gather housing unit addresses independently of any census operations. We did this by canvassing each sample block and listing each housing unit from scratch. This operation started and ended on time and before any major COVID impacts. Every other operation after Independent Listing was delayed.

The Person Interview operation was delayed from June 2020 to September 2020 and when it was finally executed, it occurred during a major spike in COVID-19 cases. During the Person Interview we sent staff to in-sample housing units to inquire about the people that were living in the household on April 1, 2020, also known as Census Day. Delays in this operation may have made it harder for respondents to recall exact details about who was living in the household on Census Day. It also provided more time for changes in the target population to occur. This includes things like births and deaths, people moving in and out of housing units, and housing units being built or demolished. Finally, due to the pandemic and the change in social conditions that it caused, people were less likely to respond to an in-person survey. These changes may have contributed to lower response rates for the Person Interview operation than desired. In response to this, an additional Person Interview operation was created. During this operation we went back out in the field and tried to interview nonresponding housing units. This occurred during February and March of 2021 and, while it did result in even more schedule delays, it also helped to increase response rates. The table shows that the conclusion of PES field operations was delayed by approximately nine months.

Table 1: 2020 PES Revised Field Milestone Schedule

Operation	Planned Dates		Actual Dates	
	Start	Finish	Start	Finish
Independent Listing	1/16/2020	3/20/2020	1/16/2020	3/20/2020
Initial Housing Unit Followup	5/6/2020	6/19/2020	7/30/2020	9/25/2020
Person Interview	6/17/2020	9/18/2020	9/24/2020	1/11/2021
Person Interview Reopen	(not originally planned)		2/11/2021	3/20/2021
Person Followup	2/3/2021	3/26/2021	6/1/2021	9/17/2021
Final Housing Unit Followup	5/19/2021	6/18/2021	11/29/2021	2/28/2022

Notes: Dates include quality control work and are final as recorded in the Integrated Master Schedule.

2.2 COVID-19 Challenges and its Affects on PES Operations

Both field and in-office operations were affected by the COVID-19 pandemic and the PES implemented many changes to adjust for these. In this section of the paper, we will focus on the following COVID-19 social changes and how they affected PES operations:

- Social distancing requirements
- Health and safety measures
- Lockdowns
- Travel restrictions

As a result of these changes, many people in the U.S. began distancing themselves from each other and started wearing personal protective equipment such as masks. During periods in which COVID cases were elevated, many people preferred to stay at home and generally ceased going out. There were also travel restrictions and lockdowns implemented in some areas. We adjusted to these challenges with different changes and modifications to PES business practices and operations.

2.1.1 Adjustments for Hiring and Retention
Social distancing and mask requirements had several direct operational impacts on PES hiring and retention. The PES had a requirement to interview people face-to-face. There were also many PES jobs that were specific to field work and required knocking on doors and interacting with the public. These types of jobs were much less desirable during the pandemic, which made it harder to recruit and retain field representatives. In response to this, the PES increased recruitment efforts and provided personal protective equipment for interviewing. We encouraged social distancing of at least six feet during interviews and implemented various other measures to increase employee confidence in organizational safety procedures.

2.1.2 Adjustments for Training
The PES had also planned large, in-person onboarding events and in-person training for new staff. For onboarding, these events originally were to take place at hotels in large meeting rooms and conference halls. Instead, we switched to much smaller scale events so that people could avoid close contact with one another. We also implemented virtual training instead of the planned in-person training. The pivot to virtual training required time to plan for new materials and presented a steep learning curve for users. This in turn exacerbated schedule delays.

2.1.3 Adjustments for In-Person Interviews

As previously mentioned, the PES faced many challenges conducting an in-person survey during the pandemic. Since the PES was ultimately an assessment of the 2020 Decennial Census, it was important for us to continue with these types of interviews, if possible, so that we could collect accurate data. However, we did make some modifications to the in-person interview operations so that we could ensure the health and safety of both staff and respondents. We encouraged social distancing for interviewers and respondents as well as provided masks for field representatives to use during interviews. Like prior post-enumeration surveys, we allowed proxy interviews after numerous, well-spaced interview attempts. A proxy interview is where someone, like a landlord or a neighbor, could answer the interview questions in place of a household member. When phone numbers were available, which was not often, we called survey nonrespondents over the phone. One of our earliest field operations, the Initial Housing Unit (IHU) Field Followup, occurred close to the start of the pandemic. During this operation, we sent field representatives out to the field to resolve discrepancies found between the PES independent list of housing units and the initial census file. For that operation, we were more tolerant of interviews by observation. This allowed field representatives to record the details of a housing unit without contacting a householder or proxy. These details included things such as whether the unit was a single-family home or part of a multiunit structure.

2.1.4 Travel for Field activities

Lockdowns and travel restrictions impacted travel for PES field operations. In the U.S., travel was restricted and sometimes denied in certain areas, especially during the early phases of the pandemic. In response to these restrictions, during the Person Interview operation we shifted the timing of interview attempts to occur toward the end of the interview period, if the area was under travel restriction. The hope was that some travel restrictions would be lifted by that point. However, it also shortened the amount of time we had to conduct the interviews and may have contributed to the lower-than-expected response rates that came out of the Person Interview operation. Also, if certain geographic regions were under strict lockdown orders, the PES worked with several local governments to gain access to these areas.

2.1.5 Clerical Activities

Up until this point in the paper, we have discussed how COVID-19 affected field operations. The PES had also planned many in-office clerical activities that we needed to adjust. This work was to be performed by a large staff of technicians sitting in close quarters with one another. Around March of 2020, much like many other office-style businesses in the U.S., we pivoted from completing clerical activities in-office to a fully virtual environment. Many of the conveniences that would have been provided in the workplace, like dual monitors, were no longer available for staff working from home. This in turn may have slowed down or encumbered clerical activities to some degree.

The PES also had to completely pause all activities at the start of the pandemic so that we could pivot to this virtual environment, as well as plan for adjustments to field activities. This specifically affected the IHU Clerical Matching and Field operations, which was scheduled to start in April of 2020. The planned and revised dates for these operations are provided in Table 2. Because of this delay, we decided to abbreviate IHU Before Followup clerical matching work to get back on schedule. While we did conduct some initial review, we were unable to complete the planned workloads, which required that we send many more cases to the field for IHU Followup work than originally planned. This also increased workloads for IHU After Followup (AFU) clerical matching. We did conduct an early AFU

clerical matching phase in an attempt to alleviate some of the workload. During this phase we processed cases that needed minor review to alleviate workloads for After Followup Clerical Matching. Finally, during the planned AFU clerical matching phase, we ended before quality control could be completed. We had hoped that by adjusting these activities, we would eventually get back on schedule, however, as time passed, it became clear that the pandemic would affect the PES schedule on a much bigger scale than originally thought. Ultimately, the decision to adjust some of the clerical work resulted in larger workloads later on and longer schedule delays.

Table 2: 2020 PES Initial Housing Unit Operations Milestone Schedule

Operation	Planned Dates		Actual Dates	
	Start	Finish	Start	Finish
Before Followup Clerical Match	4/15/2020	5/15/2020	5/28/2020	6/25/2020
Initial Housing Unit Followup	5/06/2020	6/19/2020	7/30/2020	9/25/2020
Early After Followup Clerical Match	(not originally planned)		6/30/2020	7/14/2020
After Followup Clerical Match	6/02/2020	7/24/2020	8/14/2020	11/4/2020

Notes: Dates include quality control work and are final as recorded in the Integrated Master Schedule.

3. Survey Errors and Mitigation

As a sample survey, the PES is naturally subject to a certain amount of error. It is possible that the COVID-19 pandemic exacerbated some of these errors. While we cannot directly measure the impact that the COVID-19 pandemic had on PES survey errors, we can still discuss these errors and the measures we took to mitigate them.

3.1 Undercoverage

Undercoverage in the PES or the census refers to groups of people or housing units in the target population that are not included in the census or not given a probability of being included in the sample. For the PES, lockdowns and travel restrictions may have influenced our ability to list both people and housing units that should have been in-sample. One benefit of the PES was that dual-system estimation is robust to undercoverage if there is independence between the error mechanisms in the PES and the census. However, this independence assumption could have been violated in many ways. For example, the PES and the census data collection may have both been affected by COVID-19 in the same way. Furthermore, higher levels of undercoverage generally put greater strain on this independence assumption. More discussion on undercoverage in the PES can be found in Marra and Kennel (2022).

3.2 Nonresponse

PES nonresponse includes both unit and item nonresponse. Unit nonresponse occurred when we knew a housing unit was occupied but were unable to obtain an interview for the people living in the housing unit. It also may have occurred when an entire household did not provide enough information for matching to the census during the Person Interview operation. For gathering data on housing units, unit nonresponse was less of an obstacle. If the PES knew a housing unit existed but was unable to obtain an interview, we typically were able to collect most of the required information through observation.

Item nonresponse, however, was possible for both people and housing units in the PES. It occurred when answers to survey questions were not collected during an interview. This could be characteristics such as age, sex, race, or tenure. We will now discuss how COVID-19 may have contributed to higher-than-expected rates of unit and item nonresponse in the PES, as well as the impacts of such increases.

3.2.1 Unit Nonresponse

Generally, higher than expected levels of unit nonresponse for the PES might be partially attributed to the unwillingness of people to open doors to speak to interviewers during a pandemic. Social, political, and other factors may cause suppression of response to surveys in general. Table 3 shows the occupied housing unit response rates for the 2020 and 2010 post-enumeration surveys. The interview rate was considerably higher in 2010: 96.6% compared to 83.2% in 2020. Furthermore, a greater proportion of the nonresponding housing units in 2020 consisted of cases with not enough information to be considered a complete interview compared to 2010, indicating higher levels of missing information in this survey compared to the 2010 survey.

Table 3: PES Person Interview Response Rates for Occupied Housing Units (Unweighted)

Interview Outcome	2020		2010	
	Count	Percent	Count	Percent
Total Occupied Housing Units	137,000	100.0	145,000	100.0
Interview	114,000	83.2	140,000	96.6
Noninterview	23,000	16.8	5,300	3.7
Interview not conducted	4,900	3.6	2,300	1.6
Interview not sufficient	18,500	13.5	3,000	2.1

Notes:
1. Counts may not sum to totals shown because of rounding
2. The 2020 PES counts include the Person Interview and the Person Interview Reopen.
Source: U.S. Census Bureau, Decennial Statistical Studies Division, 2020 Post-Enumeration Survey (March 2022 release) and 2010 Census Coverage Measurement survey.

The PES continued the historic practice of using a nonresponse weighting adjustment to mitigate any potential nonresponse bias resulting from high levels of unit nonresponse and conducted a nonresponse bias analysis (Jost et al., 2022) to shed light on the amount of nonresponse and the potential impact of nonresponse bias on survey estimates.

3.2.2 Item Nonresponse

Item nonresponse refers to missing data in attempted interviews. This may have occurred if respondents chose to cut an interview short, or perhaps chose to not fully respond to an interview due to fear of transmission of COVID-19 during a prolonged interview. Also, COVID-19 schedule delays in the Person Interview operation may have affected item missingness because it allowed for more time between the PES interview day and Census Day, which in turn allowed more time for people to move in and out of PES housing units. It is more challenging for the PES to match movers because we need exact details about where the person was living on Census Day, which was not always accurately reported.

Increases in item nonresponse can affect many aspects of the PES. It can put more strain on our characteristic imputation methodology, which included imputation for characteristics such as age, sex, and race. If this process incorrectly classified these missing characteristics, this could lead to heterogeneity error during PES estimation because people and housing units would be classified into the wrong post-strata. Table 4 shows the

characteristic imputation rates for various person characteristics for both the P and the E samples in the PES. Higher levels of missing item data requiring imputation were observed in 2020 compared to 2010. For more information on missing item data, refer to Phan and Lawrence (2022).

Table 4. Characteristic Imputation Rates in the 2020 and 2010 P and E Samples

Sample	Year	Percentage of people with imputed characteristic					
		Relationship	Age	Sex	Race	Hispanic Origin	Tenure
P sample	2020	1.9	11.4	1.7	5.8	3.7	3.7
	2010	0.9	4.5	0.9	1.9	1.6	2.0
E sample	2020	3.8	8.3	3.0	11.1	9.1	6.2
	2010	1.4	4.9	1.5	5.3	5.1	3.3

Source: U.S. Census Bureau, Decennial Statistical Studies Division, 2020 Post-Enumeration Survey (March 2022 Release) and 2010 Census Coverage Measurement survey.

Item nonresponse could put stress on the computer and clerical matching operations. In cases where only some of the required information is present, the matching process would have been more prone to error, perhaps creating false matches or false nonmatches. Situations also occurred where the PES was not able to search for any match at all because the case did not have enough information for matching. For data collection, item nonresponse could cause a problem for field followup if it artificially increased the rate of nonmatches. The PES sends nonmatches to the field for followup so an increase in workload could put undue stress on followup. For PES imputation, not only did we impute for characteristics, but we also imputed for match and enumeration statuses. These missing items increased the status imputation workload and in general put more reliance on the imputation procedure. For estimation, a higher item missingness could increase the nonmatch rate. This could introduce bias into our dual system estimation methodology if the increase in nonmatches is not balanced by an increase in erroneous enumerations.

3.4 Recall Error

Recall error refers to the phenomenon in which the further away an interview occurs from the reference day or target event, the harder it becomes for respondents to recall exact details about the reference day or target event. Schedule delays related to the COVID-19 pandemic may have exacerbated recall error in the PES sample. Specifically, the delay to the Person Interview operation may have made it harder for respondents to accurately recall the details of where they were living on Census Day. To minimize the potential for recall bias, the PES conducted nationwide matching and extensive field followup to correct errors in the data collection process.

4. Conclusion

The COVID-19 pandemic caused schedule delays for PES operations, changed the character of interactions between interviewer and respondent, led to adjustments in PES operations, and possibly increased levels of unit and item nonresponse, among other impacts. These had possible effects on survey errors and ultimately survey estimates. The PES updated its methodology both in its operations and during the estimation process to

adjust for these impacts and to minimize the potential for bias. The actions undertaken to adjust to the conditions of the COVID-19 pandemic helped to deliver a high-quality survey while also ensuring the health and safety of PES staff and respondents.

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