

2020 Census Nonresponse Followup Operational Assessment Report

A New Design for the 21st Century

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Executive Summary

This executive summary focuses on the key results, conclusions, and recommendations from the 2020 Nonresponse Followup (NRFU) Operational Assessment (OA) Report.

The purpose of the 2020 NRFU operation was twofold: 1) to determine the housing unit status for addresses that did not complete a census questionnaire, and 2) to enumerate the housing units that were occupied on April 1, 2020. Because of its scale, NRFU has historically been the largest and most expensive field operation of the decennial census.

The goals of the NRFU operation for the 2020 Census were to:

- Use administrative records (AR) to inform the field contact strategy and reduce contact attempts.¹
- Implement refined field operations, including a reengineered operational control system that optimized case assignments and routing.
- Maximize the efficiency and effectiveness of the field staff structure and workload.
- Control the cost of the operation and ensure the quality of the data collected.
- Develop an automated NRFU quality control (QC) program to deter and detect falsification of field interviews.

Results

The following 2020 NRFU results are an abridged version of those from the full report.

5.1.1.b. *How many cases were resolved in each phase of the NRFU contact strategy?*²

During the 2020 Census, the NRFU operation employed a phased approach for case assignment and resolution. The purpose of phase 1 was to optimize case assignment and routing to get the easiest cases resolved first and to get initial attempts made on as many cases as possible. Census field supervisor (CFS) areas became eligible for phase 2 when 85 percent of their cases were closed or reached four attempt-days. The intent of phase 2 was to retain the highest-performing enumerators to work miniclusters of cases to increase the response rate in those areas.³ CFS areas became eligible for closeout when 90 percent of their cases were closed. The

¹ For more information on how AR were used during 2020 NRFU, see Appendix E of the Detailed Operational Plan (July 2019).

² The term “case” is used throughout this report to refer to a unique address that was part of the NRFU operation.

³ The plan to retain the highest-performing enumerators to work during phase 2 could not be implemented because of litigation that prevented the natural reduction in field staff.

goal of closeout was to make unlimited additional attempts on cases for which sufficient data had not been collected or for which no AR data existed.

A total of 59.3 million cases comprised the nonresponse workload and most were resolved in phase 1 (80.7 percent).⁴ Phase 2 had the fewest case resolutions at 8.3 percent. The closeout phase successfully resolved another 10.4 percent of cases.

5.1.1.g. *How many NRFU cases were resolved, by: 1) attempt-day, 2) time of day, 3) day of the week, and 4) week of the operation?*⁵

The 2020 NRFU contact strategy gave most cases up to six attempt-days to be enumerated in the field. A little under half of field-resolved cases (43.1 percent) were resolved on the first day they were attempted. More than three-quarters of cases were resolved in three or fewer attempt-days (76.0 percent). Most field resolutions took place between noon and 7 p.m., local time (72.0 percent). Because of the novel coronavirus (COVID-19) international pandemic and other factors, there were likely more people at home on weekdays and available to conduct an interview with an enumerator. Most NRFU field resolutions occurred between mid-August and mid-September when 70.6 percent of cases were resolved.

5.1.1.h. *How many cases were resolved during NRFU by resolved status and AR outcome?*

There was a total of 59.8 million cases in the 2020 NRFU universe.⁶ Within this universe, 74.0 percent of cases were resolved in the field and 25.4 percent were resolved another way, including: by self-response during NRFU (10.2 percent), based on AR data (15.1 percent), or through a special closeout (0.1 percent).⁷ The remaining 0.6 percent of cases were unresolved at the end of data collection.⁸

Overall, 37.1 percent of NRFU cases were resolved in the field as occupied housing units, 19.1 percent as vacant units, and 16.4 percent as deletes, or not a housing unit. A small percentage

⁴ The NRFU universe for this question was the number of nonresponse cases throughout the duration of NRFU in the following workloads: NRFU production, NRFU Update Leave (UL), NRFU supplemental, NRFU AR vacant/delete with an Undeliverable as Addressed (UAA) designation, and NRFU AR vacant/delete with no UAA. It excluded cases in the NRFU QC workloads and cases worked for other operations, such as Self-Response Quality Assurance (SRQA), NRFU Reinterview (RI), Field Verification (FV), and FV QC. It also excluded in-field adds and nonresponse cases in Puerto Rico. For more information about the case types worked in NRFU, see Section 1.3.

⁵ The term “attempt-day” is used throughout this report to refer to a unique day in which a NRFU case received contact attempts by an enumerator. Within an attempt-day, a case may have received multiple contact attempts, however, most cases only had one contact attempt per attempt-day.

⁶ The NRFU universe for this question included cases in the following workloads: NRFU production, NRFU UL, NRFU supplemental, NRFU AR vacant/delete with UAA, NRFU AR vacant/delete with no UAA, and in-field adds. It excluded cases in the NRFU QC workloads and cases worked for other operations, such as SRQA, NRFU RI, FV, and FV QC. It also excluded NRFU cases in Puerto Rico and in-mover adds.

⁷ One example of when a special closeout was used was for duplicate cases that were identified and closed at the beginning of production.

⁸ The 2020 NRFU unresolved rate was the same as the 2010 NRFU unresolved rate (0.6 percent). Cases not resolved during NRFU were eligible for imputation during postprocessing activities.

of cases were resolved in the field with only a population count or housing unit status and no other interview data (1.4 percent).

5.1.9.d. What was the outcome of NRFU Reinterview (RI)?

Of the 2.2 million cases selected for RI fieldwork, 66.5 percent were resolved.⁹ All field resolved NRFU RI cases underwent computer matching. More than half of cases could not be resolved during computer matching and were referred to clerical matching. Most cases passed clerical matching. Only 100 cases (less than 0.1 percent) were hard fails, indicating the enumerator had falsified data during the NRFU interview.

There were 1,300 enumerators who were released during NRFU because of falsification or poor-quality work. They represented 0.6 percent of all enumerators who had at least one production case selected for RI that was completed in the field. Most of these enumerators received a performance fail, typically for not following field procedures on multiple cases. A total of 30 enumerators were responsible for all 100 hard fail cases where falsification was confirmed as part of the QC program.¹⁰

5.1.9.e. How many of the original NRFU cases were marked for replacement with RI data?

A total of 131,000 NRFU cases, or 0.4 percent of the total NRFU cases received by the Sampling, Matching, Review and Coding System (SMaRCS), had the original interview data marked for replacement by RI interview data. Most cases with the original interview data marked for replacement by the RI (<100.0 percent) were cases that failed clerical matching.

5.3.13. At the end of the operation, how many unresolved alerts were there by type of alert?

The 2020 NRFU operation included 25 real-time supervisory alerts to assist field supervisors and managers with monitoring the performance of enumerators. Between the start of field data collection and the end of NRFU fieldwork, 20.2 million alerts were triggered by the operational control system. Of these, 0.1 percent were not marked as resolved in the system by a field supervisor or manager at the end of the operation. The “Payroll Not Approved” alert had the highest unresolved rate; however, there were no documented cases of field staff not being paid on time, so an alert remaining unresolved did not necessarily mean that the issue underlying the alert was not resolved. Resolving alerts was lower priority than taking corrective action on the issue that triggered the alert.

5.4.14. How did the budgeted cost for NRFU compare to the actual cost of the operation?

The 2020 NRFU budget was \$1.6 billion and actual costs totaled \$1.4 billion. A shortened duration for fieldwork, staff hiring and retention challenges, and a higher-than-expected enumerator productivity rate contributed to the operation coming in \$200 million under budget.

⁹ Cases selected for RI included about 303,000 cases selected past the end of NRFU on October 15, 2020, that were ineligible for field follow-up. They were selected to inform the QC program.

¹⁰ For more information about the NRFU QC program, see the 2020 Census NRFU Quality Assurance Results.

5.4.15. What was the cost per enumerator, per case, and per attempt-day?

The average cost per stateside enumerator was \$2,400.00, including training and production expenses. The average cost per case was \$13.30. The average cost per attempt-day increased with each additional attempt-day needed to resolve a case. The first attempt-day had the lowest average cost, at \$4.71. This amount nearly doubled to \$9.24 per attempt-day for cases that were reopened during the closeout phase to receive seven or more attempt-days.

5.4.18. Present key field staffing metrics from the 2020 NRFU operation.

The hiring goal was 413,007 enumerators and 17,607 CFSs. However, only 298,000 enumerators worked at least one case in the field. The 2020 Census environment presented a unique challenge for hiring and retaining field staff to conduct NRFU. The staffing plan adapted by offering continuous hiring and training throughout the operation. NRFU operations typically experience a steeper drop in field staff levels during the second half of production as the workload decreases, however, litigation requirements issued in early September prevented the release of field staff other than through the QC process.¹¹

5.4.20. What was the average number of NRFU cases completed per hour?

The cumulative NRFU productivity rate was 1.9 cases completed per hour, which was higher than the goal of 1.55 cases per hour. The daily productivity rate was highest during the first month of NRFU and started to decline in late August, as the field workload decreased and there was more travel time between the remaining cases.

5.5.23. How did the planned start and finish dates compare with the actual start and finish dates for NRFU and NRFU RI?

The COVID-19 pandemic completely changed the data collection schedule for the NRFU operation, starting with a pause of all field operations on March 18, 2020. Early NRFU was planned to start on April 9, 2020, but was descoped because of schedule changes and the closure of many colleges and universities. The planned start and finish dates for NRFU were May 13, 2020, and July 24, 2020, respectively. NRFU RI was scheduled to start the day after Early NRFU started and continue until July 31. After several schedule adjustments, the final start for NRFU was July 16 and the end was October 15, 2020. NRFU RI began the day after NRFU's start and ended on the same day that NRFU ended.

¹¹ More information about the litigation and the Census Bureau's response can be found [here](#).

Conclusions

The 2020 Census brought unprecedented challenges to NRFU field data collection. Despite the challenges, the NRFU operation successfully enumerated 99.4 percent of its workload and came in \$200 million under budget. Additionally, the NRFU QC program effectively detected and deterred falsification to ensure collection of high-quality data.

Several innovations were instrumental to the operation's success:

- The widespread and integrated use of **automation** featured an electronic data collection instrument and an operational control system that optimized case assignments and routing.
- **AR and third-party data** successfully reduced the number of contact attempts by enabling NRFU cases to be enumerated with high-quality records, thereby improving efficiency and reducing the cost of the operation.
- A **reengineered field operation** that maximized the efficiency and effectiveness of field staff, with six regional census centers (RCCs) and 248 area census offices (ACOs).
- A **phased contact strategy** that resolved a sizeable portion of the workload in the early weeks of the operation. The closeout phase effectively improved the case resolution rate in the final weeks of NRFU by reopening certain cases for additional attempts and sending enumerator travel teams to areas that needed assistance meeting case resolution goals.
- A reengineered **NRFU QC program** that ensured falsification was a rare event in 2020. Hard fail cases, where an enumerator deliberately falsified interview data, accounted for a very small percentage of all the cases selected for NRFU RI.¹²

Though the 2020 NRFU operation was highly successful, there remain opportunities for future improvements. The challenges faced during data collection activities each presented a unique opportunity to strengthen processes and enhance data quality for future fieldwork.

Recommendations

The key recommendations for future NRFU operations are to:

- **Expand the use of AR and other data to improve the quality of enumeration data while reducing respondent burden.** AR data may also be able to assist with

¹² Because of disclosure avoidance procedures, this exact percentage cannot be displayed.

identification of knowledgeable proxy respondents or to enumerate residents in hard-to-reach situations like rural areas or gated communities.

- **Explore ways to better reach and motivate historically undercounted populations (HUPs) during field enumeration.** These groups may be more likely to make up the nonresponse workload and may not be well-represented in AR.
- **Reduce the frequency of generic person identifiers in NRFU household rosters.** In 2020, generic identifiers like “Person 1” were overused and negatively impacted data quality. Future operations might train field staff to press more firmly for respondent names or to allow generic names on the roster only in later stages of data collection.
- **Leverage advances in technology to monitor enumeration data quality in near real-time.** Monitoring data quality while in the field will inform when to continue attempts or resolve a case.
- **Revamp the Phased Contact Strategy with a focus on refining or possibly eliminating phase 2.** It was less effective than intended during 2020 NRFU for several reasons.
- **Refine the proxy contact strategy to address 2020 challenges in rural areas, restricted access situations, and seasonal rental communities.** Revisit the proxy eligibility and attempt rules for these situations.
- **Develop an automated means to move non-housing units identified during field enumeration to the appropriate operation.** More group quarters (GQs) were found during 2020 NRFU fieldwork than expected and there was no system-based approach to send them to the appropriate GQ operation.
- **Fully test all components of NRFU RI in an integrated environment to identify and address any shortcomings before the next decennial census.** The lack of full end-to-end operational testing before the 2020 Census created challenges during the operation that could have been avoided.
- **Address gaps in the 2020 NRFU QC program for Reinterview Noninterviews (RINIs), enumerator proxies, and National Processing Center (NPC) clerks during NRFU RI clerical resolution.** RINIs and enumerators acting as a proxy occurred more frequently than expected in 2020 and presented opportunities for enumerators to falsify data.

1. Introduction

The purpose of the 2020 Census Nonresponse Followup (NRFU) Operational Assessment (OA) Report is to document the major findings from the NRFU operation during the 2020 Census. The NRFU OA describes the operational workload, staffing, schedule, and cost. It also addresses the use of automation and optimization, system integration, data access and quality, and operation-specific assessment questions. NRFU is a complex operation with many components. This OA will cover results for the following workloads: (a) NRFU production, (b) NRFU Reinterview (RI), (c) Field Verification (FV), (d) NRFU supplemental, (e) NRFU Update Leave (UL), and (f) FV Quality Control (QC).¹³

The 2020 Census NRFU OA Report builds upon the preliminary findings from the 2020 Census Internal Memorandum on NRFU. However, the results in this report supersede those of the memo and represent the final set of NRFU metrics from the 2020 Census.

1.1 Intended Audience

This document is intended to provide a historical record of the 2020 NRFU operation for a variety of audiences. It will act as a reference for the Census Bureau staff who design future NRFU operations for mid-decade testing and the next decennial census. It will also be used by external stakeholders and the public to understand the challenges and successes of the 2020 NRFU operation.

Various data products and reports were released after the conclusion of the 2020 Census, including data quality metrics, demographic analysis, and the Post-Enumeration Survey (PES) Report. This NRFU operational assessment was produced independently and may contain different results than products that reflect all of the census postprocessing. Comparisons of the findings from those products and the NRFU operational assessment is outside the scope of this report.

This document assumes that the reader has at least a basic understanding of the NRFU operation. For additional background information about NRFU, refer to the 2020 Census Detailed Operational Plan for: 18. Nonresponse Followup (NRFU) Operation (July 15, 2019) and Documentation of Updates to the Nonresponse Followup Operation (October 18, 2021).¹⁴

¹³ The 2020 NRFU operation also included a workload of cases from the Self-Response Quality Assurance (SRQA) operation. Those results are excluded from this report because of their sensitive nature.

¹⁴ The 2020 detailed operational plan is available here: https://www2.census.gov/programs-surveys/decennial/2020/program-management/memo-series/2020-memo-2019_16.pdf. The documentation of updates is available here: https://www2.census.gov/programs-surveys/decennial/2020/program-management/memo-series/2020-memo-2021_20.pdf.

1.2 Nonresponse Followup Description

The NRFU operation has historically been the largest and most expensive field operation of the decennial census. The objectives of the 2020 NRFU operation were to determine the housing unit status for addresses that did not complete a census questionnaire and to enumerate housing units that were occupied on Census Day (April 1).

2020 NRFU cases originated from a variety of sources:¹⁵

- Nonresponding addresses from self-response areas. These addresses were part of the “NRFU production” workload.¹⁶
- Nonresponding addresses from UL areas. These addresses were part of the “NRFU UL” workload.
- Nonresponding addresses added to the enumeration universe after it was created. These addresses came primarily from Geography Division programs, such as the Local Update of Census Addresses (LUCA) operation and the New Construction Program (Decennial Census Management Division, 2019). These addresses were part of the “NRFU supplemental” workload.
- Addresses modeled as vacant or not a housing unit based on administrative records (AR) and sent a reminder postcard before the start of NRFU. If the United States Postal Service (USPS) reported that the mailing was “Undeliverable as Addressed” (UAA) for a housing unit, that address was put into the “NRFU vacant/delete with UAA” workload. Addresses that did not receive a UAA on their census mailing made up the “NRFU vacant/delete with no UAA” workload.
- New addresses found in the field by an enumerator during NRFU data collection that were not part of the original follow-up workload. These addresses were known as in-field adds.

The 2020 NRFU workload also included cases that supported other decennial operations and quality control:

- Addresses from self-response without a Census identification (ID) number (Non-ID) and no match in the Master Address File (MAF) were added to the FV workload. These cases did not involve an interview, but simply a verification of the addresses’ existence.

¹⁵ The term “case” is used throughout this report to refer to a unique address that was part of the NRFU operation.

¹⁶ The NRFU production workload included in-office adds, where the office staff manually added addresses that were not part of the original NRFU universe.

- Addresses from self-response that were selected for verification through the Self-Response Quality Assurance (SRQA) workload.
- Quality control of NRFU production in the form of the NRFU RI workload.
- Quality control of FV cases, known as the FV QC workload.

This operational assessment reports results for the 2020 NRFU universe of 63.7 million cases, focusing on the 59.8 million stateside production cases and 2.4 million stateside cases from the QC operations.

Table 1. National NRFU Universe, by Workload

Workload	Stateside Cases	Puerto Rico Cases	Total Cases
Total NRFU Production and QC Universes	62,150,000	1,492,000	63,650,000
NRFU Production Universe	59,770,000	1,389,000	61,160,000
NRFU Production	44,070,000	27,500	44,100,000
NRFU UL	2,542,000	1,348,000	3,890,000
NRFU Supplemental	1,076,000	1,300	1,077,000
NRFU Vacant/Delete - With UAA	9,042,000	N < 15	9,042,000
NRFU Vacant/Delete - No UAA	2,551,000	0	2,551,000
NRFU In-Field Adds	488,000	12,000	500,000
QC Universe	2,381,000	103,000	2,484,000
NRFU RI	2,179,000	58,000	2,237,000
FV	193,000	43,000	236,000
FV QC	8,600	2,000	10,500

Source: U.S. Census Bureau, 2020 Census, Enterprise Data Lake (EDL)

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) The NRFU RI and FV QC counts here differ from those in other tables because they came from different systems.

(-) The SRQA workload is excluded from this table because of sensitivity.

1.3 Operational Changes Resulting from COVID-19

There were numerous changes made to the 2020 NRFU operation in response to the novel coronavirus (COVID-19) international pandemic. This section highlights the most significant changes and attempts to focus on those stemming directly from the pandemic, rather than from natural disasters or litigation that also impacted how the operation unfolded. It may be difficult to disentangle the effects in some places as some changes may have had multiple causes.

1.3.1 Operational Design

Descope of Early NRFU. The purpose of Early NRFU was to conduct NRFU for college and university students in off-campus housing before the spring term ended. With schools closing early in response to the pandemic and NRFU fieldwork delayed until August, it was no longer possible to achieve the objective of that operational component.

Addition of Soft Launch. A soft launch was added to the 2020 NRFU operational design after Early NRFU was descope. The soft launch consisted of a series of cycles where each cycle opened additional area census offices (ACOs) for NRFU fieldwork based on state and local pandemic restrictions and operational readiness.

Table 2. NRFU Soft Launch Cycles

Cycle	Start Date(s)	Number of ACOs	Cumulative Number of ACOs
Soft Launch Cycle 1A	July 16, 2020	6	6
Soft Launch Cycle 1B	July 23, 2020	6	12
Soft Launch Cycle 2	July 26 – 30, 2020	35	47
Soft Launch Cycle 3	July 31 – Aug. 6, 2020	153	200
Production	Aug. 7 – Aug. 9, 2020	48	248

Source: U.S. Census Bureau, 2020 Census, Field Division (FLD)

Descope of Manager Visits. Manager visits (MVs) were descope after an early test of field systems, where it was discovered that multiunit groupings were not executing properly. One of the workloads to be included in the multiunit groupings by the operational control system was inadvertently omitted after the timing of workload deliveries changed in the early weeks of the pandemic. The purpose of the manager visit was for an enumerator to identify vacant units through an interview with the manager of the multiunit. The descope of MVs eliminated the need for MV Reinterview.

AR Processing. AR modeling planned to assign or refresh the housing unit status for addresses in the NRFU workload adapted to the delay of the Internal Revenue Service (IRS) 2019 tax filing deadline until July 15, 2020. As tax returns were the primary AR source used for 2020 modeling, this impacted the decision to perform monthly AR modeling between May and September.

1.3.2 Contact Strategy

Phone Contingency. In the weeks before production a NRFU outbound phone contact strategy was developed to allow maximum flexibility for areas where pandemic stay-at-home orders were in effect. Phone numbers from the Census Bureau's Contact Frame were associated with each address, where available, and displayed on the field collection device for enumerators. The phone contingency was also used in areas impacted by hurricanes or wildfires. In-person visits remained the preferred contact strategy where circumstances allowed.

Contact Strategy Phases. Phase 2 and closeout start dates shifted with the start date for NRFU and the fixed start dates were ultimately removed. Instead, census field supervisor (CFS) areas moved to phase 2 only when 85 percent of their housing units were resolved and to closeout at 90 percent resolution.

New Refusal Reason. An additional refusal reason was added to the field enumeration application to capture respondent refusals because of “COVID-19 related concerns.”

1.3.3 Field Staffing and Training

Hiring. Hiring and retaining field staff to conduct the 2020 NRFU operation was an on-going challenge during the pandemic. Because of the difficulty in maintaining an adequate number of field staff, the original training plan was adapted to offer continuous onboarding and training through the last week of NRFU production. Pay incentives were introduced to encourage staff retention and work productivity.

Training. Training plans were altered to minimize in-person interaction and explain precautionary measures that enumerators should adhere to. The orientation classroom training day was reduced to a 2-hour appointment. The remainder of the orientation day and the capstone training day were conducted through self-study reading, a podcast, and conference calls. In between the orientation and capstone days, staff took online training at home, as originally planned. Training content was added about how to work safely during the pandemic and conduct phone attempts where the phone contingency had been activated.

Field Kits. Personal protective equipment (PPE) was provided to field staff, including masks, gloves, and hand sanitizer.

NRFU RI Clerical Resolution Staff. Training plans adapted several times for staff working at the National Processing Center (NPC) and regional census centers (RCCs) who were supporting the clerical portion of NRFU RI. Training dates shifted later to meet the new operation dates and the training was delivered virtually rather than in-person. After a period of closure in the spring, the NPC shifted its in-person NRFU RI workforce to a predominately telework-ready workforce.

1.4 Schedule

A subset of key activities/milestones for the NRFU operation from the final baselined version of the 2020 Census Integrated Master Schedule (IMS) appear below.

Table 3. Key Milestones from the NRFU Operation

Milestone Name	Start	Finish
Conduct NRFU Field Data Collection	8/9/2020	10/15/2020
Conduct NRFU Reinterview Field Data Collection	8/10/2020	10/15/2020
Conduct NRFU Reinterview Discrepant Case Resolution	8/10/2020	10/27/2020
Collect NRFU Lessons Learned	10/1/2020	9/9/2021

Source: U.S. Census Bureau, 2020 Census, IMS

Note: The IMS did not include activities for the soft launch, which was a late design change.

2. Background

A brief history of the 2010 Census NRFU operation and the mid-decade research that shaped the design of the 2020 NRFU operation follows.

2.1 The 2010 Census

The 2010 NRFU operation was the Census Bureau's effort to collect basic demographic and geographic information about households in the 50 states, the District of Columbia, and Puerto Rico that did not respond to a census questionnaire, by mail-back or phone response, by the second week of April 2010.

There were three main innovations introduced for the first time during the 2010 Census (U.S. Census Bureau, 2012):

- The full implementation of the American Community Survey (ACS) to collect detailed demographic data on a regular basis, replacing the decennial census longform that was previously sent to a subset of the population.
- A modernized Master Address File/Topographically Integrated Geographic Encoding and Referencing (MAF/TIGER) database that was kept current by updates from the ACS and other Census Bureau surveys.
- A short-form-only decennial census, thanks to the collection of long-form data from the ACS.

Four different operations were included in the 2010 NRFU design: 1) NRFU, 2) NRFU RI, 3) NRFU Vacant Delete Check (VDC), and 4) NRFU Residual. Each of these operations is described below.

2.1.1 2010 NRFU

2.1.1.1 Workload, Schedule, Cost, and Outcomes

During the 2010 NRFU operation, nearly 529,000 enumerators visited 47.2 million nonresponding housing units between May 1 and July 9.¹⁷ The total cost of the operation was about \$1.6 billion, or 70.7 percent of the estimated \$2.2 billion budget.

More than half of the housing units enumerated during NRFU were occupied (60.9 percent). Of those occupied housing units, the respondent was a member of the household 75.7 percent of the time and a proxy respondent 24.3 percent of the time.¹⁸ A smaller percentage of housing units enumerated during NRFU were vacant (30.0 percent) or delete (8.5 percent).

Late mail returns (LMRs) were completed questionnaires received during the initialization of the NRFU universe before the workload was released to the local census offices (LCOs). A total of 9.1 million LMRs were removed from the workload before being sent to LCOs. During NRFU, an additional 2 million units were removed clerically from paper address registers at the LCO level. Overall, 46.6 million cases were assigned to enumerators to be worked in the field.

NRFU enumerators completed nearly 812,000 questionnaires for added housing units that were not in the original enumeration frame. Most of these added units (89.8 percent) were successfully geocoded and added to the MAF by the Geography Division (U.S. Census Bureau, 2012).

2.1.1.2 Field Staff Structure and Operational Design

Enumerators were organized into 494 LCOs nationwide. LCOs were grouped under 12 RCCs. The 12 RCCs were established in the same cities as the Census Bureau's permanent regional offices (ROs). Puerto Rico operations were run from a Puerto Rico Area Office, within the jurisdiction of the Boston RCC, set up specifically for the 2010 enumeration.

The 2010 NRFU operation was largely paper based. Enumeration of nonresponding units was conducted door to door by enumerators using printed address registers and paper questionnaires. Case assignment and payroll were done almost entirely using paper. LCO clerks transmitted assignment area address registers to crew leaders (CL) who then, in turn, distributed the work to enumerators. Upon completion of an interview, an enumerator would transmit completed paper forms along with their payroll form back to their CL. CLs performed basic checks on the forms for completeness before transmitting them to LCO staff to be checked in.

¹⁷ One local census office did not complete the operation until July 27.

¹⁸ Proxy respondents were neighbors, landlords, or real estate agents who were knowledgeable about the housing unit status and household size of a particular census address.

Check-in was performed at the LCO by local clerical staff. During the check-in process, staff keyed rudimentary data items from the interview such as the enumerator's name, the housing unit status, and the population count into the Paper-Based Operations Control System (PBOCS). The PBOCS performed basic quality checks on the data and alerted the clerk if any issues arose. The LCO then gathered the completed forms and sent them to be scanned in a regional processing facility (U.S. Census Bureau, 2012).

2.1.2 2010 NRFU Reinterview

2.1.2.1 Workload, Schedule, Cost, and Outcomes

In the 2010 Census, Reinterview operations were conducted by an independent staff of enumerators from those that conducted the initial enumeration. During the 2010 Census, NRFU and NRFU RI were in the field concurrently, however, NRFU RI started one week after NRFU began and ended three weeks after NRFU concluded. The NRFU RI workload was 1.9 million housing units and the total cost was \$95.3 million (101.3 percent of the estimated \$94.0 million budget).

Of the NRFU RI workload, about 93,600 units (4.9 percent) had their original enumeration replaced by the RI enumeration because of data falsification or other data errors. About 1,400 enumerators were determined to have falsified data, or 0.3 percent of the nearly 529,000 total NRFU enumerators who completed at least one questionnaire during the 2010 Census (U.S. Census Bureau, 2012).

2.1.2.2 Field Staff Structure and Operational Design

Reinterview cases were worked by an independent RI staff consisting of both office staff and field enumerators. The RI sought to confirm that the household had been contacted by a Census Bureau enumerator, to obtain the Census Day occupancy status, and, if occupied, to collect a household roster. If the respondent could not confirm being contacted, the RI enumerator would conduct a full interview. Contacts with units selected for RI were attempted by phone first, followed by in-person enumeration attempts for units without a successful phone interview.

Like NRFU enumerators, RI enumerators submitted completed paper forms to be reviewed and go through a series of basic quality checks. Forms were then checked in using the PBOCS and shipped for data capture.

Reinterview cases were selected using four sampling categories: random, supplemental, outlier, and hard fail. The random sample was selected from all completed cases from all enumerators. The supplemental sample was made up of cases selected by the LCO or by the Matching, Review, and Coding System (MaRCS) for an enumerator who was suspected of not following proper procedures. The outlier selection category included cases whose characteristics differed significantly from the cases of other enumerators in the area. Finally, the hard fail category

included cases that were completed by an enumerator who was found to have falsified other cases that required re-enumeration.

Data from the original interview and the RI were captured from the paper forms and combined within the Decennial Response Integration System (DRIS). DRIS sent the data to MaRCS to be matched and undergo checks for fraudulent activity. After matching, MaRCS informed the LCO if a case needed further investigation.

One of the major deficiencies in the paper-based system was that the time between when a paper RI form was sent from the LCO to be scanned and keyed and when it was available to the MaRCS system for comparison was too long. This was known as the NRFU latency period. Under normal check-in procedures, the latency period lasted 38 days, however, it was successfully shortened to 10 days by having MaRCS run computer matching on the raw data, without initial editing by DRIS (U.S. Census Bureau, 2012).

2.1.3 2010 Vacant Delete Check

Once an LCO completed its NRFU workload, it began a new and separate operation known as VDC. The VDC operation sought to verify the status of vacant units or deletes (i.e., not a housing unit), with the goal of ensuring that no residents were missed during enumeration. The first VDC case was completed during the first week of June, and the majority of the 8.7 million housing units in the workload were completed by the first week of August. The total cost of the operation was \$281.7 million (115.3 percent of the \$244.3 million estimated budget).

Four types of cases were eligible for the VDC operation: 1) NRFU vacant or delete cases that required verification, 2) cases from the supplemental NRFU universe, 3) blank mail returns, and 4) housing units added by VDC enumerators in the field.¹⁹ ²⁰ VDC was very similar to NRFU with the exception that quality control in the VDC operation was only done by phone for a subset of all cases.

More than half of the cases worked during VDC were NRFU vacant or delete cases (64.8 percent). Of the NRFU cases identified as vacant, 72.5 percent were verified as vacant during VDC. Of the NRFU delete cases, 61.2 percent of the demolished/cannot locate cases, 62.0 percent of the nonresidential cases, and 50.8 percent of the uninhabitable cases were verified as delete during VDC.

There was a total of 2.2 million cases in the supplemental NRFU universe that were worked during VDC. Thirty-five percent of the supplemental NRFU cases were determined to be occupied during VDC. Another 20.5 percent were enumerated as vacant, and the remaining 44.5 percent of housing units were marked as deletes.

¹⁹ The supplemental NRFU universe consisted of addresses added to the NRFU workload after the operation started. The bulk of these new addresses came from the LUCA operation.

²⁰ Blank mail returns were questionnaires that were mailed back, but had not been filled out by a respondent.

The blank mail return workload consisted of about 627,700 housing units, where VDC classified 41.8 percent as occupied, 49.6 percent as vacant, and 8.2 percent as deletes. NRFU enumerators added about 219,000 housing units during VDC that were geocoded and added to the MAF. However, 13,700 (6.2 percent) of these housing units were duplicates of adds made by enumerators during the NRFU operation (U.S. Census Bureau, 2012).

2.1.4 2010 NRFU Residual

An additional field operation put in place to ensure the accuracy of the 2010 Census was NRFU Residual. NRFU Residual was a late field operation to verify data for LMR units that returned a questionnaire with incomplete information and occupied units where the NRFU enumerator could not determine the population count.²¹ The NRFU Residual operation started on August 9 and ended on August 24, and its workload included more than 700,000 housing units. The cost of the operation was \$42.6 million (136.1 percent of the estimated budget of \$31.3 million).

Just over half of the housing units in the NRFU Residual operation were enumerated as occupied (51.2 percent), while 40.7 percent were vacant, and 7.8 percent were deletes. Nearly three-quarters (73.1 percent) of the occupied NRFU Residual cases where the original enumerator was unable to obtain a population count were verified as occupied during this effort. Of those occupied units, 93.1 percent had population count information at the conclusion of NRFU Residual (U.S. Census Bureau, 2012).

2.1.5 2010 Recommendations

The key recommendations from the 2010 NRFU operation are below, along with information about how these recommendations were addressed during the 2020 NRFU operation.

- 2010 Recommendation: Automate the census questionnaire, initial observation forms, and all sources for data collection.
 - 2020: The NRFU field operation was conducted using an enumeration application on a mobile device. Case assignment and management were automated and optimized to ensure enumerator efficiency.
- 2010 Recommendation: Develop a data warehouse to create a consolidated repository of operational data that all systems can access.
 - 2020: The Enterprise Data Lake (EDL) was created to be a repository for all response data, event data, metadata, and paradata collected for all decennial operations.²²

²¹ Cases where the unit was occupied but no population count was collected were also known as “POP-99” cases.

²² The Census Data Lake (CDL) preceded EDL and was the 2020 system that captured NRFU data. However, EDL is primarily where analysis was conducted for the NRFU operational assessment. For the sake of simplicity, EDL is the system referenced throughout this report.

- **2010 Recommendation:** Streamline the NRFU operation and conduct VDC and NRFU Residual concurrently with NRFU as a quality check (in addition to NRFU RI).
 - **2020:** As part of the NRFU contact strategy, all cases with a vacant or delete status from AR modeling got one field visit to verify, and all vacant or delete units observed in the field by an enumerator required verification by a second enumerator or a proxy respondent. A supplemental workload was added to the NRFU universe to enumerate new addresses to the enumeration frame from sources like the LUCA program. Paper questionnaires that did not pass sufficiency checks were added to the NRFU workload throughout the operation. Finally, NRFU cases that reached maximum field attempts with insufficient data were eligible for additional attempt-days during the closeout phase of the contact strategy.²³
- **2010 Recommendation:** Avoid adding late-planned operations and procedures.
 - **2020:** In the 2010 NRFU operation, Early NRFU was a late design change and there was incomplete documentation on its outcome. The 2020 NRFU operational design incorporated an Early NRFU suboperation and added cases from other operations (e.g., FV, SRQA, NRFU supplemental, NRFU UL, paper responses with insufficient data) throughout production that needed additional fieldwork to sufficiently enumerate them.
- **2010 Recommendation:** Design and develop contingency plans and systems in parallel with production development to ensure the contingency plan is fully tested and ready if it is needed.
 - **2020:** Risks and contingency plans for NRFU were identified and documented on an on-going basis.
- **2010 Recommendation:** Reconsider the housing unit status options presented to enumerators, the processing implications attached to each one, and the training provided to enumerators on how to identify the status.
 - **2020:** Enumerator training for the 2020 NRFU operation provided guidance on how to identify the housing unit status and how to locate and interview a proxy respondent to verify the status for vacant and delete units. Two different enumerators were required to observe that a NRFU case was vacant or delete to ensure the quality of the enumerated housing unit status.

2.2 Mid-Decade Planning for 2020

The beginning of a new decade marks the start of research and planning for the next decennial census of population and housing. Following the completion of the 2010 Census, the Census

²³ The term “attempt-day” is used throughout this document to refer to a unique day in which a NRFU case received contact attempts by an enumerator. Within an attempt-day, a case could receive multiple contact attempts, however, most cases only had one contact attempt per attempt-day.

Bureau entered a vigorous research and testing period that included four site tests between 2013 and 2016 and culminated in a dress rehearsal for the 2020 Census in 2018. The rationale for this testing leading up to the 2020 Census was to provide the opportunity for incremental and iterative development of the 2020 NRFU design, based on the successes and challenges of each site test. The goal of each test was to improve coverage and quality, while increasing efficiency and containing operational costs.

2.2.1 The 2013 Census Test

Post-2010 Census testing of operational improvements and cost-saving measures for NRFU began with the 2013 Census Test in Philadelphia, Pennsylvania. The aim of the test was to pilot several novel methods that had the potential to reduce costs associated with the NRFU operation. The methods explored in the 2013 Census Test included: 1) using AR to reduce the NRFU workload; 2) reducing the number of contact attempts made by enumerators; 3) using an adaptive case management strategy to control in-person enumeration visits; and 4) making initial enumeration contact attempts by telephone. The results of this test reaffirmed the potential of these methods to reduce costs for the 2020 Census. Recommendations from the 2013 Census Test included refinement of the contact strategies for proxies, and optimization and prioritization of cases for enumerators (U.S. Census Bureau, 2014).

2.2.2 The 2014 Census Test

The 2014 Census Test took place in parts of Montgomery County, Maryland, and the District of Columbia. The NRFU component consisted of four panels designed to continue research to improve efficiency and reduce costs of the operation by modifying contact strategies for in-person visits; streamlining operations to promote efficiencies; and using AR to reduce the NRFU workload and to inform, replace, or augment self-response. The 2014 Census Test found that the use of AR reduced the NRFU workload and improved the determination of unit status. Recommendations from the test included assessing the quality of proxy interviews, improving the automated data collection instrument, and investigating refined contact strategies for restricted access cases (Poehler et al., 2015).

2.2.3 The 2015 Census Test

The 2015 Census in Maricopa County, Arizona, was a proof-of-concept field test for a reengineered 2020 Census. The NRFU operational objectives were as follows: 1) testing a new field control system; 2) testing a real-time operational control system to integrate and manage operations; 3) using smartphone technology for census field enumeration (including the Bring Your Own Device—or BYOD—initiative); and 4) continuing to use AR and third-party data to inform and supplement field data collection efforts. Recommendations from the test included the need to consider a new approach to enumeration of multiunit (MU) households, refined instrument pathing for proxy and noninterviews, and elimination of the BYOD option for future tests (Hatcher, 2015).

2.2.4 *The 2016 Census Test*

The 2016 Census Test was conducted in portions of Harris County, Texas, and Los Angeles County, California. The objectives of the NRFU operation during this test were to continue refinement of reengineered field operations, improve the efficiency and effectiveness of field staff and workload management, use AR to reduce the NRFU workload, and incorporate reengineered quality assurance methods. Two new aspects of the NRFU operation for the 2016 test were the implementation of manager visits at MUs to obtain the occupancy status of individual units and an enhancement to the enumeration application that prompted the enumerator to begin attempting proxy interviews when the case became eligible.²⁴ During the test, a decision was made to reopen cases in Los Angeles County with insufficient data for additional attempt-days to lower the unresolved rate.

The results of the test indicated that manager visits effectively reduced the NRFU workload in MUs and the burden on respondents. The test also showed that supervisory alerts were an effective tool for monitoring enumerator performance. However, additional emphasis was required during enumerator training on the importance of attempting proxy interviews. Finally, reopening cases for additional attempt-days did result in a lower resolve rate for Los Angeles County compared to Harris County (Gibb et al., 2018).

2.2.5 *The 2018 End-to-End Census Test*

The NRFU operation for the 2018 End-to-End Census Test (E2E CT) was conducted in Providence, Rhode Island. The main NRFU objectives were to: 1) use AR to inform and reduce the NRFU workload, 2) evaluate refined field operations, including a reengineered operational control system that optimized case assignments and routing, 3) measure the efficiency and effectiveness of the field staff structure and workload, and 4) evaluate the cost of the operation and the quality of the data collected.

Operational closeout procedures were developed, tested, and refined throughout the 2018 E2E CT. They were initially implemented at the tract level when the number of resolved cases and the number of cases with at least four contact attempts met a predefined threshold. The operation moved into a “final attempts” strategy during the test, where enumerators were given ownership of cases and worked those cases until they were resolved with minimum sufficient data. In some cases that meant extending their number of maximum attempt-days beyond six.

New aspects of the NRFU operational design for the 2018 E2E CT included an automated FV workload, the addition of new addresses to the enumeration universe in a supplemental workload, the use of UAA codes from the USPS to verify the status for cases modeled AR vacant or delete, and new supervisory alerts for managing fieldwork.

²⁴ The purpose of the manager visit was to interview a building manager to determine the occupancy status of units within the multiunit on Census Day and eliminate the need for individually contacting units that the manager indicated were vacant or delete.

The NRFU QC program for the 2018 E2E CT included edits throughout the enumeration application to minimize errors, posttraining assessments and observations for low-scoring enumerators, control system alerts that detected egregious and anomalous enumerator behavior, and a RI/QC program to detect falsification of NRFU interviews, MV interviews, and FV cases. Three new aspects of the QC program for the 2018 E2E CT were the use of AR to determine eligibility for reinterview selection, an improved analytic sampling method that used case characteristics and outlier analysis to select cases for NRFU RI, and the use of the Census Questionnaire Assistance (CQA) program to make three telephone attempts on eligible NRFU RI cases before field attempts (Gibb et al., 2019).

3. Methodology

All 2020 Census OAs share a similar methodology. In general, they provide details about the implementation of individual operations and processes (including final volumes, rates, and costs) by presenting data from production systems, files, and activity reports, in addition to information collected from lessons learned and debriefing sessions. These important measures are key ingredients to defining successful completion of the 2020 Census operations and processes. Typical categories of success measures are as follows:

- **Process Measures** that indicate how well the process works, typically including measures related to completion dates, rates, and productivity rates.
- **Cost Measures** that drive the cost of the operation and comparisons of actual costs to planned budgets. Costs can include workload as well as different types of resource costs.
- **Quality Measures** of operational results, typically including things such as rework rates, error rates, and coverage rates.

In addition to planning and managing the implementation of its operation, each Integrated Project Team (IPT) had the responsibility of determining the assessment questions for its operation. In consultation with the Decennial Research Objectives and Methods (DROM) Working Group, each IPT developed assessment questions tailored to the uniqueness of its operation that would yield the most useful information to those planning similar operations in the future. Assessment questions provide the framework for the Results Section appearing in each operational assessment report.

Please note that the numbers appearing in this operational assessment report have been subjected to the U.S. Census Bureau's approved disclosure avoidance techniques including noise injection and rounding.

3.1.1 The 2020 Census

The decennial census is mandated by the U.S. Constitution to apportion seats in the House of Representatives among the states. Its purpose is to conduct a census of population and housing for the United States and to disseminate the results to the President, the states, and the American people. To conduct a full and complete count, the goal of the decennial census is to count everyone once, only once, and in the right place. In addition to informing apportionment, decennial census data are also used by governmental entities for redistricting, to inform the ACS and other Census Bureau surveys, and to allocate hundreds of billions of dollars in federal funds to local communities every year (U.S. Census Bureau, 2018).

The challenges that faced the 2020 Census during planning included a constrained fiscal environment, the rapidly changing use of technology, widespread distrust in government, declining survey response rates, an increasingly diverse population, the existence of complex living arrangements, and a population that was more mobile than ever before. To meet these challenges, the Census Bureau identified four key innovation areas for the 2020 Census: 1) reengineering Address Canvassing, 2) optimizing self-response, 3) using administrative records and third-party data, and 4) reengineering field operations (U.S. Census Bureau, 2018). Efforts to reduce the cost of the 2020 Census NRFU operation focused primarily on the last two innovation areas: 1) using administrative records and third-party data, and 2) reengineering field operations.

3.1.1.1 2020 NRFU Operational Design

It was projected that at least 60 percent of the U.S. population would self-respond to the 2020 Census within six weeks of Census Day (April 1). The remaining 40 percent of the population in the 50 states, the District of Columbia, and Puerto Rico were expected to be eligible for Nonresponse Followup. Plans were executed to recruit, hire, and train more than 420,000 field staff to conduct NRFU over a 16-week period from early-April to late-July 2020 (Decennial Census Management Division, 2019).

NRFU enumerators used the Field Data Capture (FDC) application on an iPhone to conduct interviews. The FDC application collected information on the number of people who lived at the housing unit on Census Day, their demographic characteristics and relationship to the respondent, tenure of the housing unit, and paradata related to the interview process.²⁵ ²⁶

The 2020 NRFU operation was conducted in two Type of Enumeration Areas (TEAs): Self-Response (TEA 1) and Update Leave (TEA 6). Nonresponding addresses in Puerto Rico were eligible for NRFU. The Island Areas conducted census operations independently. The enumeration universe consisted of all the addresses for living quarters that were eligible for the

²⁵ Two examples of paradata are the language in which the interview was conducted and the length of the interview.

²⁶ For more information on the contents of the NRFU interview, see the [2020 Census Content and Forms Design Report](#).

2020 Census. The 2020 NRFU universe was a subset of the enumeration universe, consisting of those addresses that did not self-respond to the census questionnaire. The NRFU universe was dynamic in nature. Addresses that required follow-up were discovered throughout the operation and added to the universe. Meanwhile, late self-responses and AR reduced the workload.

The goals of the NRFU operation for the 2020 Census were to:

- Use AR to inform and reduce the NRFU workload.^{27 28}
- Implement refined field operations, including a reengineered operational control system that optimized case assignments and routing.
- Maximize the efficiency and effectiveness of the field staff structure and workload.
- Control the cost of the operation and ensure the quality of the data collected.

The key features of the 2020 NRFU operational design included (U.S. Census Bureau, 2019):

- Use of AR and third-party data to create a modeled housing unit status and contact probabilities for stateside addresses in the NRFU universe. The modeled housing unit status determined the contact strategy for the address, and the contact probabilities provided optimized case assignments for enumerators.
- A six-attempt-day contact strategy for NRFU cases with insufficient AR data, where proxy eligibility started on the third attempt-day after an unsuccessful household attempt.²⁹
- An additional round of AR modeling part-way through the operation to identify cases with a “no determination” status from the first round of modeling that changed to an “occupied” modeled status.³⁰
- A final round of AR modeling at the end of data collection for all unresolved cases that used a more relaxed set of criteria to resolve additional cases based on their AR data.³¹

²⁷ For more information on how AR were used during 2020 NRFU, see Appendix E of the Detailed Operational Plan (July 2019).

²⁸ NRFU cases in Puerto Rico were not eligible for AR modeling.

²⁹ Stateside NRFU cases underwent AR modeling before the start of the operation to define their contact strategies. AR modeling assigned one of four statuses to each case: 1) occupied, 2) vacant, 3) delete, or 4) no determination. Cases in Puerto Rico all had a “no determination” status.

³⁰ The purpose of the second round of AR modeling was to identify cases with an “occupied” modeled status that could be closed out from the NRFU workload if they had at least one field attempt-day.

³¹ The results from the final round of AR modeling after data collection were used to determine the AR enumeration, including household demographics. Any cases that could not be AR-enumerated went to count imputation.

- Grouping units within MUs that met certain criteria into manager visit cases to identify vacant and delete units with a minimum number of contact attempts to reduce operational costs and to keep respondent burden low.
- Capability to stop fieldwork, pause fieldwork, or reassign fieldwork for special situations like dangerous areas or natural disasters.
- An Early NRFU suboperation to conduct NRFU in areas around the country where there was a high concentration of college students living in off-campus housing. Because many colleges end their spring term before NRFU starts in mid-May, Early NRFU was scheduled to start in early April.
- A FV workload where enumerators verified the location of housing units that responded without a preassigned ID and whose addresses could not be matched to the Census Bureau's address frame. This type of case did not require an interview with a respondent.
- Verification of self-reported vacant cases in the field.
- Inclusion of "reverse check-in" cases in the NRFU workload for paper questionnaires that did not pass data sufficiency checks.
- A NRFU supplemental workload to enumerate new addresses added to the enumeration universe after it was created.
- A QC program that included edits throughout the enumeration application to minimize errors, post-training assessments and observations for low-scoring enumerators, control system alerts that detected egregious and anomalous enumerator behavior, and a RI/QC program to detect falsification of NRFU interviews, MV interviews, and FV cases (Morales, 2019).³²

New aspects of the NRFU operational design for the 2020 Census included (U.S. Census Bureau, 2019):

- All cases with an AR vacant or delete status and a confirming UAA from the U.S. Postal Service received one attempt-day. In 2018, these cases were removed from the NRFU workload without any field visits. Analysis following the 2018 E2E CT indicated that some cases with an AR vacant or delete status were, in fact, occupied.
- A new, three-phased NRFU contact strategy. During the first phase, case assignments were optimized based upon the work availability and location of enumerators. Once a set percentage of cases reached four attempt-days or were resolved, a CFS area moved to the second phase. In this phase, case optimization was reduced and high-performing enumerators were given semipermanent case assignments. The third phase was a

³² For more information about the NRFU QC program, see the 2020 Census NRFU Quality Assurance Results.

closeout phase with unlimited additional attempt-days running to the end of the operation.

- The second round of AR modeling assigned three new statuses: closeout occupied, closeout vacant, and closeout delete. At the beginning of the closeout phase, cases with one of these statuses were removed from the NRFU workload if they received at least one attempt-day.
- The Early NRFU operation was planned to be part of the 2020 Census for the first time since the 2010 Census. Early NRFU was descope from the 2018 E2E CT because of resource constraints. During the 2010 Census, Early NRFU was introduced as a late, and quickly assembled, aspect of the operational design.
- Mapping functionality to allow an enumerator to view the location of their case assignments, navigate to those assignments, and be aware of dangerous addresses within their assignment area.
- A workload of cases from SRQA for verification in the field during NRFU.
- The ability to reset previously resolved cases because of data falsification, misinterpretation of NRFU field procedures, or data entry errors.
- Procedures for NRFU cases on military bases or within U.S. embassies that allowed the field manager to manually assign cases to an enumerator with access to them.
- Additional sources provided addresses for the NRFU supplemental workload that were added to the enumeration universe after its initial creation. In 2018, this workload consisted of new addresses from the U.S. Postal Service's Delivery Sequence File (DSF) and Geography Division's Ungeocoded Resolution. The 2020 NRFU supplemental workload added new addresses from the New Construction program, upheld LUCA appeals, and the Housing Unit Count Review program.
- NRFU enumerators had the capability to add cases while in the field if they came across a unit that was omitted from the enumeration universe.
- Staff at the ACOs could review the cases in the enumeration universe and add cases that were missing, based on reports from local communities or field staff.
- The MOJO-Browse Living Quarters (MOJO-BLQ) application was a new tool for CFSs that allowed supervisors to determine whether an address was in the enumeration universe.
- Management reports for headquarters staff to monitor the daily progress of the operation.

New aspects of the NRFU RI design for the 2020 Census included (Morales, 2019):

- Resolution of NRFU RI clerical cases by the NPC and RCCs. During the 2018 E2E CT, clerical resolution was tested outside the formal test environment because system development was not ready to support this aspect of NRFU RI.
- The contact strategy for NRFU RI cases included six maximum attempt-days in the field and descope outbound phone attempts through CQA from the 2018 test.
- Reports created by the Sampling, Matching, Review and Coding System (SMarCS) for monitoring the progress of NRFU RI in real time.

The table below highlights significant differences between the 2010 and 2020 NRFU operations.

Table 4. Key NRFU Differences between 2010 Census and 2020 Census

Topic Area	2010 Census	2020 Census
AR and Third-Party Data	Not part of the NRFU operational design.	Defined the contact strategy for each case and set contact probabilities for assignments.
Enumeration	Paper-based enumeration; used paper maps to locate addresses; mailed paper forms to central processing center to be scanned.	Enumerators used mobile devices to collect census data, allowing for near real-time case status updates and transmission of response data. Global Positioning System (GPS)-fed maps were incorporated into the devices to show real-time location of the address.
Training	In-person classroom training.	Combination of online, self- study, and classroom training methods.
Contacts	Enumerators were advised to attempt an address up to six times until the case was resolved.	Used a phased contact strategy that was designed to resolve cases efficiently and allowed additional attempts during operational closeout to improve the quality of data collected for certain cases.
Self-Responses	Limited ability to remove late self-responses (manual, laborious process).	Late self-responses were removed from the NRFU workload on a near real-time basis.
Field Management Structure	A standard ratio of 8 enumerators to 1 supervisor was used and there were 494 local census offices.	The planned ratio of enumerators to supervisors was 20 to 1 and there were 248 area census offices.
Multiunits	All multiunits treated similar to other households.	Planned manager visits to identify vacant and delete properties to reduce NRFU field visits, however, it was descope during the pandemic.

Source: U.S. Census Bureau, 2020 Census, 2010 OA and 2020 NRFU Detailed Operational Plan

3.1.2 Integral Systems

The 2020 NRFU operation relied on Census Enterprise Data Collection and Processing (CEDCaP) systems and non-CEDCaP systems. These systems supported a reengineered 2020 Census that used information technology and an electronic interface to collect response data, and to automate and integrate case assignment, case management, data collection, and post-data collection activities. Together, these systems provided faster, more accurate, and more secure data collection for the 2020 Census, compared with the paper-based, manual nature of the 2010 NRFU operation.

Table 5. CEDCaP and Non-CEDCaP Systems Supporting the 2020 NRFU Operation

CEDCaP Systems	Function
Concurrent Analysis and Estimation System (CAES)	Enterprise modeling platform that executed statistical modeling for administrative records.
Enterprise Censuses and Surveys Enabling platform (ECaSE) - Enumeration (ENUM)	Supported the FDC application for enumeration work and the collection of administrative data like enumerators' work availability and logged time and expenses.
Enterprise Censuses and Surveys Enabling Platform (ECaSE) - Operational Control Systems (OCS)	Created the initial NRFU universe, received status updates and response data from the FDC application, and maintained operational workloads during data collection. Contained two components: Survey OCS and Field OCS.
Non-CEDCaP Systems	Function
Decennial Applicant Personnel and Payroll System (DAPPS)	Processed and tracked selection, hiring, and payroll for field staff.
MOJO	Made optimized enumerator work assignments through the ECaSE - ENUM application based on the enumerators who were available for work, their location, the location of open/unresolved NRFU cases, and the best time to contact respondents.
MOJO-Browse Living Quarters	Provided field supervisors and ACO, RCC, and headquarters staff the ability to search for housing units and view dangerous addresses in the enumeration universe.
MOJO-Hermes	Provided management reports for ACO, RCC, and headquarters staff to monitor the progress of NRFU.
Production Environment for Administrative Records Staging, Integration, and Storage (PEARSIS)	Provided administrative records data to CAES to perform modeling and performed AR matching for the RI selection process.
Sampling, Matching, Review and Coding System (SMaRCS)	Supported quality control by selecting a sample of RI cases, implementing computer matching, and enabling clerical matching to determine whether enumerators were using validated procedures and collecting accurate data.
Unified Tracking System (UTS)	Data warehouse that combined data from a variety of census systems and created reports for management of operations and assessment of data after the operation was complete.

Source: U.S. Census Bureau, 2020 Census, 2020 NRFU Detailed Operational Plan

3.2 Assessment Questions

A. Workload, Resolve Rate, and Final Case Status

1. NRFU Production
 - a. Describe the size of the initial NRFU universe and the results of the soft launch.
 - b. How many cases were resolved in each phase of the NRFU contact strategy?
 - c. What were the results of phase 1 of the NRFU contact strategy (Full Optimization)?
 - d. What were the results of phase 2 of the NRFU contact strategy (Semipermanent Assignment)?
 - e. What were the results of phase 3 of the NRFU contact strategy (Closeout)?
 - f. When was each attempt-day completed for cases during production?
 - g. How many NRFU cases were resolved, by: 1) attempt-day, 2) time of day, 3) day of the week, and 4) week of the operation?
 - h. How many NRFU cases were resolved, by resolved status and AR outcome?
 - i. How many cases received phone attempts and what was the final case status for cases that ever received a phone attempt?
 - j. What was the distribution of household size for occupied housing units enumerated during NRFU?
 - k. How many of the cases where an enumerator left a Notice of Visit had a subsequent self-response?
 - l. In what languages were NRFU interviews conducted?
 - m. What was the distribution of people enumerated during NRFU by age, sex, race, ethnicity, relationship, and household tenure?
 - n. What were the results of AR modeling during NRFU?
2. What was the final status of cases in the AR vacant/delete (no UAA) workload?
3. What was the final status of cases in the AR vacant/delete (with UAA) workload?
4. What was the final status of self-reported vacant cases by the initial self-reported vacancy reason?
5. NRFU Adds

- a. What was the final status of cases added during NRFU, by type of add?
- b. What were the matching and geocoding outcomes for NRFU adds, by type of add?
6. NRFU Supplemental
 - a. What was the final status of NRFU supplemental cases, by source?
 - b. What was the distribution of household size for occupied housing units that were enumerated as part of the NRFU supplemental workload?
7. What was the final status of NRFU UL cases?
8. What was the final outcome for Field Verification cases?
9. NRFU Reinterview
 - a. Describe the size of the initial NRFU RI universe and the results of the soft launch.
 - b. What percentage of addresses were selected for the NRFU RI workload, by sampling method?
 - c. What percentage of resolved NRFU cases had an AR match as part of NRFU QC?
 - d. What was the outcome of NRFU RI?
 - e. How many of the original NRFU cases were marked for replacement with RI data?
 - f. In what languages were NRFU RI interviews conducted?
 - g. What was the distribution of people enumerated during NRFU RI by age, sex, race, ethnicity, relationship, and household tenure?
10. Field Verification Quality Control (FV QC)
 - a. What percentage of addresses were selected for the FV QC workload?
 - b. What was the outcome of FV QC?
- B. NRFU Attempt Outcomes
 11. What was the final case status for cases that had one or more of the following NRFU attempt outcomes on any attempt-day: refusals, restricted access, dangerous situations, language/hearing barriers, group quarters, or envelope provided to respondent?
 12. What was the final case status for refusals by refusal reason (including COVID reason)?
- C. Supervisory Alerts
 13. At the end of the operation, how many unresolved alerts were there, by type of alert?

D. Cost, Staffing, and Production Rates

14. How did the budgeted cost for NRFU compare to the actual cost of the operation?
15. What was the cost per enumerator, per case, and per attempt-day?
16. How many miles did enumerators charge: on average, overall, and by week of the operation?
17. How many hours did enumerators charge: on average, overall, and by week of the operation?
18. Present key field staffing metrics from the 2020 NRFU operation.
19. How did the field staff ratio change over the course of the operation?
20. What was the average number of NRFU cases completed per hour?
21. What was the average length of completed interviews: overall, by resolved status, and by household size for occupied units?

E. Schedule

22. How did the planned field training dates compare to the actual dates?
23. How did the planned start and finish dates compare with the actual start and finish dates for NRFU and NRFU RI?

F. Lessons Learned

24. What aspects of NRFU worked well? What needs improvement?
25. What aspects of the NRFU QC program worked well? What needs improvement?
26. What aspects of supervisory alerts worked well? What needs improvement?
27. What would the Integrated Project Team (IPT) change about the implementation of the 2020 Census NRFU operation?
28. What major challenges does the IPT foresee affecting the implementation of the NRFU operation in the future?

G. Completeness and Quality

29. What was the impact of operational adjustments resulting from the COVID-19 pandemic and natural disasters during 2020 data collection on NRFU data completeness and quality?

3.3 Data Sources and Calculations: Production Systems/Reports

A. Decennial Applicant Personnel and Payroll System (DAPPS)

This system provided data about the field staff who supported NRFU work, such as the number of miles and hours they charged to training and production. DAPPS data were used in this assessment to measure operational costs per case and per enumerator, the number of field staff by position, and changes in field staffing over time.

B. Decennial Budget Office (DBO)

The DBO provided the budgeted and actual operational costs.

C. Decennial Response File – 1 (DRF-1)

This file was used to provide the demographic characteristics of NRFU and NRFU RI respondents, as well as the household size for occupied units within certain workloads.

D. Enterprise Data Lake (EDL)

The EDL was the central repository for response data, event data, paradata, and metadata collected during the 2020 Census. This report mainly relied upon the collection and response tables to support its analysis. Data from DAPPS and the DRF-1 are also stored in EDL and used in this report.

E. Field Operational Control System (FOCS)

The primary system that supported 2020 NRFU fieldwork was FOCS. It managed case assignments and received inputs for optimization from MOJO. It also received matching and geocoding information during the NRFU adds process. For this report, FOCS provided data on phase progression, supervisory alerts, case assignments, case-level summary data, and matching and geocoding outcomes for NRFU adds.

F. Sampling, Matching, Review and Coding System (SMaRCS)

Data from the NRFU RI workload, including results from computer matching and clerical resolution were collected by SMaRCS and used in this assessment to describe the outcome of NRFU RI. Data for the FV QC workload were also collected by SMaRCS and used to answer assessment questions about the results of those cases. The NRFU fail file was used to determine the outcome of NRFU RI cases, including results from clerical resolution, and identify hard fail enumerators.

G. Survey Operational Control System (SOCS)

Workload data from SOCS were used to analyze the outcome of NRFU cases by workload type.

3.4 Lessons Learned

The NRFU IPT collected lessons learned for the 2020 NRFU operation through a series of online surveys and focus groups.

Efforts to collect 2020 NRFU lessons learned began with the administration of three online surveys distributed to members of the IPT, covering three topic areas: (1) contact strategy, (2) reporting, and (3) systems and testing. A total of 89 survey responses were received, which were used to develop focus group areas and questions for further discussion.

Between March and May 2021, the team conducted focus groups on the following topics:

- (1) Contact Strategy and Case Management
- (2) NRFU Quality Control
- (3) Systems and Testing
- (4) Unified Tracking System (UTS) and Hermes Reports
- (5) NRFU Adds and Cases from UL
- (6) Census Questionnaire Assistance
- (7) Field Support, Materials, and Kitting
- (8) Field Training
- (9) Field Verification and Self-Response Quality Assurance
- (10) Language Support
- (11) Workloads and Mailings

These efforts resulted in the collection of 172 lessons learned from the 2020 NRFU operation.

Lessons learned about the NRFU QC program were also collected through two clerical resolution debriefing sessions in fall 2020 with NPC clerks, supervisors, and RCC Quality Assurance (QA) staff.

The NRFU and NRFU QC lessons learned informed the answers to assessment questions 24 and 25 and the Recommendations in Section 6.2.

4. Limitations

During the 2020 Census, enumerators worked a variety of case types each day. When charging their time and mileage, they charged to the NRFU operation, rather than to specific case types. This made it impossible to disaggregate their charges by workload. However, it is expected that the bulk of most enumerators' workload were NRFU production cases.

Multiple systems supported the NRFU operation. Each system had its own specifications for collecting data and definitions of metrics. This sometimes created differences in the data output by them, even for what appeared to be the same metric.

The 2020 NRFU operation included a workload of cases identified by SRQA that required field follow-up. However, because of the sensitive nature of how that workload was created, its results are excluded here. The only exceptions are for the operational cost metrics since enumerators did not charge work to separate field workloads, as noted above.

NRFU enumerators were able to contact respondents by phone in certain areas through a late change to the operational design. However, because of how the phone data were collected and stored, it was not possible to determine whether a case was resolved through a personal visit or a phone attempt.

There were changes made to the analysis questions from the study plan related to late design changes from the pandemic and other factors. The questions that were removed are listed below, including questions about Early NRFU and manager visit results. Other questions were removed, reworded, or combined with existing questions for efficiency or when data limitations prevented the analysis as originally framed.

A. Workload, Resolve Rate, and Final Case Status

1. Early NRFU

- a. Describe the size of the initial Early NRFU universe, the results of the soft launch, and the number of cases that went to the field on the first day of the operation.
- b. How many cases were resolved during Early NRFU, by: 1) attempt-day, 2) time of day, 3) day of the week, and 4) week of the operation?
- c. How many cases were resolved during Early NRFU by resolved status?
- d. What was the distribution of household size for occupied housing units enumerated during Early NRFU?
- e. In what languages were Early NRFU interviews conducted?
- f. What was the distribution of Early NRFU respondents by age, sex, race, ethnicity, relationship, and household tenure?

2. Early NRFU: Manager Visits

- a. What was the final housing unit status for individual units within multiunits by the manager visit status?
- b. What was the distribution of household size for occupied housing units within multiunits enumerated during Early NRFU?

- c. What was the resolution rate for manager visit cases by the size of the multiunit?
 - d. What impact did identifying vacant and delete units through manager visits have on:
1) the number of attempt-days spent at multiunits and 2) the cost of enumerating multiunits?
3. NRFU
- a. What were the results of AR modeling on the initial NRFU universe in May?
 - b. What were the results of AR modeling in early June, including the three additional AR statuses (Closeout Occupied, Closeout Vacant, Closeout Delete)?
 - c. What was the final case status for all proxy-eligible cases?
 - d. At the end of the NRFU operation, how many cases received contact attempts? Were there cases that were never assigned or that never received contact attempts? If so, describe why and the effort taken to correct the issue, if necessary.
4. NRFU: Manager Visits
- a. What was the final housing unit status for individual units within multiunits: 1) by the initial status from administrative records modeling and 2) by the manager visit status?
 - b. What was the distribution of household size for occupied housing units within multiunits enumerated during NRFU?
 - c. What was the resolution rate for manager visit cases by the size of the multiunit?
 - d. What impact did identifying vacant and delete units through manager visits have on:
1) the number of attempt-days spent at multiunits and 2) the cost of enumerating multiunits?
5. What was the distribution of household size for occupied housing units enumerated as part of the AR vacant/delete (no UAA) workload?
6. What was the distribution of household size for occupied housing units enumerated as part of the AR vacant/delete (with UAA) workload?
7. What was the distribution of household size for occupied housing units enumerated as part of the self-reported vacant workload?
8. What was the distribution of household size for occupied housing units that were added during NRFU?
9. What was the distribution of household size for occupied housing units that were enumerated as part of the NRFU UL workload?

10. Self-Response Quality Assurance (SRQA)

- a. What was the final status of SRQA cases by phase of the NRFU contact strategy?
- b. What was the distribution of household size for occupied housing units that were enumerated as part of the SRQA workload?

11. Manager Visit Reinterview (MV RI)

- a. What percentage of addresses were selected for the MV RI workload?
- b. What was the outcome of MV RI?
- c. What was the final resolution for housing units identified as vacant or delete during the MV and identified as occupied during the MV RI?

12. Field Verification Quality Control (FV QC)

- a. What was the final outcome for FV QC cases where the first FV QC case produced conflicting results from the FV case?

C. Supervisory Alerts

- 25. Describe the supervisory alerts sent to census field supervisors to assist with day-to-day management of the NRFU operation.

D. Cost, Staffing, and Production Rates

- 26. What was the number of field staff by position: authorized, invited to training, available for work, assigned work, and worked cases?
- 27. What were the field staff frontloading rates and enumerator attrition rates?
- 28. How did the actual staffing level compare to the budgeted estimates for Early NRFU?
- 29. What was the average interview length for completed manager visits overall and by number of NRFU units within the multiunit?

E. Training

- 30. Describe the field training provided to enumerators, census field supervisors, and census field managers.
- 31. To what extent did enumerators follow the field training procedures?

G. Schedule

- 32. How did the planned start and finish dates compare with the actual start and finish dates for Early NRFU?

H. Lessons Learned

34. What aspects of Early NRFU worked well? What needs improvement?
35. What aspects of system performance and integration worked well? What needs improvement?
36. What aspects of data availability and quality worked well? What needs improvement?
37. What aspects of training worked well? What needs improvement?
38. What aspects of device receipt and usage worked well? What needs improvement?
39. What aspects of management reports worked well? What needs improvement?

5. Results

The following sections describe the results of the research questions for the 2020 NRFU operation.

5.1 Workload, Resolve Rate, and Final Case Status

1. NRFU Production

- a. Describe the size of the initial NRFU universe and the results of the soft launch.

There were 58.7 million cases in the initial NRFU universe on July 16, 2020, the first day of the soft launch.³³ Additional cases were added to the workload after that date from NRFU adds and cases identified by the operational control system as needing additional fieldwork (e.g., blank and insufficient paper forms). The soft launch was not part of the original 2020 NRFU design. It was added after Early NRFU was descoped to allow for a controlled start to the operation to verify that supporting systems were functioning correctly. This was particularly important for COVID-19 related changes that could not be tested before production started.

The soft launch consisted of a series of cycles where each cycle had additional ACOs start NRFU fieldwork based on state and local pandemic restrictions, internal readiness, and operational and system priorities. ACOs in each cycle started on a flow over a period of several weeks. However, some cases in soft launch ACOs did not have any field activity until the full NRFU launch.

³³ The initial NRFU universe was the number of nonresponse cases on or before July 15, 2020, in the following workloads: NRFU production, NRFU UL, NRFU supplemental, NRFU AR vacant/delete with UAA, and NRFU AR vacant/delete with no UAA. It excluded cases in the NRFU QC workloads, adds during NRFU, NRFU cases in Puerto Rico, and cases added to the NRFU universe after July 15, 2020.

There was a total of 17.8 million cases that were part of the NRFU soft launch. A small percentage of cases were resolved during the soft launch period from July 16, 2020, through August 8, 2020.³⁴ Most cases (83.9 percent) were not resolved during this time but went on to receive additional fieldwork when NRFU production fully launched on August 9, 2020. The goal of the soft launch was not to reach a certain resolve rate, rather, to ensure systems were ready to support a national launch of NRFU fieldwork.

About 9 percent of the NRFU soft launch cases were resolved in the field and another 7.1 percent were resolved by some other means. About half of the field-resolved cases were occupied (4.1 percent). The number of cases resolved as occupied by a proxy interview was low since few cases met the proxy eligibility criteria in this limited timeframe. Similarly, there were relatively few cases resolved with only a population count.³⁵ In phase 1 of the contact strategy, cases with only a population count continued to be assigned to obtain a sufficient response.

³⁴ In-field adds were excluded from the soft launch results because they lacked sufficient geographic information to associate them with a particular soft launch cycle.

³⁵ A small number of cases were resolved with only a population count during the soft launch period. These cases were AR vacant or delete that only got one field attempt.

Table 6. Resolved Status of NRFU Soft Launch Cases, as of August 8, 2020

Resolved Status	Number	Percent
Total Cases	17,840,000	100.0%
Field Resolved	1,596,000	8.9%
Occupied	740,000	4.1%
Household Interview	656,000	3.7%
Proxy Interview	84,000	0.5%
Vacant	442,000	2.5%
Proxy Interview	333,000	1.9%
Enumerator Observation	109,000	0.6%
Delete	413,000	2.3%
Proxy Interview	153,000	0.9%
Enumerator Observation	260,000	1.5%
Population Count/Unit Status Only	950	<0.1%
Non-Field Resolved	1,271,000	7.1%
Self-Response during NRFU	684,000	3.8%
AR Resolved	587,000	3.3%
AR Occupied	473,000	2.7%
AR Vacant	97,000	0.5%
AR Delete	17,000	0.1%
Special Closeouts	200	<0.1%
Unresolved	14,970,000	83.9%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

b. How many cases were resolved in each phase of the NRFU contact strategy?

During the 2020 Census, the NRFU operation employed a phased approach for case assignment and resolution. The purpose of phase 1 was to optimize case assignment and routing to get the easiest cases resolved first and to get initial attempts made on as many cases as possible. CFS areas became eligible for phase 2 when 85 percent of their cases were closed or reached four attempt-days. The intent of phase 2 was to retain the highest-performing enumerators to work miniclusters of cases to increase the response rate in those areas.³⁶ CFS areas became eligible for closeout when 90 percent of their cases were closed. The goal of closeout was to make

³⁶ The plan to retain the highest-performing enumerators to work during phase 2 could not be implemented because of litigation that prevented the natural reduction in field staff.

unlimited additional attempts on cases for which sufficient data had not been collected or for which no AR data existed.

A total of 59.3 million nonresponding cases comprised the nonresponse workload and about 47.9 million were resolved in phase 1 (80.7 percent of the NRFU universe).³⁷ Another 4.9 million cases were resolved in phase 2 (8.3 percent). During closeout, 6.2 million cases were resolved (10.4 percent).

Table 7. Total Cases Resolved, by Phase of the NRFU Contact Strategy

Status	Number	Percent
NRFU Workload	59,280,000	100.0%
Resolved in Phase 1	47,860,000	80.7%
Resolved in Phase 2	4,949,000	8.3%
Resolved in Closeout	6,164,000	10.4%

Source: U.S. Census Bureau, 2020 Census, EDL and FOCS

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) This table excludes in-field adds, which were not part of the starting workload and whose completion could not be linked to a certain phase. It also excludes cases that were not resolved in any phase.

c. What were the results of phase 1 of the NRFU contact strategy (Full Optimization)?

All CFS areas began phase 1 when they started NRFU fieldwork. Cases were considered resolved in phase 1 if they were completed between the creation of the NRFU universe and when the CFS area moved to phase 2 of the NRFU contact strategy. More than half (57.1 percent) of the initial NRFU workload was resolved in phase 1 by field interviews or enumerator observation. About a third of all cases resolved in the field during phase 1 were occupied households (33.5 percent). Another 19.1 percent of field resolved cases were vacant and 17.8 percent were deletes. Self-response during the beginning of NRFU accounted for 12.0 percent of the resolutions. One-visit AR cases were enumerated using AR data during this period if their sole field attempt was unsuccessful, accounting for 17.2 percent of the resolutions.

³⁷ The NRFU universe was the number of nonresponse cases throughout the duration of NRFU in the following workloads: NRFU production, NRFU UL, NRFU supplemental, NRFU AR vacant/delete with UAA, and NRFU AR vacant/delete with no UAA. It excluded cases in the NRFU QC workloads, in-field adds, and nonresponse cases in Puerto Rico.

Table 8. NRFU Phase 1 Case Resolutions, by Resolution Type

Resolved Status	Number	Percent
Starting Phase Workload	59,280,000	-
Total Resolved in Phase	47,860,000	100.0%
Field Resolved	33,870,000	70.8%
Occupied	16,050,000	33.5%
Vacant	9,138,000	19.1%
Delete	8,520,000	17.8%
Population Count/Unit Status Only	162,000	0.3%
Non-Field Resolved	13,980,000	29.2%
Self-Response during NRFU	5,732,000	12.0%
AR Resolved	8,213,000	17.2%
Special Closeouts	38,000	0.1%
Unresolved at Phase End	11,430,000	-

Source: U.S. Census Bureau, 2020 Census, EDL and FOCS

Notes:

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(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) This table excludes NRFU adds, since they lacked the data necessary to determine the phase of the operation in which they were completed.

d. What were the results of phase 2 of the NRFU contact strategy (Semipermanent Assignment)?

Cases were considered resolved in phase 2 if they were completed between the date their CFS area moved to phase 2 and the date their CFS area started closeout. A total of 11.4 million cases entered phase 2 and nearly 5.0 million were resolved before closeout started (8.3 percent of the initial NRFU universe). Phase 2 had the fewest case resolutions of any phase of the NRFU contact strategy. Most phase 2 cases were completed by fieldwork. Fewer cases were resolved by AR in phase 2 since most cases with high-quality AR were resolved with a single attempt in phase 1. Households self-responded at a lower rate in phase 2 (4.1 percent) compared to phase 1. The self-response rate was expected to decrease as it got farther away from April 1, 2020 (Census Day).

Table 9. NRFU Phase 2 Case Resolutions, by Resolution Type

Resolved Status	Number	Percent
Starting Phase Workload	11,430,000	-
Total Resolved in Phase	4,949,000	100.0%
Field Resolved	4,451,000	89.9%
Occupied	2,548,000	51.5%
Vacant	1,017,000	20.5%
Delete	577,000	11.7%
Population Count/Unit Status Only	309,000	6.2%
Non-Field Resolved	497,000	10.0%
Self-Response during NRFU	202,000	4.1%
AR Resolved	290,000	5.9%
Special Closeouts	5,200	0.1%
Unresolved at Phase End	6,480,000	-

Source: U.S. Census Bureau, 2020 Census, EDL and FOCS

Notes:

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(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) This table excludes NRFU adds, since they lacked the data necessary to determine the phase of the operation in which they were completed.

e. What were the results of phase 3 of the NRFU contact strategy (Closeout)?

A total of 6.5 million cases entered the closeout phase and 6.2 million of them were resolved by the end of NRFU (10.4 percent of the initial workload). During this phase, cases that were unresolved after six attempt-days or with minimal data received additional attempts to enumerate as many cases as possible before the end of data collection.

As in phases 1 and 2, most cases were completed by fieldwork in this phase (88.5 percent). About half of the field resolutions were occupied units (51.6 percent), 19.6 percent were vacant units, and 11.2 percent were deletes. The proportion of cases completed by AR increased to 8.2 percent in the closeout phase compared to phase 2. This increase can largely be explained by households becoming eligible for enumeration using AR "closeout" statuses. These "closeout" statuses did not meet the initial threshold for one-visit AR enumeration but had sufficient AR data for apportionment purposes. They were considered resolved after reaching the closeout phase if they had at least one unsuccessful field attempt.

Table 10. NRFU Closeout Case Resolutions, by Resolution Type

Resolved Status	Number	Percent
Starting Phase Workload	6,480,000	-
Total Resolved in Phase	6,164,000	100.0%
Field Resolved	5,456,000	88.5%
Occupied	3,180,000	51.6%
Vacant	1,206,000	19.6%
Delete	693,000	11.2%
Population Count/Unit Status Only	376,000	6.1%
Non-Field Resolved	708,000	11.5%
Self-Response during NRFU	184,000	3.0%
AR Resolved	506,000	8.2%
Special Closeouts	17,000	0.3%
Unresolved at Phase End	317,000	-

Source: U.S. Census Bureau, 2020 Census, EDL and FOCS

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) This table excludes NRFU adds, since they lacked the data necessary to determine the phase of the operation in which they were completed.

f. When was each attempt-day completed for cases during production?

Half of all cases had their first attempt-day by August 21, 2020, approximately two weeks after the start of full production. By mid-September, about five weeks into NRFU, nearly all cases had received at least one attempt-day. The typical case became proxy eligible after the third day of household attempts. Half of cases reached this milestone on September 4, and by the end of the month, 95 percent of cases completed three attempt-days.

On October 3, 12 days before the end of production, 95 percent of cases that had not been resolved received attempt-day six. The sixth attempt-day was the final one for cases during phase 2 of the operation. After six attempt-days, these cases were put on hold until closeout, where they could be reopened for additional attempts if they met certain criteria.

Table 11. NRFU Attempt-Day Milestones

Attempt-Day	50% of Cases	75% of Cases	95% of Cases
1	8/21/2020	8/30/2020	9/15/2020
2	8/26/2020	9/4/2020	9/22/2020
3	9/4/2020	9/15/2020	9/27/2020
4	9/9/2020	9/19/2020	9/30/2020
5	9/13/2020	9/21/2020	10/2/2020
6	9/15/2020	9/22/2020	10/3/2020
7+	9/19/2020	9/26/2020	10/5/2020

Source: U.S. Census Bureau, 2020 Census, EDL

- g. How many NRFU cases were resolved, by: (1) attempt-day, (2) time of day, (3) day of the week, and (4) week of the operation?³⁸

(1) Attempt-Day

The 2020 NRFU contact strategy gave most production cases up to six attempt-days to be enumerated in the field. Some cases were eligible to receive additional attempt-days during the closeout phase if they had insufficient data for apportionment. A little under half of field-resolved cases (43.1 percent) were resolved on the first day of attempts and 76.0 percent were resolved in three or fewer attempt-days. About 5.0 percent of NRFU cases received seven or more attempt-days after being reopened for additional attempts during closeout.

Table 12. NRFU Field Resolutions, by Attempt-Day

Attempt-Day	Number	Percent	Cumulative Percent
1	19,080,000	43.1%	43.1%
2	8,163,000	18.4%	61.6%
3	6,384,000	14.4%	76.0%
4	3,849,000	8.7%	84.7%
5	2,572,000	5.8%	90.5%
6	1,970,000	4.5%	95.0%
7+	2,231,000	5.0%	<100.0%
Total	44,250,000	100.0%	100.0%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

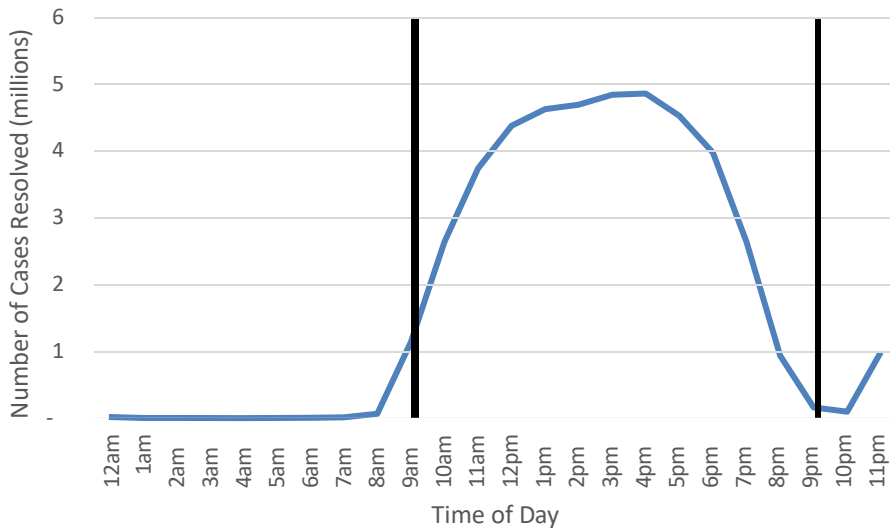
- (-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.
- (-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.
- (-) Excludes non-field resolutions, such as self-response during NRFU.
- (-) About 7,400 cases had a field-resolved event code and showed no attempts because of FOCS processing rules. They were included in the one attempt-day resolutions for this analysis.

³⁸ This analysis included in-field adds and excluded cases not resolved in the field.

(2) Time of Day

The planned daily hours for NRFU fieldwork during the 2020 Census were 9 a.m. until 9 p.m. (local time). During these hours, enumerators attempted to interview households to close unresolved cases. Approximately 97.0 percent of NRFU field resolutions took place during the expected hours for fieldwork. A total of 1.3 million cases (3.0 percent) were resolved outside of NRFU business hours. Most of these (62.8 percent) were cases where only a population count was collected, which were resolved by the Field Operational Control System (FOCS) at 11 p.m., nightly, regardless of when the interview took place.³⁹ Approximately 72.0 percent of field resolutions took place between the hours of noon and 7 p.m. NRFU resolutions peaked at 4 p.m., when 4.9 million resolutions occurred (11.0 percent).

Figure 1. NRFU Field Resolutions, by Time of Day



Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

- (-) The data in this figure have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.
- (-) Excludes non-field resolutions, such as self-response during NRFU.

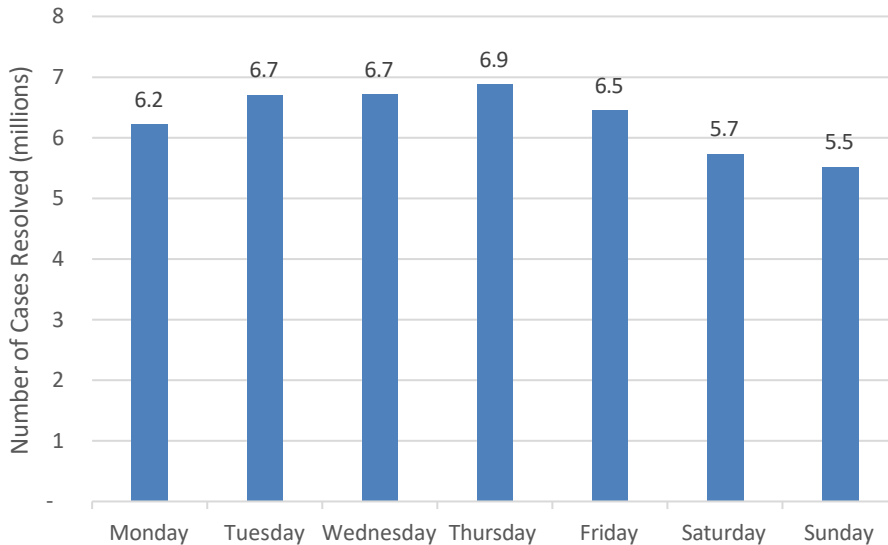
(3) Day of the Week

In 2020 the majority of NRFU cases were resolved on weekdays. Approximately 74.5 percent of NRFU field resolutions took place from Monday through Friday. There were likely more people at home on weekdays and available to conduct an interview with an enumerator, largely because of the pandemic. Thursday had the largest number of NRFU

³⁹ Cases were resolved with a population count only after reaching the allotted number of maximum attempts based on their case type.

field resolutions at 6.9 million cases (15.5 percent), while Sunday had the smallest number of NRFU field resolutions at 5.5 million cases (12.5 percent).

Figure 2. NRFU Field Resolutions, by Day of the Week



Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

- (-) The data in this figure have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.
- (-) Excludes non-field resolutions, such as self-response during NRFU.

(4) Week of Operation

The NRFU soft launch took place during weeks one through three and the first three days of week four listed in the table below.⁴⁰ Between weeks one through four, each week saw an increase in the number of ACOs activated based on state and local guidelines related to the pandemic. The soft launch design contributed to the slower initial flow of field resolutions than is often typical for the operation. All 248 ACOs started NRFU by August 9, 2020, midway into week four. NRFU field resolutions peaked in weeks five through nine (August 13 through September 16), when 31.2 million cases (70.6 percent) were resolved.

Among cases that were ultimately resolved, cumulative field resolutions reached 24.8 percent by August 19 (week five). Two weeks later, by September 2 (week seven), the cumulative field resolutions passed 50 percent. By October 7 (week 12), NRFU had surpassed 99 percent cumulative resolutions from fieldwork.

⁴⁰ For the number of ACOs that started NRFU by cycle of the soft launch, see Table 2.

Table 13. NRFU Field Resolutions, by Week of the Operation

Week	Date Range	Number	Percent	Cumulative Percent
1	July 16-22	134,000	0.3%	0.3%
2	July 23-29	247,000	0.6%	0.9%
3	July 30-Aug. 5	829,000	1.9%	2.7%
4	Aug. 6-12	3,016,000	6.8%	9.6%
5	Aug. 13-19	6,754,000	15.3%	24.8%
6	Aug. 20-26	6,955,000	15.7%	40.5%
7	Aug. 27-Sept. 2	6,504,000	14.7%	55.2%
8	Sept. 3-9	5,528,000	12.5%	67.7%
9	Sept. 10-16	5,485,000	12.4%	80.1%
10	Sept. 17-23	4,176,000	9.4%	89.6%
11	Sept. 24-30	2,975,000	6.7%	96.3%
12	Oct. 1-7	1,322,000	3.0%	99.3%
13	Oct. 8-14	289,000	0.7%	99.9%
14	Oct. 15	32,000	0.1%	<100.0%
Total		44,250,000	100.0%	100.0%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

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(-) Excludes non-field resolutions, such as self-response during NRFU.

(-) An additional 5,400 cases were resolved before July 16, 2020, or after October 15, 2020, that are excluded from this table. This included duplicate cases that were identified and closed before the soft launch start and final system processing after the end of field data collection.

h. How many cases were resolved during NRFU by resolved status and AR outcome?

Of the 59.8 million cases in the 2020 NRFU universe, 44.3 million cases (74.0 percent) were resolved in the field and 15.2 million cases (25.4 percent) were resolved by self-response during NRFU, based on their AR data, or through a special closeout.⁴¹ The remaining 331,000 cases (0.6 percent) were unresolved at the end of data collection. The 2020 unresolved rate was on par with the 2010 NRFU unresolved rate of 0.6 percent (U.S. Census Bureau, 2012).

Overall, 37.1 percent of NRFU cases were resolved in the field as occupied housing units, with more completed interviews by a household member (25.0 percent) compared to a proxy respondent (12.1 percent).

⁴¹ The NRFU universe for this question included cases in the five NRFU production workloads: NRFU production, NRFU UL, NRFU supplemental, NRFU AR vacant/delete with UAA, NRFU AR vacant/delete with no UAA, and in-field adds. It excluded cases in the NRFU QC workloads and cases worked for other operations: SRQA, NRFU RI, FV, and FV QC. It also excluded NRFU cases in Puerto Rico and in-mover adds.

During NRFU fieldwork, 19.1 percent of all resolutions were identified as vacant units. These units were more likely to be identified by a proxy interview (16.2 percent) than by an independent enumerator observation (2.9 percent). The opposite was true for deletes, or housing units that did not exist. More deletes were confirmed by enumerator observation (10.1 percent) compared to a proxy interview (6.4 percent). Deletes constituted 16.4 percent of all 2020 NRFU field resolutions.

Some cases were resolved in the field with only a population count or housing unit status and no other interview data. This type of resolution represented 1.4 percent of all NRFU cases.

About 6.1 million cases (10.2 percent) were resolved through self-response during NRFU. Some cases had high-quality AR data, and no successful field enumeration. These cases were resolved by AR. If a case had AR occupied information and only a population count collected in the field, it was treated as resolved by AR for this analysis. However, 2020 postprocessing activities favored respondent-provided information over AR. Cases resolved with AR constituted about 15 percent of all NRFU cases. AR occupied resolutions were most common, at 11.4 percent. AR vacant and AR delete resolutions were less common, at 3.0 percent and 0.6 percent, respectively.

Finally, 0.1 percent of all NRFU cases were resolved as a special closeout by a field manager within the operational control system. Some examples of special closeouts included dangerous addresses where the census field manager (CFM) confirmed it was too dangerous to continue field attempts, and duplicate cases that were identified and closed at the beginning of production.

Table 14. Resolved Status of NRFU Cases

Resolved Status	Number	Percent
Total Cases	59,770,000	100.0%
Field Resolved	44,250,000	74.0%
Occupied	22,150,000	37.1%
Household Interview	14,930,000	25.0%
Proxy Interview	7,218,000	12.1%
Vacant	11,420,000	19.1%
Proxy Interview	9,674,000	16.2%
Enumerator Observation	1,749,000	2.9%
Delete	9,823,000	16.4%
Proxy Interview	3,805,000	6.4%
Enumerator Observation	6,018,000	10.1%
Population Count/Unit Status Only	857,000	1.4%
Non-Field Resolved	15,190,000	25.4%
Self-Response during NRFU	6,119,000	10.2%
AR Resolved	9,009,000	15.1%
AR Occupied	6,841,000	11.4%
AR Vacant	1,809,000	3.0%
AR Delete	359,000	0.6%
Special Closeouts	61,500	0.1%
Unresolved	331,000	0.6%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

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(-) Includes stateside in-field adds that were geocoded.

- i. How many cases received phone attempts and what was the final case status for cases that ever received a phone attempt?

The phoning functionality was developed as part of testing in the decade leading up to 2020 but was not in the original scope of 2020 NRFU. In May 2020, a late design change was made that allowed enumerators to contact respondents by phone in areas where they could not conduct personal visits because of the COVID-19 pandemic, hurricanes, wildfires, or other reasons.

A total of 5.8 million cases received a phone attempt during NRFU.⁴² These cases represented 9.7 percent of the total NRFU universe. The way that phone data were captured made it impossible to differentiate whether cases with phone attempts were resolved through a phone contact or a subsequent personal visit. Of those that received a phone attempt, 2.6 million (45.0 percent) were resolved as occupied, either through the phone attempt or a subsequent personal visit. About a quarter (25.7 percent) of phone-attempt occupied cases were completed by a proxy respondent.

Cases with phone attempts were resolved as vacant 23.8 percent of the time and 11.2 percent of these cases were resolved as delete. Another 4.1 percent of phone-attempt cases were resolved with only a population count collected. A self-response resolution during NRFU accounted for 3.0 percent of cases that had a phone attempt. The unresolved rate for phone cases was 0.6 percent.

⁴² Cases that received phone attempts may have been in areas impacted by the pandemic or natural disasters. However, some phone attempts were part of the original contact strategy for proxy respondents not on site (e.g., landlords, real estate agents).

Table 15. Resolved Status of NRFU Cases with Phone Attempts

Resolved Status	Number	Percent
Total Cases	5,787,000	100.0%
Field Resolved	4,868,000	84.1%
Occupied	2,604,000	45.0%
Household Interview	1,118,000	19.3%
Proxy Interview	1,486,000	25.7%
Vacant	1,377,000	23.8%
Proxy Interview	1,262,000	21.8%
Enumerator Observation	115,000	2.0%
Delete	648,000	11.2%
Proxy Interview	438,000	7.6%
Enumerator Observation	210,000	3.6%
Population Count/Unit Status Only	239,000	4.1%
Non-Field Resolved	883,000	15.3%
Self-Response during NRFU	171,000	3.0%
AR Resolved	697,000	12.0%
AR Occupied	538,000	9.3%
AR Vacant	149,000	2.6%
AR Delete	10,500	0.2%
Special Closeouts	15,000	0.3%
Unresolved	35,000	0.6%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

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- j. What was the distribution of household size for occupied housing units enumerated during NRFU?

A total of approximately 22.7 million occupied households in the United States were enumerated as part of the 2020 Census NRFU operation, including households where only a population count was collected. Table 16, below, breaks down the NRFU response data from households with data-defined persons in the United States. Households with one person accounted for most of the responses at 31.0 percent of the total occupied households. Household sizes of two through four persons combined for 56.0 percent of the responses, while household sizes ranging from five to 10 persons and 11 or more tallied for about 13.1 percent of the responses.

Table 16. Household Size for Occupied NRFU Housing Units

Persons per Household	Number	Percent
1	7,045,116	31.0%
2-4	12,725,516	56.0%
5-10	2,935,720	12.9%
11+	37,610	0.2%
Total	22,743,931	100.0%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

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(-) The total number of occupied NRFU housing units in the DRF-1 includes cases with only a population count.

k. How many of the cases where an enumerator left a Notice of Visit had a self-response?

During the NRFU operation of the 2020 Census, 29.6 million cases recorded at least one non-interview attempt where a NOV was left with instructions for self-response. This number was based on the number of enumerators who marked in the enumeration application that they left a NOV. Of the cases that received a NOV, 2.7 million self-responded (9.1 percent). Self-responses were removed from the active field workload, reducing the number of contact attempts by enumerators. There was a total of 6.1 million self-responses during the NRFU operation.⁴³ About 43.9 percent of self-responses had a NOV left by an enumerator.⁴⁴

l. In what languages were NRFU interviews conducted?

The enumeration instrument for the 2020 NRFU operation was available in English or Spanish. If a respondent spoke another language, the CFM would assign the case to an enumerator who spoke that language or find an interpreter. The enumeration instrument allowed enumerators to indicate a language barrier by selecting from 62 language codes. These included English, the 59 non-English languages listed on the Language Identification Card (with both Mandarin and Cantonese options for Chinese), and an "other" category to specify additional languages. Multiple language selections were permitted.

⁴³ The 6.1 million self-responses during NRFU includes all cases that ever had a 7.100 event code (response received). Some cases with a self-response went on to receive a different final event code.

⁴⁴ There were other reasons for late self-response in addition to the NOV. Some self-response occurred after the NRFU workload was created but before an enumerator attempted an interview. The delay of the NRFU operation because of COVID-19 increased the time between the creation of the NRFU workload and the beginning of fieldwork, allowing more time for self-response. Other self-responses occurred after receipt of the NRFU AR postcard. Additional mailings were also added to the mail strategy to boost self-response. Finally, the Mobile Questionnaire Assistance (MQA) program encouraged self-response in low response rate areas.

The most common language used during 2020 NRFU interviews was English (93.1 percent). Spanish language selections made up 6.0 percent of all languages selected. Nearly half of the Spanish language selections (49.3 percent) took place in Puerto Rico. More than one language constituted about 0.6 percent of all language selections.

Table 17. Top Five Languages Selected During NRFU Interviews⁴⁵

Language	Number	Percent
Total	37,599,825	100.0%
English	35,012,038	93.1%
Spanish	2,256,236	6.0%
Mandarin	24,900	0.1%
Cantonese	11,217	<0.1%
Russian	9,675	<0.1%
All other languages	68,585	0.2%
More than one language	217,174	0.6%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

(-) Percentages may not sum to 100.0% because of rounding.

(-) Results are for the U.S. and Puerto Rico.

(-) Data reflect the number of times each language was selected during NRFU. They do not correspond to unique cases.

- m. What was the distribution of people enumerated during NRFU by age, sex, race, ethnicity, relationship, and household tenure?

There were 59.4 million data-defined people enumerated during NRFU interviews for 22.7 million occupied housing units in the 2020 Census.⁴⁶ ⁴⁷ Table 18 through Table 22 provide the following demographic characteristics for people enumerated through NRFU interviews: sex, age, race, ethnicity, and relationship status. Age was calculated based on the date of birth provided; if the date of birth was invalid or no date of birth was provided, then the age entered in the enumeration application was used. People with birthdates reported after Census Day were included in the demographic tables but constituted a small portion of all people enumerated during NRFU.⁴⁸ Table 23 provides the distribution of tenure outcomes for occupied housing units enumerated in NRFU. Results are shown for the United States, including the District of Columbia.

⁴⁵ Included interviews conducted for the following case types: NRFU production, NRFU UL, NRFU supplemental, NRFU AR vacant/delete with UAA, NRFU AR vacant/delete with no UAA, and in-field adds.

⁴⁶ The criteria for determining a data-defined person are considered sensitive, but at a high level they ensure a person record meets a minimum threshold to be considered sufficient for processing.

⁴⁷ The universe for the NRFU demographic tables was occupied housing units that had person responses. Cases with a population count only were excluded since they had no person-level data.

⁴⁸ There were 71,048 people with a reported birthdate after Census Day included in the NRFU demographic tables and 69 people in the NRFU RI demographic tables.

Because the demographic data used in this assessment do not reflect the final result of response processing and are unedited, direct comparisons with published 2020 Census results are not possible. These tables include a row for people with missing values for the specific characteristic. The housing table includes a row for occupied housing units without a tenure value. The data in published census reports have undergone editing and imputation, and therefore will have no missing values.

During the 2020 Census, there were more males than females enumerated during NRFU (46.7 percent and 44.9 percent, respectively). The remaining 8.4 percent of people enumerated during a NRFU interview had a missing value for the sex question.

Table 18. Standard Demographic Table for Sex During NRFU

Sex	Number	Percent
Total Population	59,438,362	100.0%
Male	27,766,863	46.7%
Female	26,708,320	44.9%
Missing	4,963,190	8.4%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

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The distribution of NRFU-enumerated people by age was generally uniform with a slightly higher percentage of respondents aged 65 and over (6.6 percent) compared to other age groups. Of all the demographic characteristics collected during NRFU interviews, age had the largest percentage of missing values at 27.8 percent.

Table 19. Standard Demographic Table for Age and Sex During NRFU

Age and Sex	Number	Percent
Total Population	59,438,362	100.0%
Under 5 years	2,937,024	4.9%
5 to 9 years	3,254,023	5.5%
10 to 14 years	3,330,583	5.6%
15 to 19 years	3,267,040	5.5%
20 to 24 years	3,603,329	6.1%
25 to 29 years	3,654,181	6.1%
30 to 34 years	3,559,774	6.0%
35 to 39 years	3,284,947	5.5%
40 to 44 years	2,948,637	5.0%
45 to 49 years	2,602,409	4.4%
50 to 54 years	2,476,280	4.2%
55 to 59 years	2,183,873	3.7%
60 to 64 years	1,864,381	3.1%
65+ years	3,927,160	6.6%
Missing	16,545,014	27.8%
Male	27,766,867	46.7%
Under 5 years	1,467,287	5.3%
5 to 9 years	1,642,727	5.9%
10 to 14 years	1,703,463	6.1%
15 to 19 years	1,700,628	6.1%
20 to 24 years	1,847,863	6.7%
25 to 29 years	1,875,472	6.8%
30 to 34 years	1,804,404	6.5%
35 to 39 years	1,662,288	6.0%
40 to 44 years	1,491,307	5.4%
45 to 49 years	1,322,973	4.8%
50 to 54 years	1,269,923	4.6%
55 to 59 years	1,128,988	4.1%
60 to 64 years	954,821	3.4%
65+ years	1,812,602	6.5%
Missing	6,082,186	21.9%
Female	26,708,314	44.9%
Under 5 years	1,418,004	5.3%
5 to 9 years	1,569,384	5.9%
10 to 14 years	1,594,247	6.0%
15 to 19 years	1,544,103	5.8%
20 to 24 years	1,708,869	6.4%
25 to 29 years	1,763,114	6.6%

Age and Sex	Number	Percent
30 to 34 years	1,741,190	6.5%
35 to 39 years	1,612,996	6.0%
40 to 44 years	1,448,756	5.4%
45 to 49 years	1,274,435	4.8%
50 to 54 years	1,200,842	4.5%
55 to 59 years	1,051,050	3.9%
60 to 64 years	905,479	3.4%
65+ years	2,102,825	7.9%
Missing	5,773,035	21.6%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

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Nearly half of the people enumerated by NRFU were White alone (48.5 percent), followed by Black or African American alone (14.4 percent), and Some Other Race alone (11.8 percent). About 10.1 million people (16.9 percent) had a missing value for race.

Table 20. Standard Demographic Table for Race During NRFU

Race	Number	Percent
Total Population	59,438,362	100.0%
White alone	28,839,505	48.5%
Black or African American alone	8,555,424	14.4%
Asian alone	2,403,362	4.0%
American Indian and Alaska Native alone	917,125	1.5%
Native Hawaiian and Other Pacific Islander alone	215,871	0.4%
Some Other Race alone	6,986,024	11.8%
Two Or More Races	1,446,821	2.4%
Missing	10,074,286	16.9%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

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NRFU-enumerated people were more likely to be Not Hispanic or Latino (60.1 percent), compared to Hispanic or Latino (25.7 percent). About 14.2 percent of people did not have an ethnicity reported.

Table 21. Standard Demographic Table for Ethnicity During NRFU

Ethnicity	Number	Percent
Total Population	59,438,362	100.0%
Not Hispanic or Latino	35,735,059	60.1%
Hispanic or Latino	15,273,799	25.7%
Missing	8,429,414	14.2%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

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Householders made up about 38.2 percent of NRFU household respondents. Another 25.5 percent were the biological son or daughter of the householder, and 12.0 percent were the opposite-sex husband/wife/spouse. Missing rates for relationship status were among the lowest of the demographic characteristics collected.

Table 22. Standard Demographic Table for Relationship During NRFU

Relationship	Number	Percent
Total Population	59,438,362	100.0%
Householder	22,681,436	38.2%
Opposite-sex Husband/Wife/Spouse	7,144,674	12.0%
Opposite-sex Unmarried Partner	1,573,581	2.6%
Same-sex Husband/Wife/Spouse	52,277	0.1%
Same-sex Unmarried Partner	59,365	0.1%
Biological Son or Daughter	15,184,530	25.5%
Adopted Son or Daughter	170,310	0.3%
Stepson or Stepdaughter	651,247	1.1%
Brother or Sister	1,007,686	1.7%
Father or Mother	1,009,116	1.7%
Grandchild	1,272,376	2.1%
Parent-in-law	133,178	0.2%
Son-in-law or Daughter-in-law	224,282	0.4%
Other Relative	1,063,364	1.8%
Roommate or Housemate	2,640,547	4.4%
Foster Child	46,608	0.1%
Other Nonrelative	668,841	1.1%
Missing	3,854,873	6.5%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

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(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

Just over half of NRFU occupied housing units were rented (53.4 percent). Another 23.3 percent were owned with a mortgage or loan. The remaining 10.7 percent had a missing response to the tenure question.

Table 23. Standard Demographic Table for Tenure During NRFU

Tenure	Number	Percent
Total Occupied Housing Units	22,743,931	100.0%
Owned with a Mortgage or a Loan	5,297,480	23.3%
Owned without a Mortgage or a Loan	2,473,887	10.9%
Rented	12,154,001	53.4%
Occupied without Payment of Rent	351,286	1.5%
Missing	2,440,927	10.7%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

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These distributions may vary across different census operations because of differences in the corresponding populations and census procedures.

n. What were the results of AR modeling during NRFU?

AR were used during the 2020 NRFU operation to reduce the number of contact attempts for cases with existing high-quality information about the household. AR modeling was run before the start of NRFU and monthly during production to identify additional cases that met the criteria. Certain types of cases were not eligible for AR modeling, including FV, SRQA, in-field adds, and NRFU UL cases.

The 2020 NRFU design added closeout AR determinations, which used loosened quality criteria during the closeout phase of the operation to close unresolved cases that had received at least one contact attempt. In census tests during the prior decade, these cases would have received the full contact strategy. If they remained unresolved, the lower-quality AR data were used to enumerate the household as part of data processing.

Overall, 48.3 percent of cases in the NRFU workload had data about their housing unit status from AR modeling. Cases that received an AR modeling determination of occupied, vacant, or delete were eligible to receive a reduced number of contact attempts. The highest-quality AR determinations made up 38.7 percent of all NRFU cases, whereas closeout AR determinations constituted 9.6 percent of the workload.

Nearly one quarter of the NRFU universe (24.8 percent) was modeled as occupied, based on AR data. Of these AR occupied cases, nearly 10 million (17.0 percent of the total universe) were based on the highest quality threshold and 4.6 million (7.8 percent) were based on the closeout AR criteria.

Another 17.4 percent of NRFU cases were modeled as AR vacant. Higher quality AR data accounted for 15.8 percent of cases, while 1.6 percent of cases had the closeout vacant modeled status.

Cases modeled as AR delete represented 6.1 percent of the total universe, with 5.8 percent coming from the higher-quality threshold and 0.3 percent based on the closeout threshold.

Just over half of NRFU cases (51.7 percent) did not have sufficient data from AR to attribute a housing unit status. These cases received a no determination outcome from modeling and were eligible for up to six contact attempt-days.

Table 24. AR Modeling Results for NRFU

AR Modeling Result	Number	Percent
All AR Statuses	28,350,000	48.3%
AR Occupied	9,991,000	17.0%
Closeout AR Occupied	4,567,000	7.8%
AR Vacant	9,286,000	15.8%
Closeout AR Vacant	927,000	1.6%
AR Delete	3,421,000	5.8%
Closeout AR Delete	161,000	0.3%
No Determination	30,340,000	51.7%
Total	58,690,000	100.0%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

- (-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.
- (-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.
- (-) Data are based on AR modeling conducted on September 24, 2020.
- (-) No determination cases included stateside cases in TEA 6.

2. What was the final status of cases in the AR vacant/delete (no UAA) workload?

AR were used during 2020 NRFU to determine the contact strategy and reduce the number of field attempts. Operational design changes made in response to the COVID-19 pandemic increased the frequency of AR modeling from three to six rounds. This additional AR modeling

resulted in some cases' AR status changing, which impacted their number of attempt-days and final resolution.

AR modeling was first conducted in May 2020 to identify vacant and delete addresses that received a reminder postcard.⁴⁹ Most reminder postcards were returned by the post office as UAA. Cases that received a UAA on the reminder postcard received one field attempt; those that did not have a UAA were given up to six attempt-days. After the sixth attempt-day, the case was resolved by AR.

Field staff were able to resolve 90.7 percent of the AR vacant/delete cases that did not have a UAA on the reminder postcard. About two-thirds of the cases were confirmed as vacant (45.4 percent) or delete (21.4 percent). About 22.2 percent of AR vacant/delete cases were enumerated as occupied, and another 1.6 percent with a population count only.

Cases not resolved in the field were resolved by the AR modeling status. Only 4.6 percent of AR vacant/delete cases with no UAA were resolved by AR after unsuccessful field attempts. Another 4.7 percent of AR vacant or delete (with no UAA) cases were resolved by self-response during NRFU fieldwork.

A small number of cases originally modeled as vacant or delete had a status change to occupied after a subsequent round of AR modeling. These cases represented less than 0.1 percent of the AR vacant/delete workload with no UAA. An even smaller number of cases with a vacant/delete AR status were unresolved at the end of NRFU after later modeling changed their status to "no determination" and field visits were unsuccessful.

⁴⁹ Production schedule delays brought about by the pandemic lengthened the time between the AR vacant/delete modeling, postcard mailing, and the start of NRFU. These delays may have reduced the accuracy of the modeled statuses by the time NRFU started in mid-July.

Table 25. Final Case Status for AR Vacant/Delete (No UAA) Workload

Resolved Status	Number	Percent
Total Cases	2,551,000	100.0%
Field Resolved	2,313,000	90.7%
Occupied	567,000	22.2%
Household Interview	360,000	14.1%
Proxy Interview	207,000	8.1%
Vacant	1,159,000	45.4%
Proxy Interview	818,000	32.1%
Enumerator Observation	340,000	13.3%
Delete	545,000	21.4%
Proxy Interview	193,000	7.6%
Enumerator Observation	351,000	13.8%
Population Count/Unit Status Only	42,000	1.6%
Non-Field Resolved	238,000	9.3%
Self-Response during NRFU	121,000	4.7%
AR Resolved	117,000	4.6%
AR Occupied	150	<0.1%
AR Vacant	109,000	4.3%
AR Delete	7,700	0.3%
Special Closeouts	0	0.0%
Unresolved	30	<0.1%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

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3. What was the final status of cases in the AR vacant/delete (with UAA) workload?

All addresses modeled as vacant or delete using AR were sent to the field for confirmation during NRFU. Cases that received a UAA on the reminder postcard were given one field attempt. If the unit was determined to be occupied, then the case received the full contact strategy.

Field staff resolved fewer AR vacant/delete cases with a UAA (77.8 percent) compared to those without a UAA (90.7 percent). More than two-thirds of the cases with a UAA were confirmed as vacant (27.2 percent) or delete (42.8 percent). About 7.8 percent of cases were enumerated as occupied, and 0.1 percent with a population count only. Just over 20 percent of AR

vacant/delete cases with a UAA were resolved by AR after unsuccessful field attempts. Most were resolved as AR vacant (16.9 percent).

A small number of cases originally modeled as vacant or delete had a status change to occupied after a subsequent round of AR modeling. These cases represented less than 0.1 percent of the AR vacant/delete workload with a UAA. An even smaller number of cases with a vacant/delete AR status were unresolved at the end of NRFU after later modeling changed their status to no determination and field visits were unsuccessful.

Table 26. Final Case Status for AR Vacant/Delete (with UAA) Workload

Resolved Status	Number	Percent
Total Cases	9,042,000	100.0%
Field Resolved	7,037,000	77.8%
Occupied	707,000	7.8%
Household Interview	518,000	5.7%
Proxy Interview	189,000	2.1%
Vacant	2,456,000	27.2%
Proxy Interview	1,488,000	16.5%
Enumerator Observation	968,000	10.7%
Delete	3,867,000	42.8%
Proxy Interview	364,000	4.0%
Enumerator Observation	3,504,000	38.8%
Population Count/Unit Status Only	7,200	0.1%
Non-Field Resolved	2,005,000	22.2%
Self-Response during NRFU	182,000	2.0%
AR Resolved	1,823,000	20.2%
AR Occupied	600	<0.1%
AR Vacant	1,531,000	16.9%
AR Delete	291,000	3.2%
Special Closeouts	0	0.0%
Unresolved	150	<0.1%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

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(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

4. What was the final status of self-reported vacant cases by the initial self-reported vacancy reason?

Self-reported vacants (SRVs) were cases that completed a self-response (paper or internet questionnaire) with a housing unit status of vacant. They were eligible for AR modeling, but only required one field visit to confirm the vacant status. Overall, there were about 2.2 million SRVs in the NRFU universe. Enumerators were able to verify 42.0 percent of them as vacant. However, 25.5 percent of SRVs were resolved as occupied or delete after they were worked during NRFU. In total, 14.6 percent were resolved as occupied and 10.9 percent were resolved as delete. SRVs were more likely to be resolved as occupied through a proxy interview than an interview with a member of the household. The remaining 17.9 percent of SRVs were not resolved by NRFU fieldwork. Cases in this workload made up the majority of unresolved cases at the end of NRFU.

Table 27. Final Resolution of Self-Reported Vacant Cases

Resolved Status	Number	Percent
Total Cases	2,219,000	100.0%
Field Resolved	1,538,000	69.3%
Occupied	325,000	14.6%
Household Interview	125,000	5.6%
Proxy Interview	200,000	9.0%
Vacant	933,000	42.0%
Proxy Interview	723,000	32.6%
Enumerator Observation	209,000	9.4%
Delete	241,000	10.9%
Proxy Interview	159,000	7.2%
Enumerator Observation	81,500	3.7%
Population Count/Unit Status Only	40,500	1.8%
Non-Field Resolved	397,000	17.9%
Self-Response during NRFU	71,500	3.2%
AR Resolved	324,000	14.6%
AR Occupied	253,000	11.4%
AR Vacant	66,500	3.0%
AR Delete	4,300	0.2%
Special Closeouts	1,500	0.1%
Unresolved	284,000	12.8%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

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The table below provides the self-response vacancy reason for SRV cases and their final housing unit status after a verification attempt during NRFU. Two types of vacancy reasons, “for seasonal, recreational, or occasional use” and “for sale only” had the highest rates of vacant verifications (59.4 percent and 55.7 percent, respectively). The remaining vacancy reasons were verified as vacant less than half of the time. On the other hand, about 60 percent of self-reported vacant cases (or about 20 percent each) that were “rented, not occupied,” “for migrant worker,” and those with no vacancy reason given were resolved as “occupied” during NRFU.

Table 28. Final Housing Unit Status for Self-Reported Vacant Cases, by Vacancy Reason

Vacancy Reason	Final Housing Unit Status													
	Occupied		Vacant		Delete		Other Resolved		Pop Count/Unit Status Only		Unresolved		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
For rent	19,000	15.2	59,000	47.2	7,800	6.2	21,000	16.8	2,600	2.1	16,000	12.8	125,000	100.0
Rented, not occupied	17,500	20.7	31,500	37.3	8,200	9.7	15,000	17.8	1,900	2.2	11,000	13.0	84,500	100.0
For sale only	15,500	11.0	78,500	55.7	5,600	4.0	27,500	19.5	1,800	1.3	12,500	8.9	141,000	100.0
Sold, not occupied	7,400	12.2	29,000	47.9	5,500	9.1	11,000	18.2	950	1.6	6,700	11.1	60,500	100.0
For seasonal, recreational, or occasional use	63,500	10.4	364,000	59.4	39,000	6.4	79,000	12.9	5,400	0.9	61,500	10.0	613,000	100.0
For migrant worker	250	20.8	500	41.7	200	16.7	150	12.5	20	1.7	100	8.3	1,200	100.0
Other	68,500	11.5	212,000	35.6	155,000	26.0	99,500	16.7	6,500	1.1	54,000	9.1	596,000	100.0
Don't Know	350	15.2	800	34.8	150	6.5	400	17.4	90	3.9	550	23.9	2,300	100.0
Refused	N < 15	-	50	33.3	20	13.3	20	13.3	N < 15	-	30	20.0	150	100.0
No reason given	133,000	22.3	157,000	26.3	20,000	3.4	143,000	24.0	21,500	3.6	122,000	20.4	597,000	100.0
Total	325,000	14.6	933,000	42.0	241,000	10.9	397,000	17.9	40,500	1.8	285,000	12.8	2,220,000	100.0

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

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- (-) The vacancy reasons in this table came from self-response. The final housing unit status came from NRFU.

5. NRFU Adds

a. What was the final status of cases added during NRFU, by type of add?

The 2020 NRFU design allowed the enumeration of addresses that were not in the follow-up universe at the start of the operation. These types of addresses were known as “NRFU adds.” Adds were categorized as in-field, in-mover, and in-office adds.

An in-field add occurred when an enumerator came across a housing unit in the field that was not on their case list, and they had reason to believe it was missed.⁵⁰ In-office adds were identified at ACOs when the office staff received a report of a missed housing unit and confirmed it had not already been enumerated.⁵¹ Finally, in-mover adds occurred when an enumerator encountered a respondent who did not live at the address on Census Day and who did not complete a census questionnaire at their previous address. In such situations, enumerators were trained to ask the respondent to complete the NRFU interview for the address where they lived on April 1.

A total of 1.2 million stateside addresses were added and geocoded during the 2020 NRFU operation. Adds represented about 2.0 percent of the total NRFU workload. Among stateside adds, in-field adds were slightly more common than in-mover adds. In-office adds were least common.

In-field adds were more likely to be resolved as occupied (75.6 percent) than in-office adds (41.6 percent). In-office adds had higher percentages of vacant (35.7 percent) and delete (20.9 percent) resolutions compared to in-field adds (12.8 percent and 6.7 percent, respectively). More in-field adds were unresolved at the end of NRFU (3.0 percent) compared to in-office adds (0.1 percent).

All in-mover adds were resolved as occupied by an interview with a household member. This was by design since these adds were identified by talking to an in-mover respondent.

⁵⁰ A common situation when an enumerator may have created an in-field add was after discovering the existence of a basement apartment for an address on their case list. Another scenario that commonly initiated an in-field add was when an enumerator unexpectedly found a subdivided unit.

⁵¹ The in-office adds process was also used to put other kinds of cases into the NRFU workload, such as housing units found in other operations.

Table 29. Resolved Status of NRFU Adds, by Type of Add

Resolved Status	In-Field		In-Office		Inmover	
	Number	Percent	Number	Percent	Number	Percent
Total Cases	488,000	100.0%	227,000	100.0%	464,000	100.0%
Field Resolved	473,000	96.9%	226,000	99.6%	464,000	100.0%
Occupied	369,000	75.6%	94,500	41.6%	464,000	100.0%
Household Interview	262,000	53.7%	56,000	24.7%	464,000	100.0%
Proxy Interview	106,000	21.7%	38,500	17.0%	0	0.0%
Vacant	62,500	12.8%	81,000	35.7%	0	0.0%
Proxy Interview	61,000	12.5%	79,500	35.0%	0	0.0%
Enumerator Observation	1,100	0.2%	1,500	0.7%	0	0.0%
Delete	32,500	6.7%	47,500	20.9%	0	0.0%
Proxy Interview	25,000	5.1%	31,000	13.7%	0	0.0%
Enumerator Observation	7,400	1.5%	16,500	7.3%	0	0.0%
Population Count/Unit Status Only	9,400	1.9%	3,100	1.4%	0	0.0%
Non-Field Resolved	1,100	0.2%	750	0.3%	0	0.0%
Self-Response during NRFU	0	0.0%	0	0.0%	0	0.0%
AR Resolved	0	0.0%	0	0.0%	0	0.0%
AR Occupied	0	0.0%	0	0.0%	0	0.0%
AR Vacant	0	0.0%	0	0.0%	0	0.0%
AR Delete	0	0.0%	0	0.0%	0	0.0%
Special Closeouts	1,100	0.2%	750	0.3%	0	0.0%
Unresolved	14,500	3.0%	250	0.1%	0	0.0%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

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- (-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.
- (-) Includes stateside adds that were geocoded and available in EDL.
- (-) No adds were resolved through self-response. New addresses did not have a Census ID and enumerators did not leave a NOV if no one answered the door.
- (-) Adds were not part of the initial NRFU universe and did not go through AR modeling. Therefore, no adds were resolved by AR during NRFU.

b. What were the matching and geocoding outcomes for NRFU adds, by type of add?⁵²

Overall, more than half (57.5 percent) of NRFU adds matched a record in the MAF with a complete geocode or were able to have a geocode assigned through the adds process. Cases with a matched/geocoded outcome may have been duplicates of an existing case in another workload. In other instances, these cases may have represented addresses moving into the enumeration universe (e.g., a business that converted to a residence).

⁵² NRFU adds data differ between questions 5.1.5.a. and 5.1.5.b. because of different data sources. Data from FOCS were used for question 5.1.5.b. because the matching outcomes for adds were not available in EDL.

Nearly three-quarters of in-mover adds (73.1 percent) and more than half (58.3 percent) of in-field adds were matched and geocoded. Very few in-office adds were a match and had a geocode (0.8 percent). This result is in line with expectations since field office staff were able to review the entire enumeration universe before proceeding with an add, whereas enumerators were only able to view other addresses on their case list at any given time.

There were 475,000 NRFU adds that did not match an existing census record and could be geocoded. These addresses represented potentially “true” adds or addresses that were not already captured in the census address register that could be assigned the appropriate geographic codes for enumeration. Addresses that fell into this category represented 30.2 percent of all adds. Almost all in-office adds (99.1 percent) had this outcome, though only about a quarter of in-field adds (25.7 percent) and 14.1 percent of in-mover adds did. This was expected of in-office adds, since office staff were able to view what already existed in the enumeration universe before generating them.

NRFU adds with an unmatched/ungeocoded outcome were those addresses that did not match a known census address and could not be geocoded. Such addresses were, therefore, unlikely to result in a “true” add. About 15.2 percent of in-field adds, 12.5 percent of in-mover adds, and less than 0.1 percent of in-office adds could not be matched or geocoded during NRFU.

“Matched only” was the least common outcome for NRFU adds during 2020, comprising only 0.4 percent of all adds regardless of type. This outcome occurred when an added address existed in the MAF, but not the enumeration universe and could not be geocoded. Because of the missing geocode, such addresses could not be counted in the census.

Table 30. Matching and Geocoding Outcomes for NRFU Adds, by Type of Add

Outcome	In-Field Adds		In-Office Adds		In-mover Adds		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Matched/ Geocoded	350,000	58.3%	1,700	0.8%	553,000	73.1%	905,000	57.5%
Matched Only	5,000	0.8%	0	0.0%	1,600	0.2%	6,700	0.4%
Geocoded Only	154,000	25.7%	214,000	99.1%	107,000	14.1%	475,000	30.2%
Unmatched/ Ungeocoded	91,000	15.2%	30	<0.1%	95,000	12.5%	186,000	11.8%
Total	600,000	38.1%	216,000	13.7%	757,000	48.1%	1,573,000	100.0%

Source: U.S. Census Bureau, 2020 Census, FOCS

Notes:

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6. NRFU Supplemental

a. What was the final status of NRFU supplemental cases, by source?

There was a total of 1.1 million cases in the NRFU supplemental workload.⁵³ These cases constituted 1.8 percent of the 2020 NRFU universe. The supplemental workload consisted of new addresses that were added to the enumeration universe after its initial creation. In the 2020 Census, addresses in this workload came from five sources:

- United States Postal Service (USPS) Delivery Sequence File (DSF)
- Upheld appeals from the Local Update of Census Addresses (LUCA) program
- New Construction program
- Housing Unit Count Review program
- Ungeocoded Resolution process

Each address in the supplemental workload was mailed a paper questionnaire package on April 19, 2020.⁵⁴ Addresses that did not self-respond by late June were added to the NRFU field workload.

Overall, more than three-quarters (77.8 percent) of supplemental cases were resolved in the field. More cases were resolved as delete (34.5 percent) than occupied (23.2 percent) or vacant (19.3 percent). Compared to the resolved status of the entire NRFU universe, the delete resolutions for supplemental cases were notably higher and the occupied resolutions were lower (16.4 percent and 37.1 percent for all NRFU resolutions, respectively). The percentage of vacant resolutions was similar between the supplemental workload and the overall NRFU universe. Less than 1 percent (0.8 percent) of supplemental cases were resolved with a population count or unit status only.

Of the NRFU supplemental cases not resolved in the field, 15.6 percent were resolved through self-response after NRFU started, 5.8 percent were resolved by AR, and 0.7 percent received a special closeout. This left 0.1 percent of supplemental cases unresolved at the end of data collection, lower than the overall NRFU unresolved rate of 0.6 percent.

⁵³ This number excluded supplemental cases resolved in Puerto Rico. In-field, in-office, and in-mover adds were not part of this workload.

⁵⁴ NRFU supplemental addresses received a questionnaire package similar to the Internet Choice Mailing #1. The supplemental questionnaire mailing went to addresses in self-response areas only. Supplemental addresses in UL areas did not receive a mailing but were part of the field follow-up workload.

Table 31. Resolved Status of NRFU Supplemental Cases

Resolved Status	Number	Percent
Total Cases	1,076,000	100.0%
Field Resolved	837,000	77.8%
Occupied	250,000	23.2%
Household Interview	162,000	15.1%
Proxy Interview	87,500	8.1%
Vacant	208,000	19.3%
Proxy Interview	201,000	18.7%
Enumerator Observation	6,900	0.6%
Delete	371,000	34.5%
Proxy Interview	211,000	19.6%
Enumerator Observation	160,000	14.9%
Population Count/Unit Status Only	8,200	0.8%
Non-Field Resolved	239,000	22.2%
Self-Response during NRFU	168,000	15.6%
AR Resolved	62,000	5.8%
AR Occupied	48,500	4.5%
AR Vacant	6,400	0.6%
AR Delete	7,400	0.7%
Special Closeouts	8,000	0.7%
Unresolved	550	0.1%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) Includes supplemental resolutions in TEAs 1 and 6 (except Puerto Rico).

- b. What was the distribution of household size for occupied housing units that were enumerated as part of the NRFU supplemental workload?

For the 2020 Census, the supplemental workload for NRFU consisted of new addresses added to the enumeration universe from the USPS DSF refresh, the Ungeocoded Resolution Operation, the New Construction program, upheld appeals from the LUCA program, and the Housing Unit Count Review program. The NRFU operation gathered data from these responses and analyzed the household sizes stated by respondents. There was a total of 251,723 responses captured as part of the NRFU supplemental workload. This total included households where only a population count was provided, and no additional demographic data were collected.

The table below breaks down the supplemental workload response data from households with data-defined persons in the United States. Households with one person accounted for the largest percentage of responses at 32.6 percent of the total occupied households. Household sizes of two through four persons combined for 56.9 percent of the responses, while household sizes ranging from 5 to 10 persons and 11 or more accounted for 10.3 percent and 0.2 percent, respectively.

Table 32. Household Size for Occupied NRFU Supplemental Housing Units

Persons per Household	Number	Percent
1	82,120	32.6%
2-4	143,191	56.9%
5-10	25,902	10.3%
11+	487	0.2%
Total	251,723	100.0%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

- (-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.
- (-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.
- (-) The total number of occupied NRFU supplemental housing units in the DRF-1 includes cases with only a population count.

7. What was the final status of NRFU UL cases?

There was a total of 2.5 million cases in the 2020 NRFU UL workload for the 50 states and the District of Columbia. This amounted to 4.3 percent of the total NRFU workload of 59.8 million cases. Within the NRFU UL workload, 77.5 percent were resolved in the field and 22.0 percent were resolved by either self-response during NRFU, based on their AR data, or through a special closeout. Approximately 0.5 percent were resolved with only a population count or housing unit status. The remaining 0.5 percent of cases were unresolved at the end of data collection. These results were similar to the total NRFU workload.

Overall, 33.0 percent of NRFU UL cases were resolved as occupied during fieldwork, 33.0 percent as vacant, and 11.0 percent as deletes. This workload had a higher self-response rate during NRFU than the NRFU production workload overall (18.1 percent and 10.2 percent, respectively).

There was a total of 1.3 million cases in the 2020 NRFU UL workload for Puerto Rico. Within this workload, 86.1 percent were resolved in the field and 13.9 percent were resolved either by self-response during NRFU, based on their AR data, or through a special closeout. Approximately 0.9

percent of these cases were resolved with only a population count or housing unit status. The remaining 0.1 percent were unresolved at the end of data collection.

Overall, 58.6 percent of NRFU UL cases in Puerto Rico were enumerated as occupied, 20.8 percent as vacant, and 5.8 percent as delete.

Table 33. Final Status of NRFU UL Cases

Resolved Status	United States		Puerto Rico	
	Number	Percent	Number	Percent
Total Cases	2,542,000	100.0%	1,348,000	100.0%
Field Resolved	1,971,000	77.5%	1,160,000	86.1%
Occupied	840,000	33.0%	790,000	58.6%
Household Interview	626,000	24.6%	629,000	46.7%
Proxy Interview	213,000	8.4%	161,000	11.9%
Vacant	840,000	33.0%	280,000	20.8%
Proxy Interview	807,000	31.7%	269,000	20.0%
Enumerator Observation	32,500	1.3%	10,500	0.8%
Delete	279,000	11.0%	78,000	5.8%
Proxy Interview	182,000	7.2%	54,500	4.0%
Enumerator Observation	97,500	3.8%	23,500	1.7%
Population Count/Unit Status Only	11,500	0.5%	12,000	0.9%
Non-Field Resolved	558,000	22.0%	187,000	13.9%
Self-Response during NRFU	460,000	18.1%	187,000	13.9%
AR Resolved	92,500	3.6%	0	0.0%
AR Occupied	90,000	3.5%	0	0.0%
AR Vacant	2,200	0.1%	0	0.0%
AR Delete	250	<0.1%	0	0.0%
Special Closeouts	5,800	0.2%	150	<0.1%
Unresolved	13,500	0.5%	1000	0.1%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) In-field adds are not included in this table.

(-) AR modeling was not run for cases in Puerto Rico.

8. What was the final outcome for Field Verification cases?

The 2020 NRFU operation included a workload of FV cases that had self-responded without a Census ID and could not be matched to the MAF. FV cases required one field visit to verify whether the address existed. If an enumerator was able to verify the location of the address,

GPS coordinates were captured by the enumeration application. A sample of FV cases was selected for the FV QC workload to detect falsification.

There were fewer than 200,000 FV cases in 2020, representing just 0.3 percent of the NRFU workload. Most FV cases were resolved in the field (89.6 percent) with the map spot verified (59.6 percent). About one quarter (24.9 percent) of FV cases were resolved in the field but the map spot was unverified. By the end of NRFU, 0.2 percent of FV cases had not been resolved.

Table 34. Field Verification Workload Outcomes

Resolved Status	Number	Percent
Total Cases	193,000	100.0%
Field Resolved	173,000	89.6%
Map Spot Verified	115,000	59.6%
Map Spot Unverified	48,000	24.9%
Map Spot Other	9,700	5.0%
Special Closeouts	20,000	10.4%
Unresolved	450	0.2%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

- (-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.
- (-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.
- (-) Includes stateside FV cases.
- (-) FV cases could not be reset like other case types. Instead, the system could close a FV case through a "special closeout" if necessary.

9. NRFU Reinterview⁵⁵

- a. Describe the size of the initial NRFU RI universe and the results of the soft launch.

SMArCS received 1.4 million NRFU cases during the NRFU RI soft launch and nearly 69.0 percent were eligible for RI.⁵⁶ Of the 939,000 cases that were eligible for RI during the soft launch, 7.9 percent were selected to be part of the NRFU RI field workload. These cases accounted for 5.5 percent of all cases received by SMArCS during this period. Most cases that completed computer matching during the soft launch passed (63.8 percent), 33.2 percent were referred to clerical matching, and 3.0 percent were Reinterview Noninterviews (RINIs). A RINI occurred when the RI for a case closed without resolution (e.g., because of a language barrier

⁵⁵ For additional results from the NRFU QC program, see the 2020 Census NRFU Quality Assurance Results.

⁵⁶ Eligibility for NRFU RI was defined by the workload type, the case-level event code received after a contact attempt, and the AR match status.

or restricted access on the last attempt-day), or the RI was completed with insufficient data to allow computer matching.

Most cases that completed clerical matching during the soft launch also passed (78.0 percent). About 23.7 percent of the clerical cases had a fail outcome. A very small number of cases had a hard fail outcome, indicating falsification.

Table 35. NRFU RI Soft Launch Results

Soft Launch Result	Number	Percent
Cases Received by SMarCS	1,364,000	100.0%
RI Eligible	939,000	68.8%
Selected for RI	74,500	7.9%
Completed Computer Matching	23,500	31.5%
Pass	15,000	63.8%
RINI	700	3.0%
Refer to Clerical	7,800	33.2%
Completed Clerical	5,900	75.6%
Pass	4,600	78.0%
Fail	1,400	23.7%
Hard Fail	N < 15	-

Source: U.S. Census Bureau, 2020 Census, SMarCS

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) Data are for U.S. cases processed by SMarCS during the NRFU soft launch, from July 16, 2020, to August 8, 2020.

(-) Cases selected for RI during the soft launch that did not complete fieldwork or computer matching flowed into the production NRFU RI workload.

b. What percentage of addresses were selected for the NRFU RI workload, by sampling method?

The SMarCS system received 36.1 million NRFU cases during the soft launch and production, and 72.8 percent of those cases were eligible for RI.⁵⁷ In total, 8.3 percent of the RI eligible cases were selected for fieldwork. These cases represented 6.0 percent of all the NRFU cases received by SMarCS. By comparison, the QC program was designed to select approximately 5.0 percent of all cases for fieldwork. Of the RI eligible cases, 4.5 percent were selected by analytic

⁵⁷ NRFU cases with the following event codes were not ingested by SMarCS: (a) 6.040 (maximum collection attempts), (b) 6.041 [maximum attempts: partial information (population count)], and (c) 6.010 (case closed). This was the result of a change between the 2018 test and 2020 NRFU, and resource limitations that prevented the system updates needed.

sampling, 2.2 percent by random sampling, 1.5 percent by rework sampling, and less than 0.1 percent by supplemental sampling.⁵⁸

Table 36. Cases Selected for NRFU RI, by Sampling Method

	Number	Percent
Cases Received by SMarCS	36,100,000	100.0%
RI Eligible	26,270,000	72.8%
Selected for RI	2,181,000	8.3%
Analytic	1,185,000	4.5%
Random	584,000	2.2%
Rework	401,000	1.5%
Supplemental	12,000	<0.1%

Source: U.S. Census Bureau, 2020 Census, SMarCS

Notes:

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(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) Data are for stateside cases received and selected between July and October 2020.

(-) The number of NRFU cases selected for RI includes about 303,000 cases selected on or after October 15, 2020, the last day of NRFU production. These cases could not be worked in the field. They were selected to further inform the QC program.

c. What percentage of resolved NRFU cases had an AR match as part of NRFU QC?

Overall, 11.7 percent of the NRFU cases received by SMarCS had their interview data verified by AR, making a field reinterview unnecessary.

d. What was the outcome of NRFU RI?

Of the 2.2 million cases selected for RI fieldwork, 66.5 percent were resolved.

⁵⁸ For an explanation of the different sampling methods used to select RI cases, see the 2020 NRFU Quality Assurance Plan and Sampling Specification.

Table 37. NRFU RI Results

	Number	Percent
Cases Received by SMarCS	36,100,000	100.0%
Confirmed by AR	4,235,000	11.7%
RI Eligible	26,270,000	72.8%
Selected for RI	2,181,000	8.3%
Field Resolved	1,450,000	66.5%
Unresolved	732,000	33.6%

Source: U.S. Census Bureau, 2020 Census, SMarCS

Notes:

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(-) Data are for stateside cases received and selected by SMarCS between July and October 2020.

All field resolved NRFU RI cases underwent computer matching. More than half (56.1 percent) of cases could not be resolved during computer matching and were referred to clerical matching. Another 34.2 percent of cases received a pass outcome from computer matching and 9.6 percent of cases resulted in a RINI. Most cases passed clerical matching during NRFU (83.8 percent). Only 100 cases (less than 0.1 percent) were hard fails, indicating the enumerator had falsified data during the NRFU interview.

Table 38. NRFU RI Computer and Clerical Matching Results

	Number	Percent
Completed Computer Matching	1,441,000	100.0%
Pass	493,000	34.2%
RINI	139,000	9.6%
Refer to Clerical	809,000	56.1%
Completed Clerical	809,000	100.0%
Pass	678,000	83.8%
Fail	131,000	16.2%
Hard Fail	100	<0.1%

Source: U.S. Census Bureau, 2020 Census, SMarCS

Notes:

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(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) Data are for stateside cases processed by SMarCS between July and October 2020.

(-) There were 30 cases referred to clerical matching that were never worked because of a system glitch.

(-) There were 20 cases with a pass or RINI outcome from computer matching erroneously sent to clerical matching.

There were 1,300 enumerators who failed the QC program and were released during NRFU. They represented 0.6 percent of all enumerators who had at least one production case selected for RI that was completed in the field. Most enumerators who failed QC received a performance fail, typically for not following field procedures on multiple cases, even after coaching from a supervisor (less than 100.0 percent). A much smaller percentage of the enumerators who failed QC had a non-RI fail because of falsification discovered outside of the RI process (4.6 percent). Finally, 30 enumerators were responsible for the 100 hard fail cases where falsification was confirmed as part of the QC program.

Table 39. NRFU Enumerators Who Failed QC, by Type of Fail

	Number	Percent
NRFU Enumerators	291,000	100.0%
One or More Cases Selected for RI	264,000	90.7%
One or More Cases Completed RI	222,000	84.1%
Enumerators Who Failed QC	1,300	0.6%
Performance Fail	1,300	<100.0%
Non-RI Fail	60	4.6%
Hard Fail	30	2.3%

Source: U.S. Census Bureau, 2020 Census, SMarCS

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) Data are for stateside enumerators who completed at least one NRFU production case between July and October 2020.

There were 1.1 million NRFU cases in Puerto Rico received by SMarCS and 86.1 percent were eligible for RI. About 6.0 percent of the RI eligible cases were selected for fieldwork. These cases represented 5.1 percent of all the NRFU cases received by SMarCS. Of the cases selected for RI fieldwork, 72.4 percent were resolved.

Table 40. NRFU RI Results for Puerto Rico

	Number	Percent
Cases Received by SMarCS	1,127,000	100.0%
RI Eligible	970,000	86.1%
Selected for RI	58,000	6.0%
Field Resolved	42,000	72.4%
Unresolved	16,000	27.6%

Source: U.S. Census Bureau, 2020 Census, SMarCS

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) Data are for Puerto Rico cases received and selected between July and October 2020.

Half (50.0 percent) of RI cases in Puerto Rico could not be resolved during computer matching and were referred to clerical matching. Another 42.9 percent of cases received a pass outcome from computer matching and 7.9 percent of cases resulted in a RINI. Most cases passed clerical matching during NRFU (85.7 percent). Only a few cases were a hard fail.

Table 41. NRFU RI Computer and Clerical Matching Results for Puerto Rico

	Number	Percent
Completed Computer Matching	42,000	100.0%
Pass	18,000	42.9%
RINI	3,300	7.9%
Refer to Clerical	21,000	50.0%
Completed Clerical	21,000	100.0%
Pass	18,000	85.7%
Fail	2,800	13.3%
Hard Fail	N < 15	-

Source: U.S. Census Bureau, 2020 Census, SMarCS

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) Data are for cases processed between July and October 2020.

There were 40 enumerators in Puerto Rico who failed the QC program during NRFU. They represented 0.6 percent of all enumerators who had at least one production case selected for RI that was completed in the field. Most enumerators who failed QC received a performance fail.

Table 42. NRFU Enumerators in Puerto Rico Who Failed QC, by Type of Fail

	Number	Percent
NRFU Enumerators	7,000	100.0%
One or More Cases Selected for RI	6,600	94.3%
One or More Cases Completed RI	6,200	93.9%
Enumerators Who Failed QC	40	0.6%
Performance Fail	40	<100.0%
Non-RI Fail	N < 15	-
Hard Fail	N < 15	-

Source: U.S. Census Bureau, 2020 Census, SMarCS

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) Data are for cases processed between July and October 2020.

e. How many of the original NRFU cases were marked for replacement with RI data?

A total of 131,000 NRFU cases, or 0.4 percent of the total NRFU cases received by SMarCS, had the original interview data marked for replacement by RI interview data. Most cases with the original interview data marked for replacement by the RI were cases that failed clerical matching (near 100.0 percent).

Table 43. NRFU Fail Cases Marked for Replacement

	Number	Percent
Cases Received by SMarCS	36,100,000	100.0%
RI Replacement Cases	131,000	0.4%
Fail	131,000	<100.0%
Hard Fail	100	0.1%

Source: U.S. Census Bureau, 2020 Census, NRFU RI Fail File

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) Data are for stateside cases as of October 29, 2020.

f. In what languages were NRFU RI interviews conducted?

The majority of 2020 NRFU RI interviews were conducted in English (90.5 percent). Nearly 8.0 percent of interviews selected Spanish as the language spoken. Of the Spanish selections, 27.1

percent took place in Puerto Rico. About 1.2 percent of all NRFU RI interviews were conducted in two or more different languages.

Table 44. Top Five Languages Selected During NRFU RI Interviews

Language	Number	Percent
Total Responses	55,196	100.0%
English	49,947	90.5%
Spanish	4,349	7.9%
Mandarin	67	0.1%
Vietnamese	30	0.1%
Cantonese	24	<0.1%
All other languages	115	0.2%
More than one language	664	1.2%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

(-) Percentages may not sum to 100.0% because of rounding.

(-) Results are for the U.S. and Puerto Rico.

(-) Data reflect the number of times each language was selected during NRFU RI. They do not correspond to unique cases.

- g. What was the distribution of people enumerated during NRFU RI by age, sex, race, ethnicity, relationship, and household tenure?

There were 59,636 data-defined people included on NRFU RI interviews for 20,110 occupied housing units during 2020 NRFU.⁵⁹ This section presents the demographic characteristics for people who reported that they had not previously completed a NRFU interview with an enumerator, and so completed the full questionnaire with the NRFU RI enumerator. People who confirmed they had completed a NRFU questionnaire were asked to provide the population count and household roster only; they were not asked to provide characteristics for the household.

Refer to question 5.1.1.m. for information about how the demographic data were tabulated and the limitations on comparability to published 2020 Census data products.

Overall, the demographics of people enumerated during NRFU RI were like those of people enumerated during NRFU. However, the percentage of missing values for each characteristic was higher during NRFU RI interviews. See Appendix D for the NRFU RI standard demographic tables.

⁵⁹ The universe for the NRFU RI demographic tables was occupied housing units that had person responses. Cases with a population count only were excluded since they had no person-level data.

10. Field Verification Quality Control (FV QC)

a. What percentage of addresses were selected for the FV QC workload?

The majority of FV cases were eligible to be selected for QC and 5.0 percent were ultimately selected. Similar to NRFU RI cases, FV QC cases required a different enumerator from the enumerator who completed the FV case to verify the address location.

Table 45. FV and FV QC Workloads

	Number	Percent
Total Resolved FV Cases	173,000	100.0%
Eligible for FV QC	172,000	99.4%
Selected for FV QC	8,600	5.0%

Source: U.S. Census Bureau, 2020 Census, SMaRCS

Notes:

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(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

(-) Data are for stateside FV and FV QC cases.

b. What was the outcome of FV QC?

The original FV and FV QC data were compared through computer matching and an outcome code was assigned based on the FV enumerator's work and paradata collected in the enumeration application. The possible FV computer matching outcome codes were pass, fail, and QC incomplete. A pass was assigned if the FV and FV QC cases had the exact same response, indicating that the FV enumerator did not falsify data. Computer matching assigned a fail outcome if the FV and FV QC case were not a match, meaning that the original data could not be verified. Finally, a QC incomplete outcome meant that the FV QC data could not be collected.

The majority of FV QC cases had a pass outcome during computer matching (82.6 percent). For 14.0 percent of FV QC cases, the QC enumerator found a different result from the FV enumerator. This resulted in a fail. A small percentage of FV QC cases were not completed in the field during NRFU (2.9 percent).

Table 46. FV QC Case Outcomes

	Number	Percent
Total FV Cases	173,000	100.0%
Eligible for FV QC	172,000	99.4%
Selected for FV QC	8,600	5.0%
Pass	7,100	82.6%
Fail	1,200	14.0%
QC Incomplete	250	2.9%

Source: U.S. Census Bureau, 2020 Census, SMaRCS

Notes:

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(-) Data are for stateside FV and FV QC cases.

5.2 NRFU Attempt Outcomes

11. What was the final case status for cases that had one or more of the following NRFU attempt outcomes on any attempt-day: refusals, restricted access, dangerous situations, language/hearing barriers, group quarters, or envelope provided to respondent?

A relatively small proportion of the NRFU workload encountered one or more barriers to enumeration that led to nonresponse for a particular attempt-day. When this happened, cases typically continued to receive up to six attempt-days, though the contact strategy adapted in response to the situation. For example, a case that received two refusals with the same enumerator was assigned to a different enumerator for future attempts.

A total of 8.7 million NRFU cases, or 14.5 percent of the workload, experienced one or more of these nonresponse outcomes. The most common type of nonresponse outcome was restricted access. Restricted access occurred when an enumerator was unable to reach the door of an address, perhaps because of a gate or need for an access code. Respondent refusals and language barriers were the second and third most common nonresponse outcomes. Almost all cases with a nonresponse attempt were ultimately resolved. Cases with language barriers had the highest resolve rate (99.9 percent), indicating that reassigning the case to an enumerator who spoke the language was a successful strategy. Restricted access cases had the lowest resolve rate of the nonresponse types (99.4 percent). The COVID-19 pandemic and subsequent descoping of manager visits for multiunit cases likely made restricted access situations especially challenging in 2020.

Table 47. Cases with Nonresponse Attempt and Percent Resolved

Nonresponse Type	Number	Percent Resolved
Restricted Access	4,349,000	99.4%
Refusal	3,480,000	99.6%
Language Barrier	528,000	99.9%
Group Quarters	454,000	99.5%
Dangerous Situation	295,000	99.7%
Envelope Provided to Respondent	217,000	99.7%
Hearing Barrier	17,500	99.7%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Cases with the same nonresponse outcome on more than one attempt were only counted once. However, some cases received different nonresponse outcomes on different attempts and were counted in each nonresponse type where they appeared.

(-) The total 2020 NRFU workload was 59,770,000.

Table 48, below, shows the final case status for the top three nonresponse types during the 2020 NRFU operation. Refusals and language barriers often indicated that the unit was occupied, as did many other nonresponse types. However, it was possible for the housing unit status to change between Census Day and the date of the field attempt, particularly because NRFU took place four or more months later.

Restricted access, refusal, and language barrier cases were all likely to be resolved in the field through an interview or enumerator observation. Cases with restricted access were more likely to be resolved as vacant or delete than the other two types. Those that were occupied were more likely to be resolved with a proxy than a household member. Cases with a refusal or language barrier were more likely to be occupied by a household interview. Though these cases were often successfully resolved in the field, they did have higher rates of being resolved with only a population count (9.3 percent and 7.8 percent, respectively).

Restricted access cases had a high rate of resolution through AR (23.9 percent), which indicated that a sizeable portion were vacant (9.4 percent). The use of AR data during 2020 NRFU played a key role in successfully resolving many of these cases where access barriers prevented field enumeration.

Table 48. Final Status for Cases with Top 3 Nonresponse Outcomes

Resolved Status	Restricted Access		Refusal		Language Barrier	
	Number	Percent	Number	Percent	Number	Percent
Total Cases	4,349,000	100.0%	3,480,000	100.0%	528,000	100.0%
Field Resolved	3,101,000	71.3%	2,564,000	73.7%	434,000	82.2%
Occupied	1,699,000	39.1%	1,759,000	50.5%	353,000	66.9%
Household Interview	709,000	16.3%	882,000	25.3%	247,000	46.8%
Proxy Interview	990,000	22.8%	877,000	25.2%	106,000	20.1%
Vacant	785,000	18.1%	283,000	8.1%	26,500	5.0%
Proxy Interview	749,000	17.2%	266,000	7.6%	25,000	4.7%
Enumerator Observation	36,000	0.8%	17,000	0.5%	1,400	0.3%
Delete	454,000	10.4%	197,000	5.7%	14,000	2.7%
Proxy Interview	297,000	6.8%	129,000	3.7%	9,000	1.7%
Enumerator Observation	157,000	3.6%	67,500	1.9%	4,900	0.9%
Population Count/Unit Status Only	163,000	3.7%	325,000	9.3%	41,000	7.8%
Non-Field Resolved	1,220,000	28.1%	902,000	25.9%	93,500	17.7%
Self-Response during NRFU	165,000	3.8%	360,000	10.3%	45,000	8.5%
AR Resolved	1,039,000	23.9%	535,000	15.4%	47,000	8.9%
AR Occupied	494,000	11.4%	486,000	14.0%	43,500	8.2%
AR Vacant	408,000	9.4%	40,500	1.2%	2,800	0.5%
AR Delete	137,000	3.2%	8,700	0.3%	700	0.1%
Special Closeouts	16,500	0.4%	6,700	0.2%	1,300	0.2%
Unresolved	27,500	0.6%	14,000	0.4%	900	0.2%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

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(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

12. What was the final case status for refusals by refusal reason (including COVID reason)?

There were 3.5 million cases with at least one NRFU attempt that resulted in a refusal. These cases represented about 5.7 percent of the total NRFU workload. In total, 4.9 million refusal reasons were selected during NRFU fieldwork, where multiple refusal reasons could be selected on a single attempt. The table below outlines how often each of the 16 refusal reasons were selected during NRFU.

The bulk of refusals (62.6 percent) fell into three categories:

1. Not interested / Does not want to be bothered – 25.0 percent.
2. Reported completing questionnaire using the internet or telephone – 22.6 percent.
3. Respondent too busy / Doesn't have time – 15.0 percent.

Just before the start of data collection, a new refusal reason was added to the questionnaire to capture refusals related to COVID-19. Respondents provided this as their refusal reason 103,000 times, which represented 2.1 percent of all refusals. This table does not include situations where a respondent was hostile in their refusal. In many of those instances, the case was marked as a dangerous address.

Table 49. NRFU Refusal Reason Frequencies⁶⁰

Refusal Reason	Number	Percent
Not interested / Does not want to be bothered	1,214,000	25.0%
Reported completing questionnaire using the internet or telephone	1,100,000	22.6%
Respondent too busy / Doesn't have time	728,000	15.0%
Other	503,000	10.3%
Mailed in completed questionnaire	449,000	9.2%
Hang-up / Slammed door	270,000	5.6%
Privacy concerns	185,000	3.8%
Refusal because of COVID-19	103,000	2.1%
Anti-government concerns	68,500	1.4%
Done enough other surveys	55,500	1.1%
Claims does not have to do questionnaire / Survey is voluntary	50,000	1.0%
Questions legitimacy of questionnaire	43,500	0.9%
Breaks appointment (puts off enumerator indefinitely)	35,500	0.7%
Survey is a waste of taxpayer money	28,000	0.6%
Does not understand the questionnaire / Asks questions about the questionnaire	18,000	0.4%
Scheduling difficulties	13,500	0.3%
Total	4,862,000	100.0%

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

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(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

Question 11 in Section 5.2 showed that most cases that had a refusal went on to be resolved by NRFU fieldwork (73.7 percent). About 10 percent of cases with a NRFU refusal self-responded. The NRFU interview flow requested that the respondent provide at least a population count after they refused to participate in the interview. About 9 percent of NRFU refusals were resolved by collecting just a population count, higher than the typical NRFU case. A sizeable portion of cases with a refusal were resolved with AR data (15.4 percent). Very few refusal cases remained unresolved at the end of NRFU data collection (0.4 percent).

⁶⁰ On any given enumeration attempt, multiple refusal reasons could be selected in the instrument.

5.3 Supervisory Alerts

13. At the end of the operation, how many unresolved alerts were there by type of alert?

The 2020 NRFU operational design included 25 real-time supervisory alerts to assist CFSs and CFMs with monitoring the performance of enumerators.⁶¹ There were two types of alerts: (1) administrative alerts that covered staffing and timesheets and (2) performance alerts that indicated that retraining was necessary or if an enumerator should be terminated because of falsification. The primary purpose of the alerts was to foster communication between field staff during NRFU production. All but one alert did not automatically expire and required the CFS or CFM to manually resolve the alert in the FOCS.⁶² Resolving the alerts was lower priority than taking corrective action on the issue that triggered the alert. In the fast-paced environment of NRFU fieldwork and the unique challenges presented in 2020, CFMs did not always resolve alerts in FOCS before moving on to other work. See Appendix C: Field Operational Control System Alerts for descriptions of the supervisory alerts used in 2020 NRFU.

Between the start of the soft launch and the end of NRFU fieldwork, 20.2 million alerts were triggered. Of these, 28,262 alerts were not resolved by a CFS or CFM (0.1 percent of all alerts triggered).

Only one alert out of 25 had an unresolved rate greater than 1 percent during NRFU. The “Payroll Not Approved” alert had the highest unresolved rate at 5.3 percent. This CFM alert triggered when two or more days passed after an enumerator submitted their timesheet and the CFS had not acted upon it. It made up about half of all unresolved alerts. The likely reason for so many unresolved alerts is that after ensuring the enumerators’ payroll was approved, many CFMs simply forgot to resolve the alert in FOCS. To support this explanation, there were never any issues with enumerators not getting paid during 2020 NRFU.

As shown in the following table, all enumerator performance-based alerts had unresolved rates of 0.8 percent or lower. Seven of the 12 performance alerts had unresolved rates of less than 0.1 percent.

Throughout NRFU, a total of 5.7 million “Long Distance” alerts triggered, representing 28.2 percent of all alerts triggered. The purpose of this alert was to notify the CFS when an enumerator attempted a case more than 5,000 feet from the assigned location. Preliminary analysis suggests that this alert triggered as intended. It was not triggered on cases when the GPS coordinates could not be obtained because of connectivity, for FV cases, or cases with phone attempts. However, many alerts were triggered when enumerators opened a case to review the details without attempting an interview.

⁶¹ Originally, 26 supervisory alerts were planned for NRFU. The “Not Working” alert was turned off on June 15, 2020, after the soft launch was added to the operational design. This was done to avoid having the alert triggered in ACOs that had not started working NRFU cases yet. The alert triggered erroneously on October 1, 2020. Those results were excluded in this analysis.

⁶² The “Look Ahead Availability” alert expired automatically.

Table 50. NRFU Unresolved Alerts

Alert Name	Number of Alerts Triggered	Number Unresolved	Percent Unresolved
CFM Alerts			
CFS Removed	1,174	0	0.0%
Closeout CFS Area	23,090	172	0.7%
Payroll Not Approved	266,282	14,066	5.3%
Phase 2 CFS Area	23,998	108	0.5%
Stale	988,952	4,460	0.5%
CFS Alerts			
Administrative Alerts			
Look Ahead Availability	17,608	0	0.0%
No Timesheet	430,584	326	0.1%
Overtime Claimed	921,088	884	0.1%
Potential Overcharge Hours	323,106	146	<0.1%
Potential Overcharge Miles	356,008	142	<0.1%
Unable to Assign Work	216	0	0.0%
Work Not Started	2,023,298	208	<0.1%
Working Before Assigned Hours	1,699,504	314	<0.1%
Performance Alerts			
Hard Fail Employee	1,726	14	0.8%
High Attempts/Hour	5,876	0	0.0%
High Completed Case Rate	100,354	8	<0.1%
High POP1 Rate	27,784	0	0.0%
High Refusal Rate	60,872	2	<0.1%
Long Distance	5,709,650	2,186	<0.1%
Low Attempts/Hour	10	0	0.0%
Low Completed Case Rate	82,500	4	<0.1%
No Proxy Attempts	2,566,132	278	<0.1%
Short Interview	700,654	3,780	0.5%
Unconfirmed Delete	2,251,426	694	<0.1%
Unconfirmed Vacancy	1,653,574	470	<0.1%
Total	20,235,466	28,262	0.1%

Source: U.S. Census Bureau, 2020 Census, FOCS

Notes:

(-) Percentages may not sum to 100.0% because of rounding.

(-) Table includes supervisory alerts triggered stateside and in Puerto Rico between July 16, 2020, and October 15, 2020.

5.4 Cost, Staffing, and Production Rates

14. How did the budgeted cost for NRFU compare to the actual cost of the operation?

The 2020 NRFU operation came in \$200.0 million under budget. The \$1.6 billion budget included higher pay rates for enumerators and CFSs, but not the cost of devices or monetary incentives for field staff that were part of the late design changes. The \$1.4 billion actual cost of NRFU included training and production costs for enumerators and CFSs, as well as field incentive pay.⁶³ Several factors contributed to the 2020 NRFU operation coming in under budget. One factor was that production schedule shifts related to the pandemic and litigation ultimately led to a shorter duration of the operation.⁶⁴ Staffing challenges throughout NRFU were another contributing factor to the lower-than-expected cost of the operation. Finally, the enumerator productivity rate was higher than anticipated and this added efficiency likely decreased the cost.

Table 51. NRFU Budgeted and Actual Costs

Budget	Actual	Variance
\$1,635,134,461	\$1,435,121,505	(\$200,012,956)

Source: U.S. Census Bureau, 2020 Census, DBO

15. What was the cost per enumerator, per case, and per attempt-day?

The average cost per enumerator was \$2,400.00, including direct training and production expenses for all stateside enumerators (e.g., wages, mileage). This did not include the cost of travel for enumerators who were moved to other ACOs to work cases. It also did not include the cost of field incentive pay or the employer portion of payroll taxes.

Table 52. Cost per NRFU Enumerator

	Cost	Number of Enumerators	Average Cost per Enumerator
Overall	\$931,214,264.28	386,000	\$2,400.00
Training	\$162,220,939.75	376,000	\$450.00
Production	\$768,993,324.53	309,000	\$2,500.00

Source: U.S. Census Bureau, 2020 Census, DAPPS

Notes:

(-) Excludes travel costs and field incentives that were part of late design changes.

(-) Some enumerators charged exclusively to the training or production code in DAPPS for the duration of NRFU. This made the overall number of enumerators larger than the number of enumerators who charged to training.

⁶³ Actual costs included charges from field staff in the United States and Puerto Rico.

⁶⁴ The 2020 NRFU operation was originally scheduled to run from April 9, 2020, until July 31, 2020 (114 days). The actual production dates were July 16, 2020, until October 15, 2020 (92 days).

The average cost per NRFU case was \$13.30.⁶⁵ Looking at the cost of the operation per attempt-day, the average cost increased with each additional attempt-day needed to resolve a case. The first attempt-day had the lowest average cost, at \$4.71. This amount nearly doubled to \$9.24 per attempt-day for cases that were reopened during the closeout phase to receive seven or more attempt-days.

Table 53. Cost per NRFU Attempt-Day

Attempt-Day	Average Cost
1	\$4.71
2	\$5.02
3	\$5.88
4	\$6.40
5	\$6.93
6	\$7.41
7+	\$9.24

Source: U.S. Census Bureau, 2020 Census, DAPPS

16. How many miles did enumerators charge: on average, overall, and by week of the operation?

As part of conducting the NRFU field operations, enumerators were instructed to track and log the number of miles driven in their personal vehicle for training and to complete their assignments in the field enumeration application. These miles were charged to the NRFU operation for reimbursement. The number of miles that was submitted by each enumerator was approved by the corresponding field supervisor when they reviewed the time and expense charges.

The table below summarizes the number of miles accumulated by all enumerators throughout the NRFU operation, starting with the first day of training in early July and ending in mid-October when production finished. NRFU enumerators charged a sum of 195.4 million miles during the 2020 Census. The average mileage charge per enumerator was 506.8 miles. Mileage charges varied widely based on the geographic location of field staff.

Table 54. Miles Charged by NRFU Enumerators

Number of Enumerators	Total Miles	Mean Miles
386,000	195,377,859	506.2

Source: U.S. Census Bureau, 2020 Census, DAPPS

Note: Includes training and production charges by stateside enumerators.

⁶⁵ Based on 57,800,000 NRFU stateside cases in DAPPS with at least one attempt-day. This included self-response cases during NRFU if there was a prior NRFU attempt and FV, FV QC, and NRFU RI cases. SRQA cases were excluded.

Table 55 further breaks down the total number of miles by week of the operation. The week of training before NRFU started through week six showed a steady increase in miles. Many CFS areas were in phase 1 during these early weeks, when assignments were optimized according to their location and availability of enumerators. Peak mileage charges were recorded in September, during weeks 7 through 11. As areas moved into phase 2 of the contact strategy, the open cases were more spread out and, thus, increased travel between cases. The mileage numbers for the final three weeks of production reflected a slowdown in mileage charges as many areas completed their NRFU workload.

Table 55. Miles Charged by NRFU Enumerators, by Week

Week	Date Range	Miles
0	July 7 – 15	269,079
1	July 16 – 22	784,189
2	July 23 – 29	1,505,985
3	July 30 – Aug. 5	5,093,275
4	Aug. 6 – 12	8,769,997
5	Aug. 13 – 19	13,930,261
6	Aug. 20 – 26	17,501,741
7	Aug. 27 – Sept 2	21,094,612
8	Sept. 3 – 9	23,215,526
9	Sept. 10 – 16	25,421,094
10	Sept. 17 – 23	25,665,269
11	Sept. 24 – 30	25,025,931
12	Oct. 1 – 7	18,610,557
13	Oct. 8 – 14	7,621,484
14	Oct. 15	868,859
Total		195,377,859

Source: U.S. Census Bureau, 2020 Census, DAPPS

Note: Includes training and production mileage charges by stateside enumerators.

17. How many hours did enumerators charge: on average, overall, and by week of the operation?

NRFU enumerators recorded their training and production hours in the handheld device at the end of each day for their field supervisor to approve. Stateside enumerators logged a total of 37.5 million training and production hours. On average, NRFU enumerators spent 97.3 hours in training and working cases during production.

Table 56. Hours Charged by NRFU Enumerators

Number of Enumerators	Total Hours	Mean Hours
386,000	37,545,393	97.3

Source: U.S. Census Bureau, 2020 Census, DAPPS

Note: Includes training and production charges by stateside enumerators.

The table below shows the distribution of training and production hours charged by enumerators throughout the operation. Hours were lower during training and the soft launch through week two. During this time, not all ACOs were working NRFU cases yet. Hours began to increase in week three, when more ACOs were active. Most hours were logged during weeks four through ten. In week 11, the number of hours dropped below 3.0 million for the first time in seven weeks. This downward trend continued as more CFS areas began operational closeout activities.

Table 57. Production Hours Charged by NRFU Enumerators, by Week

Week	Date Range	Hours
0	July 7 – 15	132,965
1	July 16 – 22	278,388
2	July 23 – 29	861,618
3	July 30 – Aug. 5	2,683,987
4	Aug. 6 – 12	3,885,984
5	Aug. 13 – 19	4,577,090
6	Aug. 20 – 26	4,713,101
7	Aug. 27 – Sept. 2	4,495,532
8	Sept. 3 – 9	3,943,468
9	Sept. 10 – 16	3,930,563
10	Sept. 17 – 23	3,269,665
11	Sept. 24 – 30	2,604,912
12	Oct. 1 – 7	1,537,424
13	Oct. 8 – 14	563,980
14	Oct. 15	66,718
Total		37,545,393

Source: U.S. Census Bureau, 2020 Census, DAPPS

18. Present key field staffing metrics from the 2020 NRFU operation.

The 2020 NRFU staffing goals were based on the original operational design and expectations about enumerator productivity from the 2010 Census. The 2020 Census environment presented a unique challenge for hiring and retaining field staff to conduct NRFU. The COVID-19 pandemic delayed NRFU fieldwork and changed several aspects of the operational design. Because of the challenges presented by conducting fieldwork during the pandemic, the staffing plan adapted by offering continuous hiring and training of NRFU field staff throughout the duration of the operation.

The hiring goal for NRFU was 413,007 enumerators and 17,607 CFSs. The goal to deploy represented the number of staff needed to start fieldwork. The core staff were the number of enumerators and CFSs expected to be retained by the third week of production. Each successive metric assumed some level of staff attrition from the prior metric.

Table 58. NRFU Field Staffing Goals, by Position

Position	Hiring Goal	Deployment Goal	Core Staff Goal
Enumerators	413,007	386,198	300,460
CFSs	17,607	17,590	15,023

Source: U.S. Census Bureau, 2020 Census, FLD

Table 59 shows the actual number of enumerators and CFSs who received training pay, completed the assessment at the end of training, and entered work availability in the enumeration application. It also shows the number of enumerators who received a case assignment from FOCS and those who worked one or more cases in the field between July 16, 2020, and October 15, 2020. A total of 384,000 enumerators received pay for time spent in NRFU training. By the time NRFU was active in the field, fewer than 300,000 enumerators worked cases.

Table 59. Actual NRFU Field Staff Levels, by Position

Position	Received Training Pay	Completed Assessment	With Work Availability	Assigned Cases	Worked at Least One Case
Enumerators	384,000	332,000	327,000	309,000	298,000
CFSs	24,500	20,500	N/A	N/A	N/A

Source: U.S. Census Bureau, 2020 Census, FLD, DAPPS and EDL

Note: The number of staff who received training pay is staff who received at least one hour's worth of training pay in DAPPS.

Table 60 presents the number of enumerators who were available to work cases each week of NRFU. Late July through late August saw increases in the number of working enumerators, when more ACOs started NRFU during the soft launch. Beginning at the end of August, the number of working enumerators began to decline each week. This trend continued with larger declines week-to-week through the end of NRFU in mid-October. These changes in the rate of working enumerators followed the diminishing size of the NRFU workload and the progression of the contact strategy phases. However, it is important to note that under normal circumstances, there would typically have been larger declines as more cases are closed and staffing levels reduced in response. Litigation prevented the field from reducing staff levels during the latter half of the 2020 NRFU operation, other than through natural attrition and QC actions.

Table 60. Working NRFU Enumerators and Change Rate, by Week

Week	Date Range	Number of Working Enumerators	Weekly Change Rate
1	July 16 – 22	6,800	-
2	July 23 – 29	18,000	1.6
3	July 30 – Aug. 5	63,000	2.5
4	Aug. 6 – 12	165,000	1.6
5	Aug. 13 – 19	217,000	0.3
6	Aug. 20 – 26	231,000	0.1
7	Aug. 27 – Sept. 2	230,000	(0.0)
8	Sept. 3 – 9	217,000	(0.1)
9	Sept. 10 – 16	203,000	(0.1)
10	Sept. 17 – 23	187,000	(0.1)
11	Sept. 24 – 30	166,000	(0.1)
12	Oct. 1 – 7	136,000	(0.2)
13	Oct. 8 – 14	106,000	(0.2)
14	Oct. 15	53,500	(0.5)

Source: U.S. Census Bureau, 2020 Census, DAPPS

Note: The number of working enumerators was defined as the number of enumerators with work availability on any day during the defined date range.

19. How did the field staff ratio change over the course of the operation?

The weekly field staff ratio followed the typical NRFU distribution with a smaller ratio of enumerators to field supervisors at the beginning and end of the operation and the largest ratios during the height of production. The goal for the 2020 NRFU operation was to have approximately 20 enumerators for every supervisor.⁶⁶ NRFU fell short of this goal, reaching a max ratio of only 15 enumerators to one supervisor. The operation experienced staffing challenges throughout production, which led to the decision to offer continuous hiring and training.

Normally there would have been a steeper drop in field staff levels during the second half of the operation as the workload decreased and staff are released. A temporary restraining order was issued on September 5, 2020 (week eight), which prevented the NRFU operation from releasing field staff. Staffing levels did decrease somewhat in the final three weeks of the operation because of attrition and QC processes.

⁶⁶ By comparison, the 2010 NRFU field staff ratio was eight enumerators for each supervisor. Field staff worked in 494 local census offices. The 2020 NRFU field staff worked out of 248 area census offices, increasing the efficiency of field work with half the number of local offices.

Table 61. NRFU Field Staff Ratio, by Week of the Operation

Week	Date	Number of Enumerators	Number of CFSs	Enumerator to CFS Ratio
1	July 16 – 22	32,000	18,500	2:1
2	July 23 – 29	73,000	18,500	4:1
3	July 30 – Aug. 5	243,000	18,500	13:1
4	Aug. 6 – 12	270,000	18,500	15:1
5	Aug. 13 – 19	271,000	19,000	14:1
6	Aug. 20 – 26	263,000	19,000	14:1
7	Aug. 27 – Sept. 2	251,000	18,500	14:1
8	Sept. 3 – 9	232,000	18,500	13:1
9	Sept. 10 – 16	217,000	18,000	12:1
10	Sept. 17 – 23	196,000	18,000	11:1
11	Sept. 24 – 30	170,000	17,500	10:1
12	Oct. 1 – 7	135,000	17,000	8:1
13	Oct. 8 – 14	103,000	16,000	6:1
14	Oct. 15	69,500	14,000	5:1

Source: U.S. Census Bureau, 2020 Census, DAPPS

20. What was the average number of NRFU cases completed per hour?

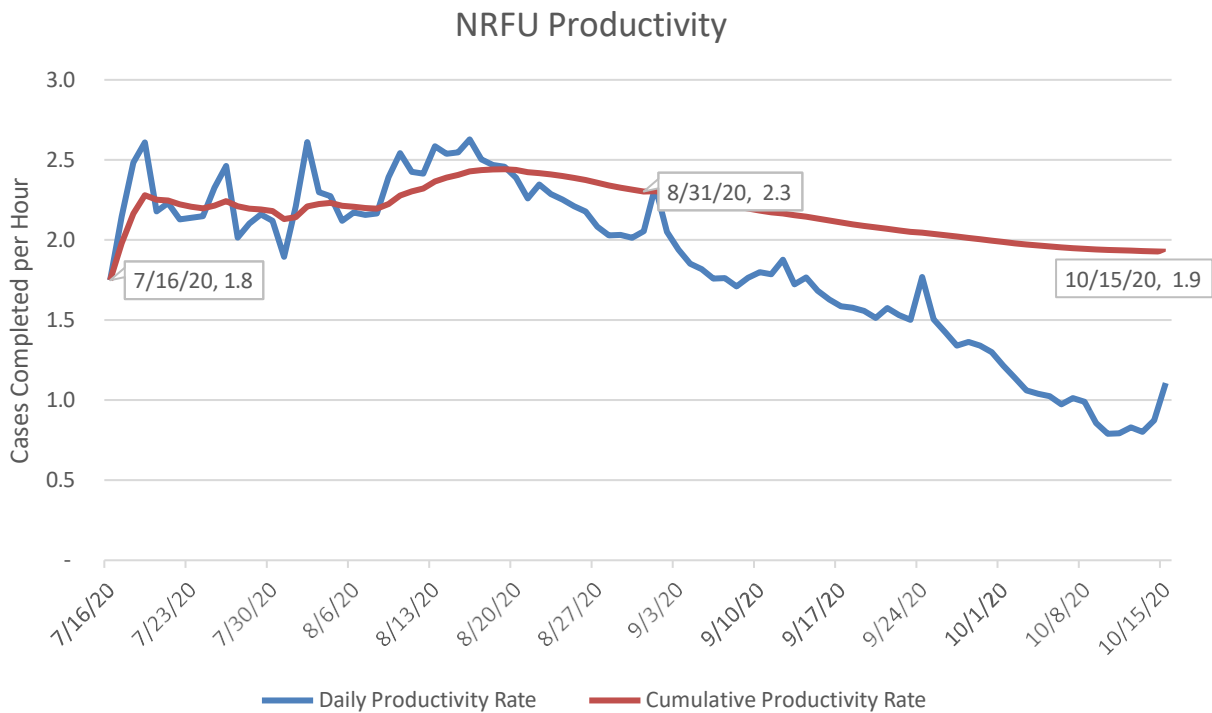
NRFU enumerators worked 30.0 million hours and completed a total of 57.8 million cases between July 16 and October 15, 2020.⁶⁷ The 2020 productivity goal for NRFU was 1.55 cases per hour.⁶⁸ Despite schedule changes and staffing challenges driven by the COVID-19 pandemic, NRFU exceeded the budgeted productivity rate. The cumulative productivity rate at the end of the NRFU operation was 1.9 cases completed per hour. There was some variation throughout the production timeframe, but cumulative productivity started and remained above 1.55 cases completed per hour.

The daily productivity rate was more volatile, as expected. It was highest during the first month of NRFU and started to decline in late August. This happened as the field workload decreased and there was more travel time associated with the completion of the remaining cases.

⁶⁷ Included stateside cases completed during NRFU except cases from SRQA. Included self-responses with at least one earlier NRFU attempt, AR occupied cases, and special closeouts after NRFU started.

⁶⁸ The productivity goal was based on the 2020 life cycle cost estimates created by DBO.

Figure 3. NRFU Daily and Cumulative Productivity Rates



Source: U.S. Census Bureau, 2020 Census, EDL and DAPPS

21. What was the average length of completed interviews: overall, by resolved status, and by household size for occupied units?

There was little variation in the average interview length among the NRFU production workloads.⁶⁹ NRFU interviews had an average length of about seven minutes, which was shorter than the 10-minute estimate that enumerators provided to respondents at the start of the interview. As expected, occupied housing units had slightly longer interviews at about nine minutes. Interviews with a household member tended to be longer than those with a proxy respondent. Proxy interviews for occupied housing units may have been shorter than household interviews because proxies often provided less information. Interviews for vacant or delete units with proxy respondents were the shortest, at about four minutes.

⁶⁹The NRFU production workloads included: NRFU production, NRFU UL, NRFU supplemental, NRFU vacant/delete with UAA, and NRFU vacant/delete with no UAA.

Table 62. Average Length of Completed Interviews, by Resolved Status

Resolved Status	Average Interview Length (minutes)	Number of Cases
All Interviews	7.2	37,540,000
Occupied	8.9	23,710,000
Household Respondent	9.2	16,310,000
Proxy Respondent	8.1	7,398,000
Vacant	4.5	9,960,000
Delete	4.1	3,876,000

Source: U.S. Census Bureau, 2020 Census, EDL

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts may not sum to total because of rounding and disclosure avoidance measures.

Cases were identified by event codes in EDL response tables. Case resets and reopened cases were not removed for this analysis.

Occupied housing units with more people had longer interviews than those with fewer people. This pattern was true whether the interview occurred with a household or a proxy respondent.

Table 63. Average Interview Length for Occupied Housing Units, by Household Size

Household Size	Mean Interview Length (minutes)	Number of Cases
All Occupied Interviews	8.9	23,710,000
Household Interviews	9.2	16,310,000
1	6.0	4,333,000
2	8.0	4,303,000
3	9.6	2,788,000
4	11.0	2,360,000
5	13.0	1,362,000
6+	17.0	1,162,000
Proxy Interviews	8.1	7,398,000
1	6.3	3,021,000
2	7.9	2,137,000
3	9.4	986,000
4	11.0	738,000
5	12.0	317,000
6+	16.0	199,000

Source: U.S. Census Bureau, 2020 Census, EDL

Note: Counts may not sum to total because of rounding and disclosure avoidance measures.

5.5 Schedule

22. How did the planned field training dates compare to the actual dates?

Enumerator training was designed to begin with a one-day, in-person orientation, after which enumerators would have one week to complete nine hours of online training. After completing the online training, they were to return to the classroom for a capstone training day.

Orientation and capstone classroom training sessions for enumerators were planned to be staggered across five days to allow for smaller class sizes. CFSs were to follow a similar training schedule, with an additional six hours of online training and a second capstone training day with content specific to the duties of a CFS.

Early NRFU CFSs attended orientation on March 10, 2020, and began online training. Some ACOs held capstone training during the week of March 16, and some did not. On March 18, field operations were suspended and Early NRFU was canceled in response to the COVID-19 pandemic. On April 24, Early NRFU CFSs were authorized to charge time to retake portions of the online training as a refresher while they waited for the operation to begin.

During the pause in operations, the training plan was modified to allow for social distancing and limit the amount of in-person contact with trainees. Enumerator training began with a two-hour in-person orientation appointment where small groups of enumerators completed their onboarding paperwork and picked up their device on a staggered schedule. After this appointment, enumerators returned home to review orientation self-study materials and participate in a conference call with their supervisor to answer any questions and clarify instructions for completing online training. After completing the online training and capstone self-study, enumerators participated in a capstone conference call with their supervisor.

To account for varying levels of COVID transmission throughout the country, the schedule for restarting the NRFU operation included staggered start dates for four soft launch cycles and a production cycle. Cycles 1A and 1B each included six ACOs and the initial training for those ACOs was conducted according to schedule. Starting with cycle 2, some ACOs started training enumerators early, on a flow basis, and sending them to the field as soon as possible. All ACOs had at least some enumerators working in the field by August 9. However, staffing levels were far below the target for deployment and training continued on a flow basis throughout the remainder of the operation in most offices.

Table 64. Planned and Actual NRFU Field Training Dates

Planned Training Schedule					
	CFS Orientation	CFS Capstone	Enumerator Orientation	Enumerator Capstone	Operation Start Date
Early NRFU	3/10/2020	3/17 – 3/18/2020	4/1 – 4/4/2020	4/6 – 4/11/2020	4/9/2020
NRFU	4/14/2020	4/21 – 4/22/2020	5/6 – 5/9/2020	5/11 – 5/16/2020	5/13/2020
Actual Training Schedule					
	CFS Orientation	CFS Capstone	Enumerator Orientation	Enumerator Capstone	Operation Start Date
Soft Launch Cycle 1A	6/18/2020	6/25 – 6/26/2020	7/7 – 7/11/2020	7/14 – 7/18/2020	7/16/2020
Soft Launch Cycle 1B	6/25/2020	7/2 – 7/6/2020	7/14 – 7/18/2020	7/21 – 7/25/2020	7/23/2020
Soft Launch Cycle 2	7/1/2020	7/9 – 7/10/2020	7/21 – 7/25/2020	7/28 – 8/1/2020	7/30/2020
Soft Launch Cycle 3	7/8/2020	7/16 – 7/17/2020	7/28 – 8/1/2020	8/4 – 8/8/2020	8/6/2020
Production	7/14/2020	7/21 – 7/22/2020	7/31 – 8/5/2020	8/7 – 8/12/2020	8/9/2020

Source: U.S. Census Bureau, 2020 Census, FLD

23. How did the planned start and finish dates compare with the actual start and finish dates for NRFU and NRFU RI?

The COVID-19 pandemic completely changed the data collection schedule for the NRFU operation. All field operations were paused on March 18, 2020, as the Census Bureau began evaluating its strategy for completing the decennial census. NRFU fieldwork restarted on a flow basis in specific areas of the country in July. The start of field operations in an area depended on a number of factors, including the rate of COVID-19 cases and state and local restrictions.

The planned start and finish dates for Early NRFU were April 9, 2020, and July 24, 2020, respectively. However, Early NRFU was ultimately descope because of schedule delays and the closure of many colleges and universities in response to the pandemic. Early NRFU RI was descope, as well.

A soft launch was added to the scope of the operation and served two purposes. First, it allowed for smaller scale execution of the NRFU operation before national implementation. The soft launch also allowed for a controlled rollout of the operation that could take staffing and health risk factors into account. It began on July 16, 2020, and consisted of four cycles with several ACOs in each cycle. Each subsequent cycle had a staggered start about one week after the start of the previous cycle.⁷⁰

The planned start and finish dates for NRFU were May 13, 2020, and July 24, 2020. After several schedule changes in response to the pandemic and litigation, the actual start and finish dates were July 16, 2020, and October 15, 2020 (including the soft launch).

The planned start and finish dates for NRFU RI were May 14, 2020, and July 31, 2020. The delayed NRFU start date and addition of the soft launch cycles changed the actual start of NRFU RI to July 17, 2020. Like NRFU, the actual finish for NRFU RI was October 15, 2020.

⁷⁰ For the number of ACOs that started NRFU by cycle of the soft launch, see Table 2.

Table 65. NRFU Planned and Actual Dates, by Component

	Planned Start	Planned Finish	Actual Start	Actual Finish
Early NRFU	4/09/2020	7/24/2020		Descope
Early NRFU RI	4/10/2020	7/31/2020		Descope
Soft Launch Cycle 1A	N/A	N/A	7/16/2020	10/15/2020
Soft Launch Cycle 1B	N/A	N/A	7/23/2020	10/15/2020
Soft Launch Cycle 2	N/A	N/A	7/26 – 7/30/2020	10/15/2020
Soft Launch Cycle 3	N/A	N/A	7/31 – 8/6/2020	10/15/2020
NRFU	5/13/2020	7/24/2020	8/7 – 8/9/2020	10/15/2020
NRFU RI	5/14/2020	7/31/2020	7/17/2020	10/15/2020

Source: U.S. Census Bureau, 2020 Census, NRFU Runbook

5.6 Lessons Learned

24. What aspects of NRFU worked well? What needs improvement?

Through the administration of a web-based survey and a series of focus group sessions with members of the NRFU IPT, the team collected 172 lessons learned for the 2020 NRFU operation. There were 21 best practices that should be adopted by future NRFU operations. The remaining 151 lessons learned represented areas where there is an opportunity for improvement. The sections below document the most significant lessons learned during the 2020 NRFU operation.

Best Practices

Automation. The use of automation throughout the design of the 2020 NRFU operation was a key factor in its success. The automation and integration of systems for recruiting, onboarding, and training field staff led to the successful hiring of more than 300,000 enumerators. For the first time, an automated data collection instrument was used to collect and transmit NRFU respondents' interview data. Automation was also used for case assignment and management, which increased enumerator efficiency and reduced field costs. During the 2020 NRFU operation, there were no instances of unplanned downtime for the supporting systems.

Administrative Records. The use of AR and third-party data was a key innovation area for the 2020 NRFU operation. It successfully reduced the number of contact attempts for NRFU cases with high-quality AR data. The success of the AR implementation in 2020 suggests that there may be opportunities for a more expanded use during future NRFU operations. Some possibilities include using AR for American Indian Areas during field enumeration, improving the use of AR matching to reduce the NRFU RI clerical workload, and using AR more liberally during the closeout phase.

Blended Field Staff Training Plan. The 2020 NRFU operation included a blended training plan for enumerators and CFSs. The blended training was designed to combine at-home online training

with live classroom training that used automated training guides. When the COVID-19 pandemic forced training to be conducted remotely, the classroom training was shifted to a series of self-studies, conference calls, and a podcast. Even with the shift to remote instruction, the automated, blended training was a big advancement from the paper-based, verbatim training method used in past censuses. The online training standardized training across the country and allowed for training on more topics in less time. Compared to previous censuses, incorporating online training reduced the amount of time spent traveling to a classroom, and the automated training guides made conducting remote training possible during the pandemic. There were many aspects of the training content that worked well, including the use of mnemonics, which staff found very helpful. The mnemonics included the A+ Model (Acknowledge, Answer, Ask), used by enumerators to convert reluctant respondents during interviews, and the 4D Method (Define, Discover, Discuss, Document), used by supervisors to counsel enumerators.

Soft Launch. The CFS launch and soft launch of the NRFU operation were crucial to finding system defects caused by the COVID-19 replan and other issues after Early NRFU was descoped. These efforts also helped the CQA operation get an early sense of the call volume and needs of callers before full production launched.

Greatest Challenges

COVID-19 Pandemic. Because of the pandemic, classroom training changed from in-person instruction to a series of self-studies, a podcast, and conference calls. Learners reported missing the in-person engagement when participating in role-play exercises. It is recommended to return to conducting classroom training in-person and plan for using video conferencing as a contingency. It is also recommended to continue with staggering enumerator classroom training across multiple days to allow for smaller class sizes.

The pandemic also caused delays in the production schedule and several adjustments to the operational design. This included the descoping of Early NRFU and manager visits for multiunits like apartment complexes. As a result, enumeration in areas that had been identified for Early NRFU was conducted after students had already left for another residence. Additionally, many colleges and universities closed in response to the pandemic.

Testing. The lack of full end-to-end testing, including all QC components and closeout procedures, created challenges during NRFU that could have been avoided with more complete testing before the start of the 2020 Census. For example, many field and headquarters staff found phase 2 of the NRFU contact strategy to be ineffective based on the limited number of attempt-days cases received in this phase before moving to closeout.

Field Staff Training. There were some aspects of the training content that need improvement to ensure that concepts are thoroughly understood. These include more realistic examples of situations that an enumerator would most likely experience in the field and more training on the device, such as an optional training module on the use of an iPhone for those not familiar.

In addition to increasing scenarios covered in training, a field exercise should be included to allow enumerators to practice enumerating cases in the field and then discuss any challenges they encountered with their cohort.

Examples of procedures that require more explanation include the proxy process and coding vacant, nonexistent, duplicate, and erroneous addresses. For proxies, staff expressed a need for more information on finding proxies especially in rural and unique areas. Enumerators also struggled with how to handle cases in seasonally vacant areas and addresses with restricted access. Also, more specific criteria should be included in training for when to use the dangerous address designation. Training on these topics can be improved by including more examples of common situations and outlining the steps to code these cases in the instrument. In addition to training improvements, it is also recommended to research whether the paths for coding these cases in the instrument can be made more intuitive.

Restricted Access. Cases where the enumerator could not make contact with a respondent because of some type of barrier were common and challenging to resolve. The descoping of manager visits for multiunits compounded these challenges. Reinstating manager visits for future NRFU operations will be beneficial, but additional research should focus on increasing the chances of successful enumeration for restricted access cases with fewer contact attempts.

Proxy Procedures. The 2020 design allowed enumerators to act as a proxy for a case if they were knowledgeable about it. However, some enumerators overused the capability and quality control for such cases could have been more robust. Additionally, many proxy respondents were reluctant to participate in an interview or only had limited knowledge about the residents of the census address.

Group Quarters. More group quarters (GQs) were found during NRFU fieldwork than expected and there was no system-based approach to send them to the appropriate operation. As a result, they were enumerated as housing units during NRFU. Future operations should ensure that all living quarters are enumerated within the appropriate universe so that the highest quality of data are collected.

25. What aspects of the NRFU QC program worked well? What needs improvement?

The NRFU IPT collected 172 lessons learned for the 2020 NRFU operation; 62 of these lessons learned were for the QC program. The QC lessons learned were collected through: (1) NRFU RI lessons learned sessions with census headquarters staff, (2) a QC focus group with members of the NRFU IPT, and (3) clerical resolution debriefings with NPC clerks, supervisors, and RCC QA staff. The QC lessons learned included three best practices and 59 challenges or opportunities for improvement. The sections below document the most significant lessons learned for 2020 NRFU QC.

Best Practices

Automation. The use of automation throughout the 2020 NRFU design included components of the QC program. The QC workloads also relied upon an automated data collection instrument, case management, and optimized assignments for field staff. Additionally, the use of automation during computer matching allowed for more efficient resolution of cases, thereby reducing the RI workload requiring clerical review.

Administrative Records. In addition to being a key innovation area for the 2020 NRFU operation, AR were effectively used in the QC program to reduce the RI workload when the NRFU interview had a sufficient match to existing AR. There may be additional opportunities in the future to further reduce the RI and clerical workloads through an expanded use of AR and other innovations.

Use of Parameters. Parameters were built into many aspects of NRFU RI sampling and processing, which made updating them very quick and efficient when changes were needed to alter system performance or adapt plans in response to the pandemic and other challenges.

Greatest Challenges

COVID-19 Pandemic. Like NRFU more broadly, the COVID-19 pandemic also affected the NRFU QC program. Changes to the start date for fieldwork led to the descoping of RI for Early NRFU and manager visits. Additionally, multiple changes to the end date of the operation resulted in production and QC ending on the same day. Finally, the pandemic changed the administration of clerical resolution from in person to virtual for staff that were not initially telework-ready.

Testing. NRFU RI was never fully tested leading up to the 2020 Census, including clerical resolution as an integrated component. This led to quite a few issues with the design of the QC program, particularly clerical resolution. Shortcomings were found with the supporting system. For example, NPC clerks found aspects of the user interface confusing, there were missing or inaccurate fields for the capture of Puerto Rico style addresses, and a lack of sufficient load testing that led to system slowdowns. When these issues were found during production, it was often too late to correct the root cause of the problem. This created the need to develop workarounds. In the future, all components of NRFU RI need to be fully tested in an integrated environment before production for the decennial census.

Shared Field Staff. The 2020 NRFU operation used a shared set of field staff who worked NRFU production and QC cases. This increased the training content for all enumerators, rather than staff training on production or QC only. Receiving both types of training may have created confusion about how RI procedures differed from production procedures. In general, there are cost and quality tradeoffs associated with whether shared or separate field staff are used that should be explored in the future.

Gaps in QC. Some gaps in the QC program were identified during production that should be addressed in future designs to ensure the highest quality of data collected during NRFU. These gaps were related to a lack of QC oversight for RINIs, enumerators acting as a proxy, and the work of NPC clerks during NRFU RI clerical resolution.

Clerical Resolution. There were several challenges experienced during the clerical resolution component of NRFU RI, where NPC clerks reviewed production and RI cases that did not pass computer matching to determine if falsification had occurred. These challenges included hiring an insufficient number of Spanish-speaking clerks, dealing with a workload that exceeded our predictions, and having clerks assign outcome and reason codes that were deemed somewhat subjective.

Reports. The reports generated by SMarCS to manage clerical resolution had several shortcomings that reduced their usefulness. For example, the system tallied hard fails differently within different reports, did not separately track performance fails within the reports, and was not able to produce national level reports because of an inability to concurrently process all cases.

26. What aspects of supervisory alerts worked well? What needs improvement?

Alerts were intended to help CFSs manage their team of enumerators and monitor any possible issues in the field. Alerts also helped CFSs to identify behaviors and actions that their enumerators needed to improve. CFSs used alerts to have pointed discussions with their staff and direct the enumerators to take corrective action, which led to better productivity and higher quality data.

The primary issues with alerts included the large number of alerts that were generated, duplicate or erroneous alerts, and “lost” alerts generated by traveling enumerators. Future operations would benefit from more meaningful and targeted alerts, an improved user experience for alert functionality in the OCS, and additional training content for CFSs and CFMs on alert management and resolution.

27. What would the Integrated Project Team (IPT) change about the implementation of the 2020 Census NRFU operation?

Phased Contact Strategy. The 2020 NRFU contact strategy consisted of three distinct phases of data collection designed to maximize efficiency and cost savings early in the operation and increase the resolve rate later in the operation. Phase 2 was intended to give enumerators more ownership over their assigned cases to increase the likelihood that the cases would be resolved, however, several challenges related to the pandemic and litigation reduced the effectiveness of that phase. By contrast, phase 1 and closeout were highly effective in meeting their objectives. Based on this knowledge, the IPT may have designed the phased contact strategy differently by either redefining or eliminating phase 2.

Generic Person Identifiers. If a respondent was reluctant to provide their name during a NRFU interview, enumerators were trained to have them provide a generic name or nickname, such as “person 1” or “woman.” Allowing generic names was designed to convert a potential refusal into a completed interview. However, generic names were used more frequently during field data collection than expected and this complicated downstream activities like NRFU RI matching, that used respondent names as part of the case selection process. In hindsight, the NRFU IPT may have trained field staff to press more firmly for respondent names or allow generic names only in later stages of data collection.

Field Manager Workload. CFMs had many responsibilities during 2020 NRFU, including acting on cases sent to supervisor review and resolution of issues in the field that triggered supervisory alerts. CFMs’ other day-to-day management duties sometimes created a backlog of cases in supervisor review or field alerts to go stale even if the underlying issue had been resolved. A more efficient way to manage CFMs’ workloads may have involved reducing the types of cases eligible for supervisor review or allowing CFSs to assist with their adjudication. Additionally, allowing alerts like the stale alert to resolve automatically when the underlying issue was addressed would have freed up CFMs to focus on their other responsibilities.

QC Program Gaps. The NRFU IPT would change the implementation of the QC program by addressing gaps discovered during the 2020 operation. Two opportunities for a stronger QC strategy involved RINIs and enumerators acting as a proxy for their own cases. Both situations occurred more frequently than expected during 2020 NRFU and there was no targeted approach to ensure that enumerators were not using them to falsify data. In the future, the NRFU IPT may recommend oversampling cases for RI where the enumerator acted as a proxy and developing a strategy to review RI cases that resulted in RINIs.

28. What major challenges does the IPT foresee affecting the implementation of the NRFU operation in the future?

Field Staff Hiring and Retention. An ongoing challenge for the NRFU operation, and the decennial census more broadly, is hiring and retaining a set of highly skilled, temporary field staff. An additional challenge particular to NRFU is finding staff with availability to conduct interviews during weekday evenings and weekends, when respondent contacts are typically most successful. The 2020 Census environment made staff hiring and retention even more challenging.

One idea to mitigate the staffing challenge is to set up future field enumeration in a way that allows field staff to more easily be moved between field enumeration operations. Administrative systems and training plans would need to be structured to support these efforts. Additional benefits may be gained from notifying staff of premium pay opportunities and expanding premium pay to peak NRFU response times.

Declining Response Rates. Increasing requests for survey participation coupled with security breaches and loss of personal information have created an environment of general reluctance

to participate in government surveys. In response, the NRFU operation must constantly balance the need for high quality enumeration data with the objective to keep respondent burden low.

AR can partially fill gaps created by unwilling respondents by providing a high-quality enumeration record where no response has been collected. AR may also be useful in identifying knowledgeable respondents to serve as proxies for other addresses in the neighborhood. Additionally, there are opportunities to improve the respondent interview flow to reduce the number of incomplete interviews. One idea is to group some demographic questions together for all household members to make the interview more conversational. Another idea is to have functionality to scroll through interview questions instead of having different screens for each question.

Low Propensity to Respond Areas. Certain communities across the country have a historical pattern of not responding to the census questionnaire. These communities are also often inadequately covered by AR. The role of partnership programs before peak operations is critical. Partnership efforts should focus on finding a community gatekeeper who can serve as a liaison to increase response rates, act as a proxy when necessary, and identify unique characteristics of the community that will aid in enumeration (e.g., common languages). Such outreach may have an additional benefit of decreasing dangerous address outcomes in these areas.

Field enumeration should start early in communities with a low propensity to respond, to give respondents additional time and opportunities to complete a successful enumeration. Mobile questionnaire assistance should also be deployed and made highly visible to these communities.

Locating Proxies. Finding proxy respondents in certain situations, such as rural areas, restricted access communities, and areas with a high volume of seasonal rentals, will continue to be challenging. In these situations, it is sometimes difficult for field staff to find someone to act as a proxy respondent.

Future efforts may include working with real estate companies to preidentify areas in beach towns or resort communities where there are many seasonal rentals and therefore, a high vacancy rate. This could be operationalized similar to how manager visits for multiunits were planned for the 2020 NRFU operation.

In rural areas where households may be spread out and neighbors are hard to find, in-office enumeration may be able to resolve some cases and reduce the field workload. Additionally, AR may be leveraged to find someone in the vicinity who would make a good proxy.

Finally, there may be opportunities to improve the self-reported vacant path in the internet self-response instrument to allow respondents to self-identify their vacant properties and reduce the number of necessary follow-up contacts in the field.

Balancing AR and Respondent Data. As AR sources and their applications expand in the future, a growing challenge will be balancing the quality and completeness of those data with data obtained from a respondent. There are several research initiatives underway that aim to make recommendations about how to balance different sources of data in the future based upon lessons learned from the 2020 Census. For instance, there may be strengths and weaknesses of different data sources on certain types of data where the strengths of one source can be used to mitigate the weaknesses of another.

Another research initiative centers around obtaining a near real-time glimpse into the quality of response data as it is collected. Having this information available during production will allow the operation to be more agile and to continue data collection for addresses where quality standards have not been met.

It will also be imperative that field staff training emphasizes the collection of quality enumeration data, even in later stages of data collection where completeness often takes precedence. Testing will help identify whether these changes are working and where there are gaps or opportunities for additional improvement.

5.7 Completeness and Quality

29. What was the impact of operational adjustments resulting from the COVID-19 pandemic and natural disasters during 2020 data collection on NRFU data completeness and quality?

The 2020 Census brought unprecedented challenges to NRFU, centering around conducting field data collection in the midst of a worldwide pandemic and several natural disasters in different parts of the country. In response, the NRFU IPT made numerous adjustments to the operational design and field staffing model to ensure a high-quality count and the safety of field staff and respondents.⁷¹

Data completeness during NRFU was measured by the case resolve rate. The 2020 NRFU operation ended with a high case resolve rate of 99.4 percent, on par with that of the 2010 Census. Three key factors in that accomplishment were a modified training plan, introduction of pay incentives for field staff, and creation of enumerator travel teams. The modified training plan allowed for hiring and training of field staff to continue throughout NRFU in response to staffing challenges associated with the pandemic and natural disasters during the data collection period. Pay incentives were another adaptation to the staffing model to encourage staff retention and improve case resolution rates. Field staff received incentive pay based on the hours they worked and their hourly case completion rate. Enumerator travel teams were comprised of high-performing enumerators who moved to ACOs in need of higher case resolution rates.

⁷¹ See section 1.4, “Operational Changes Resulting from COVID-19” for additional details.

The NRFU QC program managed data quality during production. It included edits throughout the automated field collection instrument, alerts for field supervisors, and a sample of cases selected for NRFU RI to detect enumerator falsification. The 2020 NRFU RI results indicated that falsification was a rare event. Hard fail cases, where an enumerator deliberately falsified interview data, accounted for less than 0.1 percent of all the cases selected for NRFU RI. Enumerators with a hard fail had their employment terminated and any previously completed cases were sent for rework.

The high case resolve rate coupled with a low falsification rate suggest that NRFU successfully met the quality and completeness standards set by prior operations. Additional data completeness and quality indicators were compiled after the completion of the 2020 NRFU operation. They include the data quality metrics, item nonresponse rates, and 2020 PES results. Discussion of those results is outside the scope of this assessment.

Despite the success of the 2020 NRFU operation, opportunities exist to improve data completeness and quality in the future. For example, reinstating Early NRFU and multiunit manager visits will improve data collection for those case types. Addressing gaps found in the QC program for RINIs and enumerator proxies will strengthen the quality of NRFU enumerations. Additional recommendations for future NRFU operations are located in the 2020 lessons learned.

6. Conclusions and Recommendations

This section of the report focuses on conclusions about the challenges and successes of the 2020 NRFU operation and recommendations for enhancements to future operations.

6.1 Conclusions

The 2020 NRFU operation's objective was to enumerate the households that did not respond to the census questionnaire by internet, mail, or telephone. Despite the historic challenge that the COVID-19 pandemic and other factors presented for conducting interviews in the field, NRFU was very successful in achieving its objective. At the end of field data collection, the NRFU case resolution rate was 99.4 percent.⁷² As another marker of its success, the 2020 NRFU operation came in \$200.0 million under budget.

There were several key reasons for the operation's success, many of which link to innovations introduced during 2020 NRFU for the first time. Perhaps the most significant was the use of automation, which allowed enumerators to conduct interviews on a mobile device, securely transmit response data in near real-time, and use GPS technology to navigate to cases on their case list. Field supervisors and managers benefited from automation that assisted with case

⁷² The 2020 NRFU resolve rate was on par with the 2010 resolve rate, which was also 99.4 percent.

assignment, case management, and monitoring the progress of fieldwork remotely. Another key innovation was the use of high-quality AR, which made fieldwork more efficient by reducing the number of contact attempts for a sizeable portion of the workload. This, in turn, reduced respondent burden. These innovations, coupled with a phased contact strategy and a high enumerator productivity rate, allowed the NRFU operation to achieve a high resolve rate in less time and at a lower cost than prior operations.

Despite the success of the 2020 NRFU operation, there remain opportunities for future improvements. Areas that were particularly difficult for the 2020 operation involved gaps in preproduction testing and the QC program, field management alert resolution, and the enumeration of GQs found during NRFU. Each of these challenges are described in more detail below.

The lack of full NRFU end-to-end testing before the 2020 Census, including integration testing, load testing for NRFU RI, and testing of all QC components and operational closeout procedures, created challenges during the operation that could have been avoided. When issues were found during production, it was often too late to correct the root cause of the problem.

During 2020 NRFU, gaps were identified in the QC program that might have been found and addressed with more robust testing before production. These gaps were related to a lack of QC oversight for RINIs, enumerators acting as a proxy, and the work of NPC clerks during NRFU RI clerical resolution.

Field management alerts were designed to allow supervisors and managers to monitor fieldwork remotely and intervene when issues arose with the performance of field staff. However, the large workload of alerts proved difficult to manage. The system generated what appeared to staff to be duplicate or erroneous alerts, and CFSs had difficulty efficiently resolving alerts in the system. The alert process also broke down when some enumerators moved to other offices to assist with the workload.

Finally, more GQs were found during NRFU fieldwork than expected, and there was no system-based approach to send them to the appropriate operation. As a result, GQs were treated as housing units, which reduced the quality of their enumeration data.

The challenges faced by the 2020 NRFU operation each present an opportunity to improve processes and strengthen data quality for future operations.

6.2 Recommendations

The following is a list of prioritized recommendations for future NRFU operations based on the 2020 NRFU experience and lessons learned.

1. Expand the use of AR and other data to address declining survey response rates. AR can improve the completeness and quality of enumeration data while reducing respondent burden. AR data may also be able to assist with identification of high-quality proxy respondents or to enumerate residents in hard-to-reach situations like rural areas or gated communities.
2. Research ways to address the on-going challenge of hiring and retaining a highly skilled, temporary field workforce for NRFU. Initial ideas include structuring field enumeration to allow field staff to move to different operations as needed and extending the field data collection period.
3. Explore ways to better reach and motivate historically undercounted populations (HUPs). These groups may be more likely to make up the nonresponse workload and may not be well-represented in AR. Field enumeration should start early in communities with high concentrations of HUPs.
4. Reduce the frequency of generic person identifiers in NRFU household rosters. In 2020, generic identifiers like “Person 1” were overused and negatively impacted data quality. Future operations might train field staff to press more firmly for respondent names or to allow generic names on the roster only in later stages of data collection.
5. Leverage advances in technology to monitor enumeration data quality in near real-time and inform the end of field data collection. Monitoring data quality while in the field would inform when to continue attempts or resolve a case.
6. Reinstate operational components that were descope in 2020 in response to pandemic-related changes. This includes Early NRFU for college and university students in off-campus housing and manager visits for multiunits like apartment complexes.
7. Revamp the Phased Contact Strategy with a focus on refining or possibly eliminating phase 2. It was less effective than intended during 2020 NRFU for several reasons.
8. Work with the appropriate areas of the Census Bureau to reduce the number of duplicate records and deletes from frame creation activities that may be included in the field follow-up workload.
9. Streamline field manager and supervisor functions to balance their workloads. Possibilities include reevaluating business rules for cases sent to supervisor review and refining the scope of field management alerts, flagging, and resolution processes.
10. Provide field staff with additional training on the proxy process, including how to find proxies in more difficult situations, and coding of vacant and delete units. Include a field exercise in training to allow enumerators to practice “real world” scenarios and discuss

any challenges with their cohort. Field supervisors and managers would benefit from additional training content and practice with alert management and resolution.

11. Refine the proxy contact strategy to address 2020 challenges in rural areas, restricted access situations, and seasonal rental communities by revisiting proxy eligibility and attempt rules. Consider streamlining the proxy interview with an emphasis on data quality.
12. Improve the enumeration of vacant and delete units by preidentifying them where possible during self-response or through outreach to management companies for multiunit buildings. Review the field collection instrument for ways to make resolution of vacant and delete units by enumerators more intuitive.
13. Develop an automated means to move non-housing units identified during field enumeration to the appropriate operation.
14. Fully test all components of NRFU RI, including clerical resolution, in an integrated environment to identify and address any shortcomings before the next decennial census.
15. Address gaps found in the 2020 NRFU QC program. Two areas in need of QC procedures are RINIs and enumerator proxies. Both situations occurred more frequently than expected during 2020 NRFU and both presented opportunities for enumerators to falsify data.
16. Explore the cost and quality tradeoffs associated with using a shared or separate field staff to support NRFU and NRFU RI.
17. Determine the best method for ad hoc reporting during production that includes operational monitoring. Solutions may include expanding ad hoc reporting capabilities in reporting systems or expanding the role of existing production reporting teams.
18. Develop cross-operational reports and ensure all affected operations are involved in testing and validation. Even if these reports are not released to the public, they would give operation teams and senior leadership the ability to keep track of 2030 progress at multiple levels of geography.

7. Acknowledgements

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Members of the NRFU Integrated Project Team.

8. Review / Approval Table

The individuals or groups that appear in the table below have reviewed and approved this operational assessment report.

Role	Approval Date
Decennial Census Management Division (DCMD) ADC for Nonresponse Followup	01/18/2023
Decennial Census Management Division (DCMD) Division Chief	03/03/2023
Decennial Research Objectives and Methods (DROM) Working Group	02/23/2023
Decennial Communications Coordination Office (DCCO)	03/27/2023
Disclosure Review Board (DRB)	08/21/2023

9. Document Revision and Version Control History

The table below includes entries for each major version of this operational assessment report along with a brief description of the version and/or any changes made to the preceding version.

Version/Editor	Date	Version Description/Revisions
1.0/Bernstein	11/08/23	Final Version Approved for Public.

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Appendix A: Glossary of Acronyms

Acronym	Definition
ACO	Area census office
ACS	American Community Survey
ADC	Assistant Division Chief
AR	Administrative records
BYOD	Bring your own device
CAES	Concurrent Analysis and Estimation System
CDL	Census Data Lake
CEDCaP	Census Enterprise Data Collection and Processing
CFM	Census field manager
CFS	Census field supervisor
CL	Crew lead
COVID-19	Coronavirus disease
CQA	Census Questionnaire Assistance
DAPPS	Decennial Applicant Personnel and Payroll System
DBO	Decennial Budget Office
DCCO	Decennial Communications Coordination Office
DCMD	Decennial Census Management Division
DRB	Disclosure Review Board
DRF – 1	Decennial Response File – 1
DRIS	Decennial Response Integration System
DROM	Decennial Research Objectives and Methods Working Group
DSF	Delivery Sequence File
DSSD	Decennial Statistical Studies Division
E2E CT	End-to-End Census Test
ECaSE	Enterprise Censuses and Surveys Enabling platform
ECaSE-ENUM	Enterprise Censuses and Surveys Enabling platform - Enumeration
ECaSE-FOCS	Enterprise Censuses and Surveys Enabling platform – Field Operational Control System
ECaSE-SOCS	Enterprise Censuses and Surveys Enabling platform – Survey Operational Control System
EDL	Enterprise Data Lake
EXCB	Evaluations and Experiments Coordination Branch
FDC	Field Data Capture

Acronym	Definition
FLD	Field Division
FOCS	Field operational control system
FV	Field verification
GPS	Global Positioning System
GQ	Group quarters
HUP	Historically undercounted population
ID	Identification
IMS	Integrated master schedule
IPT	Integrated project team
IRS	Internal Revenue Service
LCO	Local census office
LMR	Late mail return
LUCA	Local Update of Census Addresses
MAF	Master Address File
MAF/TIGER	Master Address File/Topographically Integrated Geographic Encoding and Referencing
MaRCS	Matching, Review, and Coding System
MOJO	MOJO
MOJO-BLQ	MOJO-Browse Living Quarters
MQA	Mobile Questionnaire Assistance
MU	Multiunit
MV	Manager visit
NOV	Notice of visit
NPC	National Processing Center
NRFU	Nonresponse Followup
NRFU RI	Nonresponse Followup Reinterview
OA	Operational assessment
PBOCS	Paper-Based Operations Control System
PEARSIS	Production Environment for Administrative Records Staging, Integration, and Storage
PES	Post-Enumeration Survey
PMGB	Portfolio Management Governance Board
PPE	Personal protective equipment
QA	Quality assurance
QC	Quality control
RCC	Regional census center
RINI	Reinterview noninterview
RO	Regional office
SMaRCS	Sampling, Matching, Review and Coding System
SRQA	Self-Response Quality Assurance
SRV	Self-reported vacant

Acronym	Definition
TEA	Type of enumeration area
UAA	Undeliverable as addressed
UL	Update Leave
USPS	United States Postal Service
UTS	Unified Tracking System
VDC	Vacant Delete Check

Appendix B: Glossary of Event Codes

Event Code	Description
1.010	Response acquired
1.021	Response acquired by proxy
1.050	Partial or break-off with sufficient information
1.051	Partial or break-off with sufficient information by proxy
3.024	Occupied by AR
3.029	Occupied closeout by AR
4.000	Nothing known about respondent or address
5.040	Non-residence
5.048	Vacant by proxy
5.049	Vacant by manager
5.050	Vacant – verified
5.054	Delete by proxy
5.055	Vacant by AR
5.059	Vacant closeout by AR
5.063	Delete by manager
5.064	Delete – verified
5.066	Delete by AR
5.069	Delete closeout by AR
5.081	Does not exist
5.082	Demolished/burned out
5.084	Uninhabitable
5.085	Empty mobile home site
5.090	Other not eligible
6.010	Case closed
6.040	Maximum collection attempts
6.041	Maximum collection attempts: partial information (population count)
7.100	Response received

Appendix C: Field Operational Control System Alerts

CFM ALERTS

Alerts sent to CFMs regarding the overall status of the operation.

Alert Name	Alert Description
CFS Removed	When a CFM has enumerators assigned directly to them as a result of the removal of a CFS.
Closeout Phase	When a CFS area is ready for Closeout Phase.
Stale Alert	When a CFS has not resolved an alert in two days.
Payroll Not Approved	Payroll submitted at least two workdays ago and no action has been taken.
Phase 2 Is Coming	Lead up alert, when a CFS area is almost ready for phase 2.
Ready for Phase 2	When a CFS area is ready for phase 2.

CFS ALERTS

Alerts sent to CFSs regarding the performance, conduct, time and expense, and scheduling of the enumerators assigned to them.

Alert Name	Alert Description
Hard Fail Enumerator	When an enumerator has been flagged for falsification.
High Attempts/Hour	When an employee has a completed a high number of attempts/hour compared with peers in a similar geographic area (over the last seven calendar days), defined as: Mean Attempts/Hour + 2 * Standard Deviation
High Completed Cases Rate	When an employee has a high rate of completed cases, defined as Mean + 2* Standard Deviation compared with peers in a similar geographic area.
High POP1 rate	When an employee has a high POP 1 rate when compared with peers in a similar geographic area, defined as: POP 1 Rate Mean + 2 *Standard Deviation
High Refusal Rate	When an employee has a high rate of attempts that result in refusals relative to peers, defined as: Refusal Rate Mean + 2 * Standard Deviation
Long Distance Flag	When work was attempted/completed on an assignment for a particular day and the employee set off the long-distance flag check.
Lookahead Work Availability	When CFS team does not have enough workers with availability for three workdays from today and there is work to be assigned
Low Attempts/Hour	When an employee has a completed a low number of attempts/hour compared with peers in a similar geographic area, defined as: Mean attempts/hour – 2 * Standard Deviation

Alert Name	Alert Description
Low Completed Cases Rate	When an employee has a low rate of completed cases defined as Mean - 2* Standard Deviation compared with peers in a similar geographic area.
MOJO Unable to Assign	MOJO is unable to assign work to a user.
No Timesheet	If an employee worked on a particular day but did not submit timesheet by 10 a.m. the next day.
No Work	When an employee has not attempted any assignment in three straight calendar workdays regardless of availability.
Overtime Claimed	Anytime overtime was entered on a timesheet.
Potential Overcharge Hours	Anytime miles claimed exceeds expected miles (within "X" tolerance).
Potential Overcharge Miles	Anytime miles claimed exceeds expected miles (within "X" tolerance).
No Proxy Attempts	When two or more cases were proxy eligible but the employee did not enter any proxy attempts into the enumeration application.
Short Interview	Any short interview completed by the employee defined as: Interview length is two minutes or less.
Unconfirmed Delete by Observation	When an employee has two or more deletes that are not confirmed either by a proxy or a second enumerator.
Unconfirmed Vacancy by Observation	When an employee has two or more vacant outcomes that were not confirmed either by proxy or a second enumerator.
Work Not Started	When an employee was scheduled to work and has an assignment that has been pushed to their device for that workday, but they have not attempted a case after 45 minutes plus their estimated drive time to their assignment.
Working Before Assigned Hours	Identifies when an employee attempts a case more than 30 minutes before their assigned start time.

Appendix D: Standard Demographic Tables for NRFU RI

Table 66. Standard Demographic Table for Sex During NRFU RI

Sex	Number	Percent
Total Population	59,636	100.0%
Male	26,332	44.2%
Female	25,789	43.2%
Missing	7,509	12.6%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

Table 67. Standard Demographic Table for Age and Sex During NRFU RI

Age and Sex	Number	Percent
Total Population	59,636	100.0%
Under 5 years	2,919	4.9%
5 to 9 years	3,223	5.4%
10 to 14 years	3,400	5.7%
15 to 19 years	3,325	5.6%
20 to 24 years	3,186	5.3%
25 to 29 years	3,336	5.6%
30 to 34 years	3,430	5.8%
35 to 39 years	3,089	5.2%
40 to 44 years	2,812	4.7%
45 to 49 years	2,361	4.0%
50 to 54 years	2,197	3.7%
55 to 59 years	1,838	3.2%
60 to 64 years	1,630	2.7%
65+ years	2,871	4.8%
Missing	19,936	33.4%
Male	26,374	44.2%
Under 5 years	1,536	5.8%
5 to 9 years	1,572	6.1%
10 to 14 years	1,734	6.7%
15 to 19 years	1,699	6.4%
20 to 24 years	1,665	6.3%
25 to 29 years	1,751	6.6%
30 to 34 years	1,705	6.5%
35 to 39 years	1,471	5.6%

Age and Sex	Number	Percent
40 to 44 years	1,338	5.1%
45 to 49 years	1,170	4.4%
50 to 54 years	1,113	4.2%
55 to 59 years	896	3.4%
60 to 64 years	815	3.1%
65+ years	1,304	4.9%
Missing	6,406	24.3%
Female	25,736	43.2%
Under 5 years	1,381	5.4%
5 to 9 years	1,593	6.2%
10 to 14 years	1,687	6.6%
15 to 19 years	1,549	6.0%
20 to 24 years	1,541	6.0%
25 to 29 years	1,698	6.6%
30 to 34 years	1,752	6.8%
35 to 39 years	1,585	6.2%
40 to 44 years	1,404	5.5%
45 to 49 years	1,182	4.6%
50 to 54 years	1,078	4.2%
55 to 59 years	939	3.6%
60 to 64 years	755	2.9%
65+ years	1,473	5.7%
Missing	6,171	24.0%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

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Table 68. Standard Demographic Table for Race During NRFU RI

Race	Number	Percent
Total Population	59,636	100.0%
White alone	22,689	38.0%
Black or African American alone	10,850	18.2%
Asian alone	2,310	3.9%
American Indian and Alaska Native alone	588	1.0%
Native Hawaiian and Other Pacific Islander alone	207	0.3%
Some Other Race alone	8,931	15.0%
Two Or More Races	1,385	2.3%
Missing	12,583	21.1%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

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Table 69. Standard Demographic Table for Ethnicity During NRFU RI

Ethnicity	Number	Percent
Total Population	59,636	100.0%
Not Hispanic or Latino	31,380	52.6%
Hispanic or Latino	18,202	30.5%
Missing	10,007	16.8%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

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Table 70. Standard Demographic Table for Relationship Status During NRFU RI

Relationship	Number	Percent
Total Population	59,636	100.0%
Householder	18,986	31.8%
Opposite-sex Husband/Wife/Spouse	6,008	10.1%
Opposite-sex Unmarried Partner	1,349	2.3%
Same-sex Husband/Wife/Spouse	39	0.1%
Same-sex Unmarried Partner	51	0.1%
Biological Son or Daughter	15,555	26.1%
Adopted Son or Daughter	116	0.2%
Stepson or Stepdaughter	623	1.0%
Brother or Sister	1,233	2.1%
Father or Mother	1,168	2.0%
Grandchild	1,448	2.4%
Parent-in-law	208	0.3%
Son-in-law or Daughter-in-law	218	0.4%
Other Relative	1,510	2.5%
Roommate or Housemate	2,570	4.3%
Foster Child	75	0.1%
Other Nonrelative	1,030	1.7%
Missing	7,444	12.5%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.

Table 71. Standard Demographic Table for Tenure During NRFU RI

Tenure	Number	Percent
Total Occupied Housing Units	20,110	100.0%
Owned with a Mortgage or a Loan	4,356	21.7%
Owned without a Mortgage or a Loan	1,979	9.8%
Rented	10,306	51.2%
Occupied without Payment of Rent	280	1.4%
Missing	3,090	15.4%

Source: U.S. Census Bureau, 2020 Census, DRF-1

Notes:

(-) The data in this table have been rounded or injected with noise as part of the Census Bureau's approved disclosure avoidance practices applied to this report.

(-) Counts and percentages may not sum to totals because of rounding and disclosure avoidance measures.