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Investigating the 2010 Undercount of Young Children – Analysis of Complex Households

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1. INTRODUCTION[1]

The 2010 Census had a net undercount of 4.6 percent for the population age 0 to 4 compared to a net overcount of 0.1 percent for the total population (Hogan et al. 2013). This 4.6 percent translates into a net undercount of almost 1 million young children. The coverage of young children in the decennial census is a persistent problem (West and Robinson 1999). Moreover, there is evidence that the undercount for this population has been increasing while there has been an improvement in coverage for other age groups (O'Hare 2015). The growth in the net undercount of young children is concerning, and in response, the Census Bureau formed the Task Force on the Undercount of Young Children and the Children Undercount Research Team to address this issue (U.S. Census Bureau 2014).

The Research Team has used data from multiple sources including vital statistics, Census operations, Census evaluations, and household surveys to investigate this problem. A common finding across this research is that variation in household structure is closely related to the undercount of young children (U.S. Census Bureau 2016, U.S. Census Bureau 2017a, b, & c). In recent decades, shifts in demographic, social, and economic patterns in the United States have led to changes in household and family structure. As a result, today there is less overlap between families and households than in the past as families are often spread over multiple households or multiple families may be living in one household (Cherlin 2010). Family diversity and complexity may cause ambiguity for census respondents about whom to include on the household roster, which may increase the likelihood that some household members are not counted.

Research on the undercount of young children has included indicators of household structure, mainly by focusing on the relationship of the young child to the householder. Relying only on the direct relationship between individuals and the householder may mask additional intricacies in living situations. In this report, we use the complex household typology, developed by Schwede and Terry (2013), to measure household structure. The typology uses information on the relationship to the householder for all household members to capture the diversity and complexity in structure that may not be reflected in the individual relationships. For instance, the living situation of a young child who lives with just his or her biological parents may be qualitatively different from that of a young child living with his or her parents and extended family or nonrelatives.

In this report, we use the complex household typology to analyze household structure and the undercount of young children in the 2010 Census. First, we classify households in the 2010 Census using the complex household typology, which includes a wider variety of household types than has previously been analyzed in the census. Next, we provide a descriptive profile of children in the 2010 Census by the complex household typology. In addition to summarizing the distribution of enumerated young children across these household types, this report expands recent Coverage Followup (CFU) and Census Coverage Measurement (CCM) analyses to see if specific types of

[1] The authors are indebted to programmers Marie Pees and Janet Wysocki for working with us to create new complex household variables in custom 2000 and 2010 Census data sets and for their suggestions. We thank Bill O'Hare, Patricia Goerman, Ben Bolender, Pat Cantwell, and Lisa Blumerman for reviewing earlier versions of this report and Howard Hogan, Mary Mulry, Heather King, and other members of our Young Children Undercount Research Team for the many stimulating comments that helped shape this research.

complex households had a greater likelihood of errors involving young children. We conclude with a discussion of the importance of including complex household types in analyses of coverage.

2. BACKGROUND

The population age 0 to 4 had a 4.6 percent net undercount in the 2010 Census. This estimate was produced by comparing the census counts for young children to the results of the 2010 Demographic Analysis (DA). DA is one of two methods that the Census Bureau uses to evaluate coverage in the census. This method used vital records on births and deaths from the National Center for Health Statistics and data on international migration to produce a cohort estimate of the population as of April 1, 2010. The second method used to measure coverage in the census is Dual-System Estimation using a post-enumeration survey. In 2010, this operation was called the Census Coverage Measurement program (CCM). However, the CCM results did not show the same high undercount for young children, possibly because of correlation bias between the post-enumeration survey and the census (O'Hare et al. 2016).

In 2013, the Census Bureau formed the Task Force on Young Children to bring analysts from across the organization to discuss the issue (U.S. Census Bureau 2014). The Task Force developed recommendations for researching the undercount of young children further. In 2015, the Children Undercount Research Team was organized with the goal of using existing data in innovative ways to better understand why children are missed in the census. The Research Team analyzed data from vital records, DA, the CFU operation, CCM, the American Community Survey (ACS), and other sources. A common finding across these different analyses is that household structure and the living situations of young children are highly correlated with possible coverage errors in the 2010 Census (U.S. Census Bureau 2016, U.S. Census Bureau 2017a, b, & c).

2.1 Trends in Household Structure

In recent decades, household structure in the United States has changed dramatically due to shifting patterns in family formation, fertility, immigration, incarceration, and economic inequality. Cohabitation (living together before marriage) has become a common stage in family formation (Bumpass and Lu 2000). In fact, in the 2006 to 2010 period, nearly half of all women age 15 to 44 in the National Survey of Family Growth reported cohabiting before their first marriage (Copen et al. 2013). In 2012, 41 percent of opposite-sex cohabiters had children under the age of 18 living with them, almost the same as 40 percent for opposite-sex married couples (Vespa, Lewis, and Kreider 2013). Increasingly, women are having children with more than one partner during the life course (Carlson and Furstenberg 2006). Multi-partner fertility creates complex interconnections within and between families and households.

Changes in both the amount of immigration and the country of origin of migrants have impacted family structure as households with new immigrants are more likely to include multiple generations, extended family, and nonrelatives (Van Hook and Glick 2007; Glick, Bean, and Van Hook 1997). With incarceration rates rising dramatically for some race and income groups,

parental imprisonment has added to the diverse family situations of many young children (Wildeman 2009).

Changing household structures are tied to economics. Changes in family structure from 1976 to 2000 corresponded with growing economic inequality (McLanahan and Percheski 2008, Martin 2006). Diverse household structures increased during the 2007 to 2009 years of the recession and were associated with unemployment (Elliott, Young, and Dye 2011). In the recession, the percentage of mothers staying home declined and homeownership declined by 15 percent among households with their own children under 18 (Vespa, Lewis, and Kreider 2013). In 2009, 9 percent of White, 17 percent of Black and 14 percent of Hispanic children resided with at least one grandparent and most of these also lived with one or more parents (Kreider and Ellis 2011). In 2012, about 10 percent of children lived with a grandparent and coresident grandparents are more likely to be in poverty (Ellis and Simmons 2014). Research indicated that the proportion of adult children age 25 to 34 living with their parents increased from 22 percent in 2010 to 29 percent a year later (Parker 2012). In addition, many young adults age 25 to 29 increased their residential dependency on others during the recession and may have fared worse than other age groups economically (Mykyta 2012). During the 2007 to 2010 year period, sharing of one's household with at least one "additional adult" of age 18 or above who was not the householder, spouse, or cohabiting partner increased, perhaps as a strategy to mitigate economic circumstances during the recession by adding more adults. The proportion of children in such households rose from about 18 to about 20 percent. Personal poverty rates were higher for householders in shared households than in other types of households (Mykyta and Macartney 2012).

The separation of family and household discussed above can make it difficult to define the particular family relationships in and between households, even for the people living there. Brown and Manning (2009) showed that family complexity led to greater family boundary ambiguity, especially for cohabitating stepfamilies. Other research has found that divorced parents often have difficulty describing the living arrangements of their children when the child spends substantial time in both parents' homes (Lin et al. 2004). Research using data from the Fragile Families and Child Wellbeing study showed that unmarried parents often differed when identifying the child's resident parent (Waller and Jones 2014).

2.2 Household Structure and Coverage

Until relatively recently, there were few reports of coverage that mentioned higher likelihoods of undercounting people who were distant relatives of the householder (those without stand-alone relationship response categories, such as nephew or sister-in-law) or nonrelatives of the householder.[2] The post-enumeration regression studies conducted after Census 2000 showed higher nonmatch rates or substantially lower odds ratios of being included in the census for distant relatives and nonrelatives as compared to householders, spouses, and "own children" (Wolfgang et al. 2002). Two other studies showed that siblings, as well as distant relatives and nonrelatives, also showed higher nonmatch rates or lower odds ratios of being counted in Census 2000 (Beaghen,

[2] A review of 1990 and 2000 census post-enumeration reports concluded that "Distant relatives have lower inclusion probabilities than immediate family members" (email from Bill Bell to David Whitford, 5/25/2004).

Feldpausch, and Byrne, 2001) and in the 1990 Census (Diffendal and Belin 1991 memorandum cited in Bell, 2004).

Relationship categories of nonrelatives and "other than spouse" as well as race, and other variables were also associated with coverage differences (Ellis 1994). In the 2010 CCM Program, Olson and Sands (2012) documented that householders, spouses, and "own children" (biological, step, and adopted children in their formulation) had an overcount rate of 0.32 percent and coresident adult children had an overcount rate of 2.91 percent , but other household members (more distant relatives and nonrelatives) had a high undercount rate of 3.53 percent. The latter findings on relationship to householder were included as subsidiary data in a technical report focused on post-stratification coverage comparisons. Because these findings were not part of the main results in 2010, they were not mentioned in the 2012 Census Coverage Measurement Press Release.

Households such as those with siblings, distant relatives, or nonrelatives had been lumped under the generic label "complex households" in prior studies. Prior qualitative studies also showed linkages of complex households, race and ethnicity, and possible coverage issues (de la Puente 1993; Schwede 2007, 2006, 2004 and 2003; and Schwede, Blumberg, and Chan, 2006).

2.3 Complex Household Typology

Despite these documented linkages of complex households to miscounts over three censuses, there has not been a generally accepted, standardized definition and typology to classify a wider range of complex households with decennial census data. Clearly, there needs to be a system for categorizing the growing diversity in household structures including households with nonrelatives other than unmarried partners, those that are lineally (or vertically) extended with kin or in-laws, or laterally (or horizontally) extended with adult siblings and "other unspecified relatives" who may be nieces, uncles, brothers-in-law, or others. This hampered the ability to systematically define and analyze the distribution of complex households across quantitative and qualitative studies and to explore linkages to race and ethnicity, response rates, and coverage.

Schwede developed a qualitative definition of complex households as part of a Census 2000 ethnographic evaluation (Schwede 2003, Schwede, Blumberg and Chan 2006) and developed an alternative classification system with census relationship categories that encompassed a wider range of household variation than is used in decennial census publications. She inductively developed the complex household typology by categorizing the 42 most common household relationship configurations (each with more than 100,000 households) in Census 2000 for a 2010 Census ethnographic evaluation (Schwede and Terry 2013). These accounted for 96 percent of all households in Census 2000 (Hobbs 2005, Table A3, page 34). The typology initially created two main categories based on the perceived complexity of enumerating all people in a household correctly: Noncomplex and Complex. The not-complex category comprised three subtypes that seemed not to be complex for the Census Bureau to enumerate and measure. They included nuclear families with or without their own joint biological or adopted children, stem families (one parent with one or more biological or adopted children), and one-person households.

All other combinations were classified as complex for measurement purposes. These were divided into three subcategories: complex family households (two or more person households, with at least

one person related to the householder by birth, marriage, or adoption), complex nonfamily households (two or more people, with no one related to the householder), and other complex combinations. The complex family households were further subdivided into eight sub-subcategories, such as blended families, three-generation families, skip-generation families, laterally extended families, and family households with any nonrelatives.

The typology was used in the 2010 Census evaluation on enumeration methods and coverage (Schwede and Terry 2013). The authors documented that complex households were associated with differences in possible coverage error across 288 2010 Census interviews observed and recorded live covering a total of 953 people. In the overall sample across the nine observation sites, 15 percent of the young children age 0 to 4 had possible coverage error, the highest rate of all age cohorts.[3] Subsequent research using the typology and decennial census data has found that from 2000 to 2010, the percentage of complex households increased from 21 percent to 23 percent and that the percentage of the population living in complex households increased from 29 percent to 33 percent (Schwede, Jensen, and Wysocki, 2017). The percent of young children living in complex households increased from 34 percent in 2000 to 40 percent in 2010.

2.4 Coverage Followup Operation – 2010 Census

The 2010 CFU operation identified potential coverage errors on mail-returned and enumerator-completed questionnaires based on responses to a set of coverage probes. The undercount probes were designed to identify possible census omissions. One response category on the self-response questionnaire explicitly asked about "children, such as newborn babies or foster children." On enumerator-completed questionnaires, respondents were reminded to include "babies" and "foster children." CFU relied on a centralized telephone followup to recontact households with suspected coverage errors to review the roster and determine the need for changes (additions or deletions). Overall, 56 percent of the CFU workload cases were completed. See U.S. Census Bureau (2017 a&b) for details of the 2010 CFU operation.

U.S. Census Bureau (2017a) analyzed the characteristics of households with positive responses to one of the child-specific coverage probes. In the 2010 Census, about 5 out of every 1,000 households marked one of the child-specific coverage probes, indicating some confusion about whether or not they should include a child on their census form. U.S. Census Bureau (2017b) also looked at CFU results by type of household, focusing on the young children added to household rosters due to CFU. The CFU operation accounted for about 3 young children out of every 1,000 young children enumerated in the 2010 Census.

Both of the studies using CFU data identified household structure as warranting further investigation. The two CFU reports used only the broad categories of complex and noncomplex households. Drilling down into the detailed subcategories holds promise to identify, more specifically, the types of households with suspected coverage errors involving young children.

[3] The study was not a random sample, and standard errors are not available to conduct formal statistical testing for these estimates. See Schwede and Terry (2013) for more information on the site selection and sample sizes for the study.

2.5 Census Coverage Measurement

The 2010 CCM served as a vehicle to evaluate coverage in the 2010 Census and identify shortcomings warranting attention in designing the 2020 Census. The 2010 CCM sample was an area-based sample comprising block clusters in each state, the District of Columbia, and Puerto Rico. CCM listers independently listed all housing units in the sample block clusters. Independent from the 2010 Census, the CCM enumerated everyone living in the P-sample housing units. To identify which individuals the census correctly enumerated, erroneously enumerated, or omitted, the CCM matched people enumerated in the P sample to people enumerated in the 2010 Census. The 2010 CCM produced population estimates and net coverage estimates for the total population and for many demographic subgroups. Moldoff (2008) provides an overview of the 2010 CCM.

U.S. Census Bureau (2017c) analyzed CCM nonmatch rates for young children. The nonmatches are people who were not counted in the census, people who were counted in the wrong location, and people who were counted but did not provide sufficient information for matching. About 11 percent of all P-sample young children (age 0 to 4) could not be matched to a 2010 Census record. The CCM nonmatch rate was roughly 10 percent for a biological child compared to 16 percent for grandchildren, 18 percent for stepchildren, 22 percent for other relatives, and 25 percent for unrelated children. Using the detailed categories in the complex household typology will allow us to assess if certain subgroups had notably high nonmatch rates.

3. RESEARCH QUESTIONS

This report answers the following research questions.

1. How were young children in the 2010 Census distributed across detailed complex household types? How did this vary by race and Hispanic origin of the young child?
2. Which detailed complex household types had the greatest number of positive responses to one of the child-specific undercount probes and the highest positive-response rates? How did this vary by race and Hispanic origin of the householder?
3. Which detailed complex household types had the greatest number of young children added in coverage followup (CFU) and the highest CFU add rates? How did this vary by race and Hispanic origin of the young child?
4. Which detailed complex household types had the greatest number of nonmatches and highest nonmatch rates in CCM?

4. METHODOLOGY

In this report, we use the complex household typology to analyze the relationship between household structure and the undercount of young children in the 2010 Census. The data come from the 2010 Census counts, the CFU operation, and the 2010 CCM. We use the 2010 Census data to describe the living situations of young children and highlight variation in household structure by age, race, Hispanic origin and geography. Next, we use the CFU data to measure indicators of

possible coverage error in the 2010 Census by the complex household typology. Finally, we analyze nonmatch rates between the Census and CCM data by complex household status and type.

4.1 Sources of Data

The primary source of data for the summary of complex households was the Census Edited File (CEF). The CEF contains the final edited and imputed characteristics for all people, i.e., the records the 2010 Census used in most tabulations. The relationship of each person to the householder was used to assign the household structure type to each occupied housing unit.

This report also uses response data from the Census Unedited File (CUF) to identify housing units with specific responses to the undercount questions. We focus on the 612,000 households with a positive response to one of the child-specific undercount probes. This includes households marking the "*children, such as newborn babies or foster children*" probe on self-response forms and households responding "*Yes*" to either the "*babies*" or "*foster children"* probes on NRFU forms. To calculate the proportion of households that responded positively to one of the undercount probes, we used final edited 2010 Census data on occupied housing units (households) as denominators. We excluded any questionnaires that did not include the coverage question, leaving us with 115.6 million households as our national denominator[4].

We identified added young children from the CFU operation using data assembled in the CFU analysis file. This file was the basis for the 2010 CFU evaluations. We also identified young children that CFU validated after an enumerator listed their names in response to the NRFU undercount question. Combining these two universes provided us with a total of 69,500 young children added to the 2010 Census by CFU or added in NRFU and validated in CFU. We used the final 2010 Census count of young children as denominators. The 2010 Census included 20,160,000 children under age 5 living in housing units in the 50 states and the District of Columbia.

4.2 Relationship Question in the 2010 Census

In the 2010 Census, a household included all of the people who occupied a housing unit. One person was designated as the householder (a person who owns or rents the housing unit). Hill et al. (2008) found that in the American Community Survey about 83 percent of the time the householder was the respondent for the household. The relationship question asks how each member of the household was related to the householder and the answers for people in the household are used in the construction of household types[5]. Figure 1 is a reproduction of the 2010 Census question on relationship to householder. Responses to this question are used to define families and household types. The data allow two broad partitions of household members into relatives and nonrelatives. Relatives include spouses, biological, adopted and step sons and daughters, brothers and sisters,

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[4] Questionnaires that did not include the coverage question were experimental versions of the questionnaire and households where the census count was imputed.

[5] Most surveys and censuses collect relationship of each person to the householder, which can mask some interrelationships among people other than the householder in the household. In contrast, a small number of surveys, such as the Survey of Income and Program Participation, collect all household interrelationships, which would allow a wider range of complex households to be identified. For a more in-depth discussion of the variation of relationship questions in federal surveys, see Interagency Working Group on Measuring Relationships in Federal Household Surveys (2014).

parents and parents-in-law, grandchildren, and sons- and daughters-in-law. People living in the household who are not related to the householder include housemates and roommates, roomers and boarders, and unmarried partners of the householder. There are also categories for unspecified "other relatives" and "other nonrelatives."

2. How is this person related to Person 1? *Mark* ☒ *ONE box.*

- ☐ Husband or wife
- ☐ Biological son or daughter
- ☐ Adopted son or daughter
- ☐ Stepson or stepdaughter
- ☐ Brother or sister
- ☐ Father or mother
- ☐ Grandchild
- ☐ Parent-in-law
- ☐ Son-in-law or daughter-in-law
- ☐ Other relative
- ☐ Roomer or boarder
- ☐ Housemate or roommate
- ☐ Unmarried partner
- ☐ Other nonrelative

Figure 1. Facsimile of 2010 Census Relationship Question

The Census Bureau uses the relationship responses to form family and nonfamily households. A family consists of a householder and one or more other people living in the same household who are related to the householder by birth, marriage, or adoption. A family household may also contain people who are not related to the householder. A nonfamily household consists of a householder living alone or with nonrelatives only. Lofquist et al. (2012) summarize 2010 Census data on households and families. In this analysis, we use the relationship question in the 2010 Census, CFU, and CCM data—which were all coded the same—to classify housing units using the complex household typology.

4.3 Producing the Complex Household Typology

The Complex Household Typology classifies households based on unique combinations of relationships within the household. Schwede et al. (2005) used Census 2000 data to identify 42 different household types. Using the 2010 relationship codes, the number of categories was slightly lower because we were not able to identify households with nieces and nephews as a separate category. We collapsed the detailed complex household categories into 12 broad groups that reflect dimensions such as vertical ascending and descending households, laterally extending households, and households with other relatives, nonrelatives, and unmarried partners. To produce the typology, we established a hierarchy where the household could contain many different types of relationships but would ultimately be classified based on the relational distance to the householder. Relational distance refers to how closely the two people are connected. A spouse or biological child would be a closer relationship to the householder than a nonrelative. Figure 2 illustrates the hierarchy of relationships within the household (from the relationship question, Figure 1) that is used in the classification of the household type.

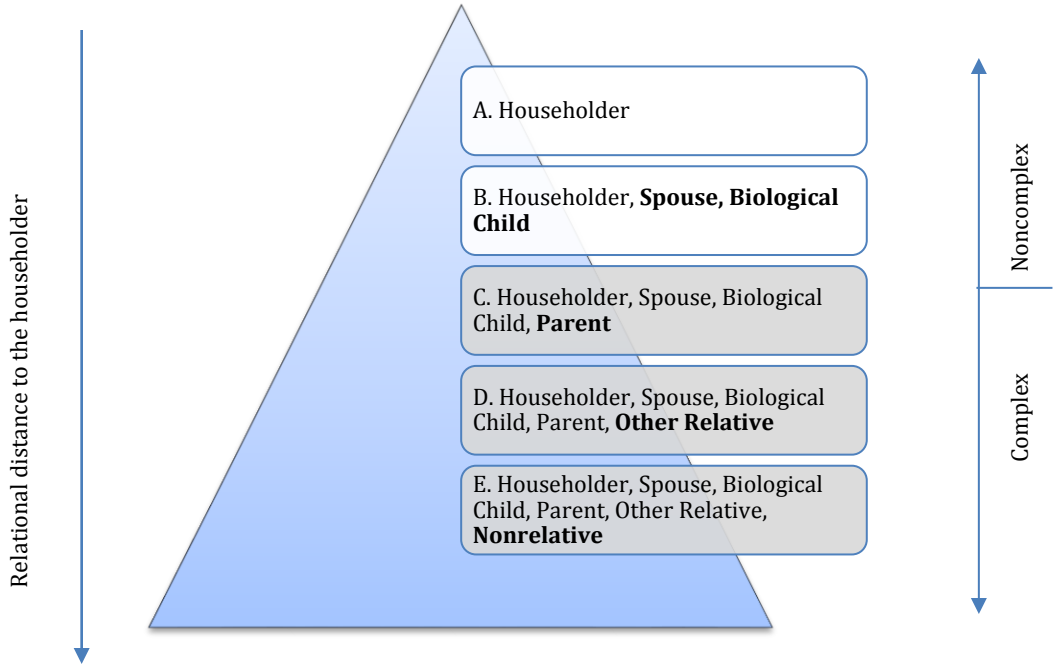

Figure 2. Example of the Hierarchy of Relationships that Determine the Complex Household Type

In this example, Household A in Figure 2 would be classified as a nonfamily, noncomplex household where the householder lives alone. Household B in Figure 2 is a nuclear family or noncomplex family household. Household C is the same as Household B, except for it also includes a parent of the householder, making it a complex multi-generation household. Household D includes a non-specified or "other" relative, which would make it a complex family household with other relatives. Finally, Household E includes all of the relationships as the other households but also includes a nonrelative. According to our hierarchy of relationship types, this household would be classified as a complex family household with nonrelatives because the nonrelative is the most distant relationship in the householder. See Appendix 2 for a diagram of the complex household typology.

4.4 Definitions

4.4.1 Complex Household Typology

Appendix 1 includes the detailed descriptions of the specific set of relationships that fall into each of the household types used in this typology. For the CFU results in this report we collapsed the detailed household types into the following groupings:

Noncomplex Households:

- **Nuclear family** – Households with a householder, spouse, and biological or adopted child or a householder and spouse.
- **Stem family** – Households with a householder and biological or adopted child.
- **Householder lives alone**

Complex Households:

- **Blended family** – Households with a householder, spouse, and stepchild (with or without a biological child).
- **Multi-generational** – Households with three or four generations. This includes households with a householder, biological child, and grandchild (with or without a spouse present) and households with a householder, biological child, and parent or parent-in law (with or without a spouse present). It also includes households with a householder, biological child, grandchild, and a parent or parent-in law (with or without a spouse present).
- **Family with unspecified other relatives –** Households with a householder, biological child, and other relatives (with or without a spouse present) and households with a householder and other relatives (with or without a spouse present). This group also includes households with a householder, sibling or grandchild, and other relatives (with or without a spouse present).
- **Skip generation** – Households with a householder and grandchild (with or without a spouse present).
- **Family with unmarried partner** – Households with a householder, biological child, and unmarried partner (with or without stepchildren or other relatives).
- **Family with other nonrelatives** – Households with a householder, biological child, and a roomer, housemate, or other nonrelative (with or without a spouse present).
- **Nonfamily with unmarried partner** – Households with a householder and an unmarried partner.
- **Other complex nonfamily** – Households with a householder and a housemate, roomer, or other nonrelative.
- **Other complex combinations** –all other household types.

Due to small CCM sample sizes, we combined several household types to present the CCM results.

4.4.2 Race and Hispanic Origin

We used responses to the race and Hispanic origin questions to assign each householder and each added young child to one mutually exclusive race and Hispanic origin group. For Non-Hispanics, we use the six single race categories and a multiple race category; for Hispanics of any race, we use Hispanic[6].

- Non-Hispanic White alone
- Non-Hispanic Black or African American alone
- Non-Hispanic American Indian and Alaska Native (AIAN) alone
- Non-Hispanic Asian alone
- Non-Hispanic Native Hawaiian and Other Pacific Islander (NHPI) alone
- Non-Hispanic Some Other Race (SOR) alone

[6] We use "Black or African American" and "Black" interchangeably in the report. All references to specific race groups refer to people reported to be 1) of that race alone (meaning that just one race was reported on the census form) and 2) non-Hispanic (e.g., "Black" refers to those reported as not Hispanic and as one race: Black. "Hispanic" refers to anyone reported as Hispanic.

- Non-Hispanic Two or More Races
- Hispanic

4.4.3 Positive-Response Metrics

We calculated two measures related to positive responses to the coverage probes. We identified all households that marked the box for the "*children, such as newborn babies or foster children*" probe in the undercount question on self-response questionnaires or responded "*Yes*" to either the "*babies*" or "*foster children*" probes in the undercount question on NRFU questionnaires. While other undercount probes resulted in the identification of young children that respondents initially omitted and CFU later added, we chose to focus on the probes specifically designed to identify rostering errors involving children.

The first metric is the total number of positive responses to one of the child-specific coverage probes. Nationally, 612,000 households responded positively to one of these probes. We defined the positive-response rate as the ratio of the number of households with a positive response to one of the child undercount probes to the total number of households in the 2010 Census[7]. Multiplying those results by 1,000 converted the ratios to an estimate of positive responses per 1,000 households. The positive-response rate takes the size of each universe into account and describes the proportion of households with some possible confusion about rostering children. U.S. Census Bureau (2017a) found that about 5 out of every 1,000 households responded positively to one of the undercount probes about children.

4.4.4 CFU Add Metrics

We calculated two measures of added young children resulting from CFU. The first metric is the total number of CFU-added young children. In addition to the young children identified and added during the CFU interview, this count includes young children added to the NRFU questionnaire as possible omissions and validated in CFU. To assess the proportion of young children added as a result of the CFU operation, we calculated CFU add rates. We defined these rates as the ratio of the number of young children added or validated during CFU to the total number of young children in the 2010 Census. Multiplying those results by 1,000 converted the ratios to a statistic of CFU adds per 1,000 enumerated young children. U.S. Census Bureau (2017b) found that CFU adds accounted for about 3 out of every 1,000 young children in the 2010 Census.

4.4.5 CCM Metrics

We calculated nonmatch rates between the CCM results and the Census. Specifically, we matched individuals from the CCM P-sample to the census files. The nonmatches include young children who were omitted from the census, young children who were enumerated in the census but whose record did not have sufficient information for matching, and young children who were enumerated in the census but their location was outside of the geographic search area defined by the CCM program. While the nonmatches are not necessarily children who were omitted from the census, they do indicate situations with possible coverage error.

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[7] We defined total households as the subset of households where the questionnaire included a coverage question.

4.5 Estimation and Analysis

We produced counts of young children, counts of households with positive responses, counts of CFU-added young children, positive-response rates, and CFU add rates for the set of household types and race and Hispanic origin groups defined in sections 4.4.1 and 4.4.2. We also produced weighted estimates of P-sample nonmatches and weighted nonmatch rates for children living in a collapsed version of these household types. The CCM estimates include standard errors.

4.6 Limitations

A limitation of the typology is that households can only be classified based on the relationships of individuals to the householder. This may mask important familial relationships between other members of the household, such as subfamilies. In addition, some relationship categories that may be important for young children were not response choices in the 2010 Census. For example, niece or nephew were not response choices so these children were reported as "other relative," putting them in the same category as cousins or more distant relatives. This would be problematic for our analysis if respondents were more likely to include young children on their household roster that have closer familial relationships.

To overcome these limitations, we would need data on the interrelationships between all members of the household. Some demographic surveys conducted by the Census Bureau have more detailed relationship data. The Survey of Income and Program Participation contains information on the relationships between all household members. In addition, the Current Population Survey has "parental pointers" that can be used to identify subfamilies within broader households (Kreider 2008). Research has shown that the parental pointers improve the identification of stepfamilies, single-parents families, and multi-generation families (Kennedy and Fitch 2012). Because relationship status in the decennial census is only measured as the relationship to the householder, we are unable to account for the additional relationships between other members of the household.

There are important limitations to the CFU add results. The rostering effort in the 2010 CFU operation was independent from the original census response. The final list of household members came from the more detailed CFU followup interview. People were classified as CFU adds if their names could not be matched to a name on the roster of the original response. Recent research found that in some cases the young children who were categorized as CFU adds were, in fact, listed on the continuation roster but with insufficient data to be recognized as a match. In other cases the children identified as CFU adds were missing from the original roster, including the continuation roster. Due to this definition, the CFU adds overstate the true number of missing children added in CFU. This may be especially true for large households where young children were found on the continuation roster. In addition, cases were selected for the CFU operation based on predetermined criteria and not a random selection process. Households that were large in size, marked a coverage probe, or had a discrepancy between the provided population count and the number of people listed on the household roster were selected for followup. The fact that large households were automatically sent to the CFU operation may bias our results because larger households are more likely than smaller households to be complex in structure.

5. RESULTS

5.1 Young Children by Complex Household Type

How were young children in the 2010 Census distributed across detailed complex household type? How did this vary by race and Hispanic origin of the young child?

Table 1 summarizes the distribution of young children in the 2010 Census for a set of detailed household types. Nearly half of all young children lived in a nuclear family and another 11 percent lived in a stem family (no spouse present). These two household types account for over 60 percent of all young children, leaving about 40 percent of children under the age of 5 living in a complex household. Over 10 percent of all young children lived in a multi-generation household; another 1 percent lived with a grandparent without a parent present (skip generation). About 8 percent of children under the age of 5 lived in a family household with an unmarried partner.

Young children are more likely than other age groups to live in a complex household. As reported above, nearly 40 percent of young children live in complex households compared to 34 percent for the population age 5 to 9, 33 percent for the population age 10 to 17, and 32 percent for the population age 18 and older (Table 1). In addition, the type of complex household varies by age. Young children were more likely than older children to live in multi-generation, family with other relatives, family with unmarried partner, and family with other nonrelative(s) households.

Table 1. Distribution of Population by Age and Household Structure: 2010 Census

	Percent of Population			
Household Type	**Age 0 to 4**	**Age 5 to 9**	**Age 10 to 17**	**Age 18+**
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**
NONCOMPLEX	**60.4**	**66.0**	**66.6**	**67.5**
Nuclear family	49.3	51.0	48.6	46.6
Stem family	11.1	15.0	18.0	7.1
Householder lives alone	0.0	0.0	0.0	13.8
COMPLEX	**39.6**	**34.0**	**33.4**	**32.5**
Blended Family	3.4	4.8	6.1	2.3
Multi-generation	10.4	7.8	7.0	5.2
Family with other relative(s)	5.5	5.0	4.9	3.7
Skip generation	0.7	1.0	1.2	0.8
Family with unmarried partner	8.4	6.3	4.9	2.7
Family with other nonrelative(s)	7.9	6.0	5.8	5.4
Nonfamily with unmarried partner	0.3	0.4	0.5	3.8
Other complex nonfamily	0.3	0.3	0.4	4.2
Other complex	2.9	2.6	2.8	4.5

Source: 2010 Census, special tabulation

Table 2 presents these results for selected race and Hispanic origin groups. The first six race groups account for only the population that reported a single race. All young children reporting more than one race are tabulated in the "Two or More Races" category. The percentage of young children living in complex households varies considerably by the race and Hispanic origin of the child. Only about 29 percent of White young children lived in a complex household while more than 50 percent of young children with a race of Black, AIAN, and NHPI lived in a complex household. About 55

percent of all Hispanic young children lived in a complex household. We also see differences in the detailed types of households by race and Hispanic origin. Over 29 percent of all Black young children lived in a stem family household with a single parent. The proportion for White young children was about 7 percent. Over 60 percent of White and Asian young children lived in a nuclear family. This proportion is much lower for young Black, AIAN, NHPI, and Hispanic young children.

We see similar proportions of non-White young children living in multi-generation households (about 15 percent). Over 13 percent of AIAN young children lived in a family household with an unmarried partner; the proportion for Black and Hispanic young children was about 10 percent. A relatively high proportion of AIAN, NHPI, and Hispanic young children lived in family households with other nonrelatives (13 percent, 14 percent, and 14 percent, respectively).

Table 2. Distribution of the Population Age 0-4 by Household Structure, Race and Hispanic Origin: 2010 Census

	Percent of the Population Age 0 to 4							
	Non-Hispanic							Hispanic
Household Type	**White Alone**	**Black Alone**	**AIAN Alone**	**Asian Alone**	**NHPI Alone**	**SOR Alone**	**Two or More Races**	
Population age 0-4	10,240,000	2,741,000	174,000	874,000	37,500	67,000	922,000	5,104,000
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
NONCOMPLEX	**70.9**	**49.9**	**41.6**	**64.4**	**36.5**	**58.2**	**58.4**	**45.3**
Nuclear family	63.5	20.7	28.9	61.6	29.6	47.4	43.2	35.9
Stem family	7.4	29.2	12.7	2.9	6.9	10.8	15.2	9.4
COMPLEX	**29.1**	**50.1**	**58.4**	**35.6**	**63.5**	**41.8**	**41.6**	**54.7**
Blended Family	4.0	2.6	3.4	0.9	2.1	2.6	3.4	3.0
Multi-generation	7.3	15.5	16.0	14.7	15.6	11.4	10.6	12.7
Family with other relative(s)	2.3	7.8	7.2	8.1	18.2	6.2	4.0	10.2
Skip generation	0.6	1.5	1.5	0.1	0.5	0.8	0.8	0.4
Family with unmarried partner	7.5	9.6	13.5	2.1	6.7	8.3	11.7	9.7
Family with other nonrelative(s)	5.0	8.6	12.5	5.6	13.9	8.7	7.9	13.6
Nonfamily with unmarried partner	0.4	0.2	0.3	0.1	0.2	0.2	0.3	0.2
Other complex nonfamily	0.3	0.4	0.3	0.2	0.4	0.4	0.3	0.5
Other complex	1.8	3.9	3.7	3.9	5.7	3.2	2.6	4.5

AIAN: American Indian and Alaska Native; NHPI: Native Hawaiian and Other Pacific Islander; SOR: Some Other Race
Source: 2010 Census, special tabulation.

The geographic distribution of young children living in complex households corresponds with the spatial clustering of the Black, AIAN, NHPI, and Hispanic populations in the United States. Figure 3 maps the percentage of young children living in complex households by county. Counties with large percentages of young children living in complex households were most prevalent in the Southwest, which has large Hispanic and AIAN populations. The percentages of young children living in complex households were also high in the South, especially in counties in the Mississippi Delta that have large Black populations.

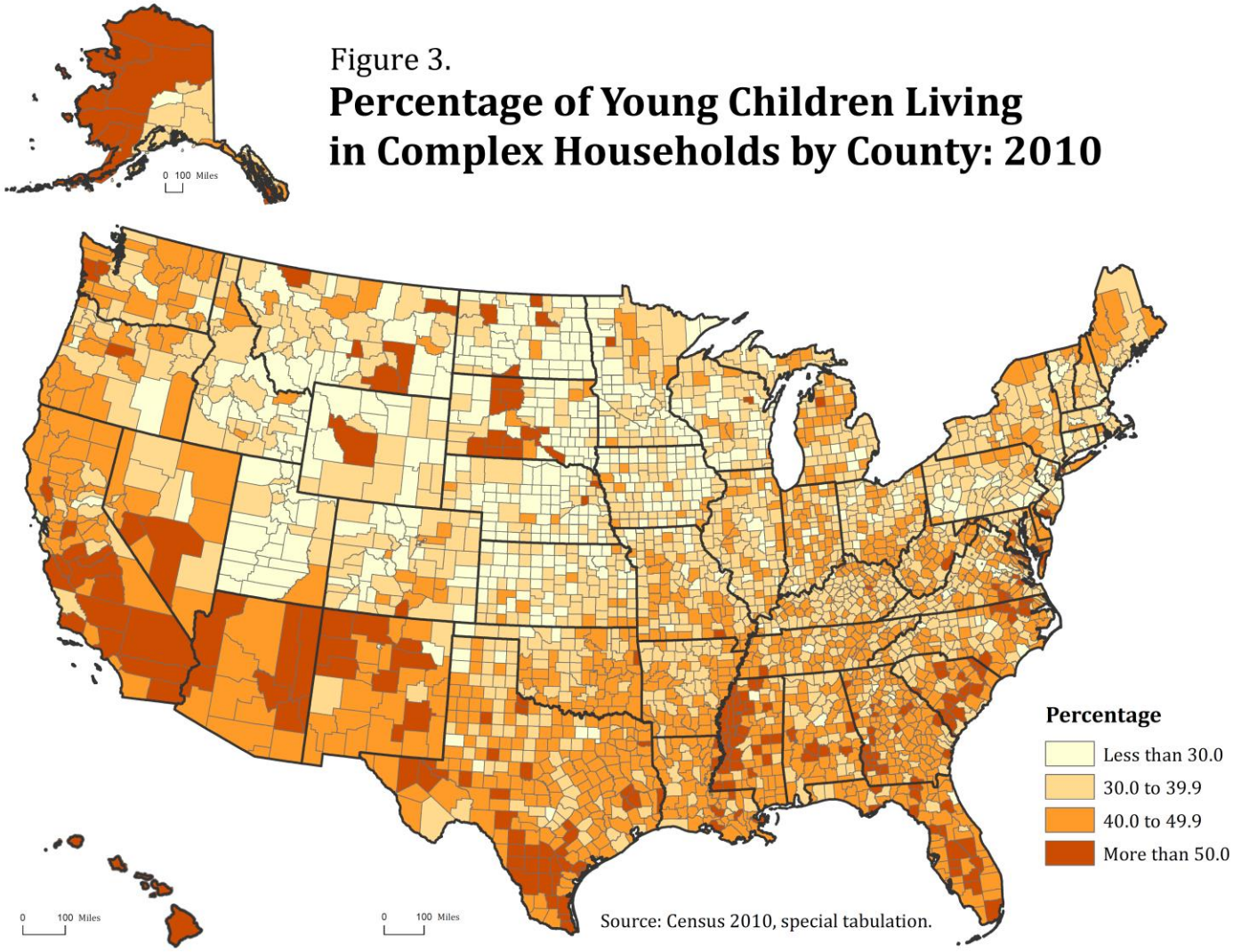

Figure 3.
Percentage of Young Children Living in Complex Households by County: 2010

There were also clusters of counties with high percentages of young children living in complex households in counties in the Midwest and Mountain West with large AIAN populations. In addition, counties in Alaska and Hawaii also had large percentages of young children living in complex households. In contrast, counties in the Great Plains and Midwest regions had the lowest percentages of young children living in complex households. Counties in the Northeast region also had lower percentages of young children living in complex households. While the map highlights the spatial clusters where the percentages of young children living in complex households are highest, it also illustrates that young children in all regions were living in complex households.

The relationships of young children to the householder by complex household status are presented in Table 3. The most common relationship types are biological or adopted child and grandchild accounting for 82 percent and 12 percent of young children, respectively. By definition, young children in noncomplex households can only be biological or adopted children; therefore, they

account for 100 percent of children in these households. However, in complex households, 55 percent of young children are biological or adopted children. In blended family households, young children are most often the biological or adopted child and not the stepchild. For multi-generation households, 23 percent of young children are a biological or adopted child while 77 percent are grandchildren of the householder. Less than half of young children living in family households with other relatives are a biological or adopted child, 37 percent are other relatives, and 13 percent are grandchildren.

In the family with unmarried partner category, 95 percent of young children are the biological or adopted child of the householder while 4 percent are a stepchild and 2 percent are other relatives. In contrast, in family households with other nonrelatives, biological children account for 52 percent, 25 percent are a grandchild, 9 percent are another relative, and 12 percent are a nonrelative. By definition, young children living in a nonfamily household with an unmarried partner and another complex nonfamily household are all nonrelatives. The other complex category includes mostly biological or adopted children (62 percent) and grandchildren (35 percent). This table highlights variation in the relationship status for young children across different household types.

Table 3. Relationship of Young Child to Householder by Complex Household Typology (row percentage)

	Percent of the Population Age 0 to 4					
	Relationship of Young Child to Householder					
Household Type	**Biological or Adopted Child**	**Stepson or daughter**	**Brother or Sister**	**Grand-child**	**Other relative**	**Non-relative**
TOTAL	**82**	**1**	**0**	**12**	**3**	**2**
NONCOMPLEX	100					
Nuclear family	100					
Stem family	100					
COMPLEX	55	2	<0.5	31	7	4
Blended Family	86	14				
Multi-generation	23		<0.5	77		
Family with other relative(s)	49	1	<0.5	13	37	
Skip generation				100		
Family with unmarried partner	95	4				2
Family with other nonrelative(s)	52	1	<0.5	25	9	12
Nonfamily with unmarried partner						100
Other complex nonfamily						100
Other complex	62	2	1	35		

Source: 2010 Census, special tabulation

5.2 Positive Responses to Child-Specific Coverage Probes by Complex Household Type

Which detailed complex household types had the greatest number of positive responses to one of the child-specific undercount probes and the highest positive-response rates? How did this vary by race and Hispanic origin of the householder?

A total of 612,000 households responded positively to one of the child-specific coverage probes. This includes responses on both self-response and NRFU questionnaires. Table 4 displays the distribution of these positive responses by household type. About 56 percent of all positive responses were in households that we defined as "noncomplex." Within the complex types, we see the greatest percent of positive responses for multi-generation and family with other nonrelative

households (8.9 and 10.3 percent, respectively). This distribution is partly driven by the total number of occupied housing units in these groups with 77 percent of all households defined as noncomplex and about 3 percent of households defined as multi-generation and family with other nonrelative households.

The positive-response rates take the universes into account and identify the groups with a disproportionate number of positive responses. Here we see that complex households have a higher positive-response rate of about 10 per 1,000 compared with fewer than 4 per 1,000 for households that are noncomplex. Within the noncomplex group we note, however, that stem family households had relatively high positive-response rates of close to 9 per 1,000. Within the complex household group, we find the highest positive-response rate of 19 per 1,000 for family with other nonrelative households. Other complex types with positive-response rates of over 15 per 1,000 are multi-generation households and complex families with other relatives. Households with householders and grandchildren with no parent present (skip generation) also had high positive-response rates of about 13 per 1,000. From these data, we also see that all types of complex households except nonfamily households with unmarried partner and other complex nonfamily households have positive-response rates that exceed the rates for nuclear family households. Complex households with multiple generations, other relatives, nonrelatives, and grandchildren appear to have had the greatest evidence of possible confusion about rostering young children.

Table 4. Positive Responses to Child-Specific Coverage Probe by Household Type

Household Type	Positive Responses to a Child-specific Probe	Percent of Total Positive Responses	Number of Occupied Housing Units	Percent of Total Occupied Housing Units	Positive Response Rate
TOTAL	**612,000**	**100.0**	**115,600,000**	**100.0**	**5.3**
NONCOMPLEX	**342,000**	**55.9**	**89,040,000**	**77.0**	**3.8**
Nuclear family	173,000	28.3	47,830,000	41.4	3.6
Stem family	91,000	14.9	10,320,000	8.9	8.8
Householder lives alone	78,500	12.8	30,890,000	26.7	2.5
COMPLEX	**270,000**	**44.1**	**26,570,000**	**23.0**	**10.2**
Blended Family	13,500	2.2	2,048,000	1.8	6.6
Multi-generation	54,500	8.9	3,593,000	3.1	15.2
Family with other relative(s)	39,000	6.4	2,487,000	2.2	15.7
Skip generation	12,000	2.0	891,000	0.8	13.5
Family with unmarried partner	30,500	5.0	2,726,000	2.4	11.2
Family with other nonrelative(s)	63,500	10.4	3,356,000	2.9	18.9
Nonfamily with unmarried partner	14,500	2.4	4,122,000	3.6	3.5
Other complex nonfamily	10,500	1.7	3,748,000	3.2	2.8
Other complex	32,000	5.2	3,600,000	3.1	8.9

Source: 2010 Census, special tabulation

We observe differences in the distribution of positive responses by race and Hispanic origin of the householder (Table 5). The differences in these distributions are largely due to the different distributions of the population across household types by race and Hispanic origin. While only about 34 percent of all positive responses in households with a White householder were in complex households, this proportion exceeds 50 percent in households with a householder who is AIAN, NHPI, or Hispanic. Most of the positive responses to a child-specific coverage probe when the householder was White were found in nuclear families. For Black householders, the greatest percentage of positive responses for noncomplex households were in stem family households. Positive responses from householders who reported as AIAN came primarily from nuclear and stem

families and from families with other nonrelatives. Nuclear families and multi-generation families accounted for nearly 59 percent of all positive responses in Asian households. Positive responses from NHPI households involved nuclear families, multi-generation families, families with other relatives, and family households with other nonrelatives. Nuclear families, stem families, multi-generation families, families with other relatives, and families with other nonrelatives accounted for 76 percent of positive responses in Hispanic households.

Table 5. Distribution of Positive Responses to Child-Specific Coverage Probe by Household Type and Race and Hispanic Origin

	Non-Hispanic							
Household Type	**White Alone**	**Black Alone**	**AIAN Alone**	**Asian Alone**	**NHPI Alone**	**SOR Alone**	**Two or More Races**	**Hispanic**
Positive Responses	245,000	132,000	4,900	39,500	1,200	1,700	18,500	169,000
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
NONCOMPLEX	**65.9**	**53.6**	**46.7**	**63.9**	**41.2**	**51.8**	**58.4**	**41.5**
Nuclear family	33.8	14.9	21.1	47.6	25.4	29.4	25.1	26.5
Stem family	13.7	24.3	15.8	7.4	8.9	16.7	19.7	10.4
Householder lives alone	18.4	14.4	9.8	8.9	6.9	5.7	13.7	4.5
COMPLEX	**34.1**	**46.4**	**53.3**	**36.1**	**58.8**	**48.2**	**41.6**	**58.5**
Blended Family	2.9	1.5	2.3	1.0	1.3	1.6	2.0	2.0
Multi-generation	6.0	11.2	11.5	10.1	11.4	9.9	8.7	10.9
Family with other relative(s)	2.5	7.5	6.6	7.2	16.7	7.6	5.0	10.8
Skip generation	1.8	3.7	3.0	0.4	0.6	1.9	2.1	1.2
Family with unmarried partner	5.0	4.5	6.7	1.4	3.2	5.0	6.1	5.9
Family with other nonrelative(s)	7.1	9.0	13.4	6.2	14.3	11.5	9.3	17.0
Nonfamily with unmarried partner	3.7	1.8	2.5	0.9	2.3	1.8	2.2	1.3
Other complex nonfamily	1.8	1.9	2.0	1.4	2.4	2.2	1.7	1.7
Other complex	3.2	5.4	5.4	7.4	6.5	6.7	4.5	7.6

AIAN: American Indian and Alaska Native; NHPI: Native Hawaiian and Other Pacific Islander; SOR: Some Other Race
Source: 2010 Census, special tabulation.

Figures 3 and 4 compare the positive-response rates for White, Black, and Hispanic householders by household type. Recall that the positive-response rates take the universes into account and show the proportion of household of a given group that had some possible confusion about rostering children. Figure 3 includes the household types with the lowest positive-response rates. We see fairly similar low positive-response rates across these three groups. While Table 5 finds the greatest numbers of positive responses for many of these groups, the proportion of these household types with positive responses remains low.

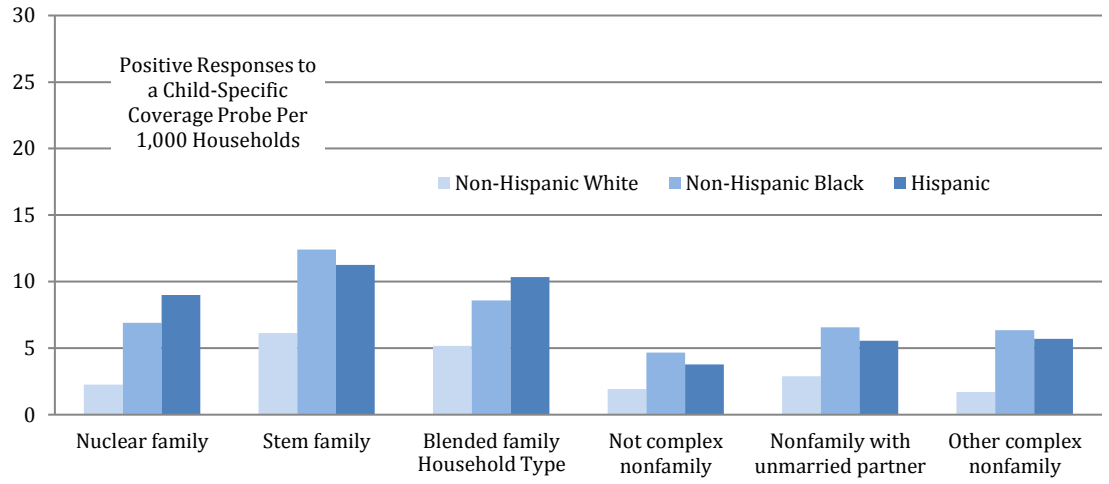

Figure 3. Positive-Response Rates by Race/Hispanic Origin and Household Type – Low Positive-Response Rates
Source: 2010 Census, special tabulation.

Figure 4 includes the household types with the highest positive-response rates. These are households that had the greatest confusion about including children on their census forms. For most of these race and Hispanic origin and household type combinations, the positive-response rate exceeds 10 per 1,000 indicating that more than 1 percent of respondents living in these types of households had confusion about including a child on their census form. Generally, the highest positive-response rates within each household type were households with a Hispanic householder. We also observe high positive-response rates in most of these household types for households with a Black householder. Family households with other nonrelatives (e.g., roomers, housemates, and roommates) had some of the highest positive-response rates across all groups.

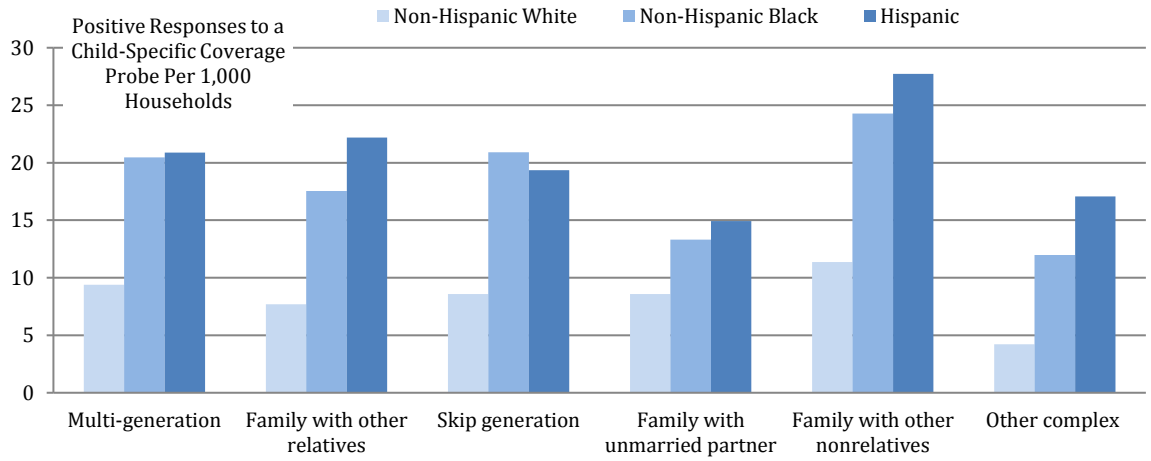

Figure 4. Positive-Response Rates by Race/Hispanic Origin and Household Type – High Positive-Response Rates
Source: 2010 Census. special tabulation.

5.3 Coverage Followup Adds

Which detailed complex household types had the greatest number of young children added in coverage followup and the highest Coverage Followup add rates? How did this vary by race and Hispanic origin of the young child?

The CFU operation accounted for 69,500 of the 20.2 million young children enumerated in the 2010 Census. This equates to a CFU add rate of about 3 per 1,000 young children. Table 6 displays the distribution of the CFU-added young children by household type. Households that we defined as noncomplex had a CFU add rate of just over 1 per 1,000 while complex households had CFU add rates of almost 7 per 1,000. Within the complex household types we see the highest CFU add rates for other complex nonfamily households (over 17 per 1,000), skip generation households (11 per 1,000), and complex family with other relatives (11 per 1,000). We find low CFU add rates for blended families and families with unmarried partners. We also find that the greatest number of CFU added young children were in the complex family with other nonrelatives, the multi-generation, the nuclear family, and the family with other relatives subgroup.

Table 6. Coverage Followup Adds by Household Type

Household Type	Young Children Added in CFU	Percent of Total Young Children Added in CFU	Number of Young Children	Percent of Total Young Children	Coverage Followup Add Rate
TOTAL	**69,500**	**100.0**	**20,160,000**	**100.0**	**3.4**
NONCOMPLEX	**16,000**	**23.0**	**12,170,000**	**60.4**	**1.3**
Nuclear family	12,000	17.3	9,932,000	49.3	1.2
Stem family	4,000	5.8	2,239,000	11.1	1.8
COMPLEX	**53,500**	**77.0**	**7,992,000**	**39.6**	**6.7**
Blended Family	950	1.4	676,000	3.4	1.4
Multi-generation	14,500	20.9	2,089,000	10.4	6.9
Family with other relative(s)	10,500	15.1	1,102,000	5.5	9.5
Skip generation	1,500	2.2	138,000	0.7	10.9
Family with unmarried partner	3,100	4.5	1,684,000	8.4	1.8
Family with other nonrelative(s)	18,000	25.9	1,590,000	7.9	11.3
Nonfamily with unmarried partner	350	0.5	54,000	0.3	6.5
Other complex nonfamily	1,200	1.7	69,000	0.3	17.4
Other complex	3,400	4.9	591,000	2.9	5.8

CFU: Coverage Followup

Source: Coverage Followup File, special tabulation.

As was true with the distribution of positive responses, the distribution of CFU adds across household type differs by race and Hispanic origin of the added child (Table 7). Again, these differences are largely due to the different distributions of young children across household types by race and Hispanic origin. However, it is useful to look at the results within a race and Hispanic origin group to understand which household types may have had more difficulty counting young children for that race and Hispanic origin group. More than 80 percent of all young children added in CFU who were Black, AIAN, NHPI, Some Other Race, or Hispanic were living in a complex household. A large proportion of the Black young children added during CFU were added into multi-generational households, family households with other relatives, and family households with other nonrelatives. Also, more than 10 percent of CFU-added Black young children were added into a stem household. For other race and origin groups, the proportion of young children added in CFU to a stem household was low. Over 74 percent of all CFU-added AIAN young children were added

into multi-generation households, family households with other relatives, or family households with other nonrelatives. CFU-added Asian and White young children were primarily added to nuclear families, multi-generation households, or families with other relatives and other nonrelatives. A low proportion of CFU-added NHPI and CFU-added Hispanic young children were added to nuclear families; over 70 percent were added into multi-generation families or families with other relatives or other nonrelatives.

Table 7. Distribution of Coverage Followup Adds by Race and Hispanic Origin

	Non-Hispanic							
Household Type	**White Alone**	**Black Alone**	**AIAN Alone**	**Asian Alone**	**NHPI Alone**	**SOR Alone**	**Two or More Races**	**Hispanic**
Coverage Followup Adds	26,000	14,500	850	3,100	400	300	3,400	21,500
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
NONCOMPLEX	**33.6**	**16.7**	**9.4**	**32.7**	**6.6**	**18.5**	**21.1**	**14.8**
Nuclear family	28.6	6.0	6.5	30.0	5.0	14.9	14.3	10.9
Stem family	5.0	10.7	3.0	2.7	1.6	3.6	6.8	3.9
COMPLEX	**66.4**	**83.3**	**90.6**	**67.3**	**93.4**	**81.5**	**78.9**	**85.2**
Blended Family	1.7	0.8	1.8	0.5	0.5	0.6	1.6	1.3
Multi-generation	17.5	25.6	23.1	22.4	21.4	20.5	20.0	20.8
Family with other relative(s)	8.6	18.5	17.7	20.5	33.2	17.2	12.3	20.0
Skip generation	2.3	3.4	3.0	0.6	0.5	2.9	2.6	1.3
Family with unmarried partner	5.3	3.9	4.8	1.3	2.6	3.2	5.4	4.1
Family with other nonrelative(s)	23.9	23.9	32.9	15.5	28.2	27.3	29.4	30.6
Nonfamily with unmarried partner	0.8	0.4	0.7	0.2	0.0	0.3	0.7	0.3
Other complex nonfamily	2.0	1.6	1.7	1.2	2.1	2.9	2.0	1.5
Other complex	4.3	5.1	4.9	5.2	4.7	6.5	4.9	5.4

AIAN: American Indian and Alaska Native; NHPI: Native Hawaiian and Other Pacific Islander; SOR: Some Other Race
Source: Coverage Followup File, special tabulation.

As households are the unit of data collection for the great majority of the population, this breakdown can be very useful for future evaluation research in efforts to target households at higher risk of child undercoverage in the 2020 Census to learn more about them. This assumes that the general 2010 patterns of adds by household type will remain similar, which appear to be relatively consistent with the overall odds-ratios for distant relatives and nonrelatives in the last three censuses cited earlier in Section 2.2.

A more in-depth examination of household type by race and Hispanic origin in Table 7 shows several patterns. First, nuclear families accounted for the highest proportion of adds for Asians and Whites at 30 percent and 29 percent, respectively. For the other groups, however, the proportion of adds in nuclear families were much lower, ranging from five percent for NHPI to about 15 percent for Some Other Race and Two or More Races.

Second, the household type with the highest or second highest proportions of CFU-added young children within seven of the eight race and Hispanic origin groups (except Asians) was family household with other nonrelatives. For Hispanic, AIAN, Some Other Race, and Two or more races households, it had the highest proportions of all adds, ranging from 27 percent to 33 percent. For Whites, Blacks, and NHPI, it had the second highest proportions, ranging from 24 percent to 28 percent. For Asians, this complex household type had the fourth largest proportion at 16 percent.

Third, multi-generation households in Table 7 had the most consistent distributions of add rates, from 18 percent for Non-Hispanic Whites to 26 percent for Non-Hispanic Blacks. Fourth, family households with other relatives was more variable, ranging from nine percent for Whites to 33 percent for NHPI.

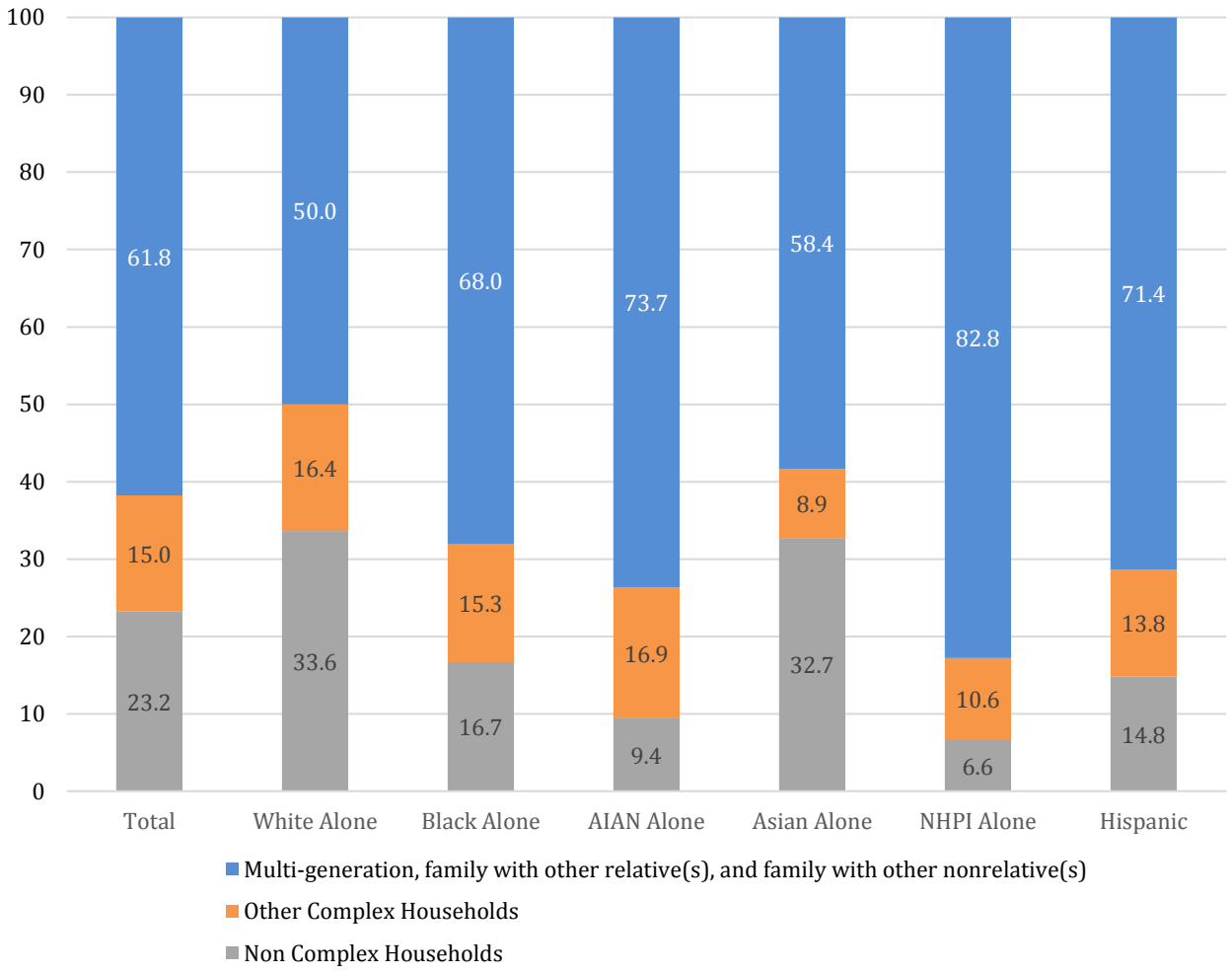

Figure 5. Distribution of Coverage Followup Adds of Young Children by Selected Household Type and Race and Hispanic Origin: 2010

AIAN: American Indian and Alaska Native; NHPI: Native Hawaiian and Other Pacific Islander
Source: Coverage Followup File, special tabulation.

Figure 5 displays the distributions of CFU adds of young children to the 2010 Census across three broad household types: 1) noncomplex; 2) complex multi-generation, complex family with other relative(s) and complex family with other nonrelatives; 3) and other complex households. Across household types, the three complex household types in blue at the top of the figure that include just

24 percent of all young children accounted for 62 percent of all CFU adds in the 2010 Census: family households with other nonrelatives (26 percent), family households with other relatives (15 percent) and multi-generation households (21 percent). Further, just these three complex household types accounted for the majority of young child adds within every one of the race and Hispanic Origin groups, ranging from 50 percent for Whites to above 70 percent for AIAN (74 percent), NHPI (83 percent) and Hispanics (71 percent).

Figure 6 displays the CFU add rates for Non-Hispanic White, Non-Hispanic Black, and Hispanic young children by selected household types. The add rates take the universe into account and identify the groups with a disproportionate number of CFU adds. The figure identifies seven household types with the highest CFU add rates. Some of these rates exceed 10 per 1,000 indicating that over 1 percent of the enumerated young children in these households were included in the 2010 Census because of the CFU operation. We see several race and Hispanic origin and households type combinations with notably high CFU add rates. Generally, the highest CFU add rates for these household types were for Non-Hispanic Black young children. Other complex nonfamily households had high CFU add rates across the groups.

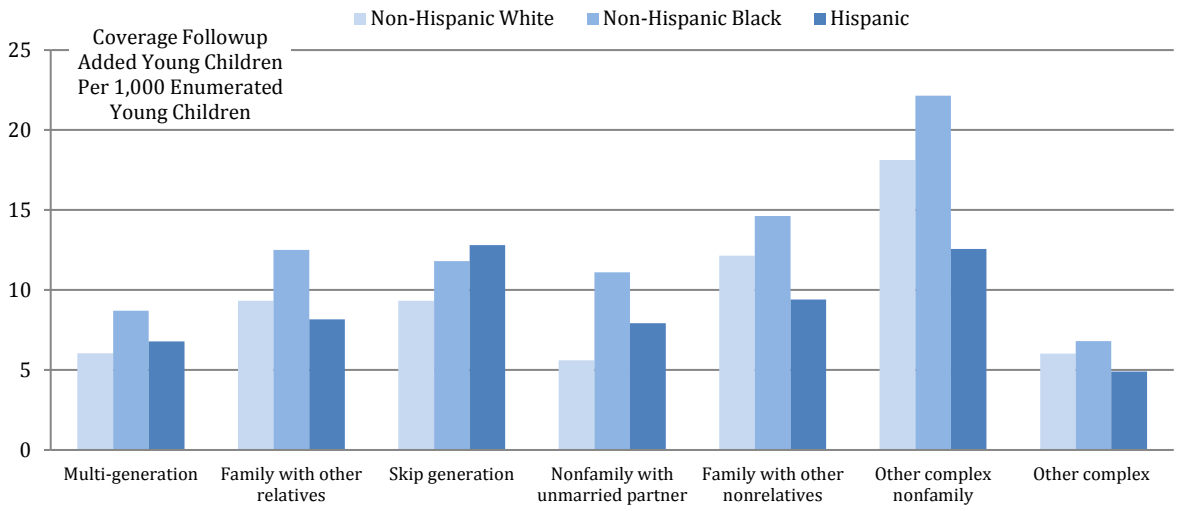

Figure 6. Coverage Followup Add Rates by Race/Hispanic Origin and Household Type – High Positive-Response Rates
Source: Coverage Followup File, special tabulation

5.4 Census Coverage Measurement Results

Which detailed complex household types had the greatest number and highest nonmatch rates in CCM?

U.S. Census Bureau (2017c) found that about 11 percent of all P-sample young children could not be matched to a 2010 Census record in the correct location. These nonmatches may represent young children who were omitted from the 2010 Census, young children enumerated in the 2010 Census with incomplete data (insufficient for matching), or young children enumerated in the 2010 Census

in a location outside of the CCM-defined search area. We interpret these P-sample nonmatches as identifying young children with 2010 Census enumeration shortcomings.

Table 8 shows the difference in nonmatch rates for complex households (14 percent) and noncomplex households (9 percent). With the exception of blended families, the P-sample nonmatch rates for all detailed complex household types were relatively high, ranging from 13 percent for other complex household types to 21 percent for nonfamily with unmarried partner or other nonrelative. For noncomplex households, stem households were high at 18 percent, compared to nuclear households with nonmatch rates of 7.2 percent. Among complex households, multi-generation households and family households with unmarried partner or other nonrelatives included the greatest numbers of P-sample nonmatched young children.

Table 8. Census Coverage Measurement Nonmatch Results by Household Type

Household Type	Percent of all Nonmatched P-Sample Young Children (weighted)	Standard Error	Nonmatch Rate (weighted)	Standard Error
TOTAL	**100.0**	**--**	**11.0**	**0.3**
NONCOMPLEX	**52.3**	**1.5**	**9.1**	**0.4**
Nuclear family	34.0	1.4	7.2	0.4
Stem family	18.3	1.1	17.6	1.1
COMPLEX	**47.8**	**1.5**	**14.1**	**0.5**
Blended family	2.4	0.4	7.6	1.3
Multi-generation	12.0	0.8	13.4	0.9
Family with other relative(s)	7.5	0.7	16.0	1.5
Skip generation	1.1	0.3	18.8	4.5
Family with unmarried partner or other nonrelative(s)	20.2	0.9	15.3	0.8
Nonfamily with unmarried partner or other nonrelative(s)	1.3	0.3	21.1	3.8
Other complex	3.1	0.5	12.6	1.8

Source: 2010 Census Coverage Measurement, special tabulation

6. DISCUSSION

In this report, we have shown that young children are more likely than older children and adults to live in complex households, the proportion of young children living in each type of household varies by race and Hispanic origin, and complex household status was related to coverage in the 2010 Census. In addition, we highlight the specific complex household types where young children are more likely to be living and that have greater coverage issues. For this section, we summarize the findings across the different analyses for the most common types of households with young children. These include nuclear families, stem families, multi-generation families, family households with other relatives, family households with unmarried partners, and family households with other nonrelatives.

Nuclear family

As mentioned earlier, in the 2010 Census, 49 percent of all young children lived in a nuclear family. However, White and Asian were the only race and ethnic groups where more than 60 percent of young children were living in a nuclear family household. In contrast, only 29 percent of AIAN

children and 21 percent of Black children were living in nuclear family households. By definition, all children living in these households are the biological or adopted child of the householder. While 41 percent of occupied housing units were nuclear family households, they accounted for only 28 percent of positive responses to one of the child coverage probes and 17 percent of young children added through the CFU operation. Approximately one third of young children that did not match between the census and the post-enumeration survey were in nuclear family households. Nuclear family households had relatively low positive-response rates of 4 per 1,000 and low CFU-add rates of 1 per 1,000. The post-enumeration survey nonmatch rate for young children living in nuclear family households was less than 10 percent. In general, nuclear family households account for a large number of young children, but the coverage risk for children in these households is low relative to other household types.

Stem family

Stem families account for 12 percent of households with young children and 11 percent of the population age 0 to 4. The percentage living in stem family households is higher for older children. For Black young children, this is the most common household type. The relationship to the householder can only be biological or adopted child. Stem families make up nine percent of occupied housing units, but 15 percent of positive responses to the child undercount probes. The positive-response rate for stem households was 9 per 1,000. Only 6 percent of young children added through CFU were living in these single-parent households; the CFU add rate was 2 per 1,000. The nonmatch rate between the census and the post-enumeration survey was 18 percent, which was as high as some complex household types. In some ways, stem family households have similar coverage patterns for young children living in complex households. In fact, these types of households may be indicative of a family that is spread across multiple housing units and this may increase the risk of being missed in the census.

Multi-generation

In the 2010 Census, 12 percent of households with young children were multi-generation households and 10 percent of the population aged 0 to 4 lived in these types of households. This was highest for Black, AIAN, and NHPI populations. The majority of these households are headed by a grandparent. In fact, only 23 percent of young children living in multi-generation households are the biological or adopted child of the householder, the remaining 77 percent are the grandchild of the householder. Only 3 percent of occupied housing units are multi-generation, but they account for nearly 9 percent of households that responded positively to the child coverage probes and therefore have a relatively high positive-response rate of 15 per 1,000. Multi-generation households account for 21 percent of the young children added through the CFU operation. This is higher than any other household type except for complex family households with other nonrelatives. The CFU add rate for multi-generation households was 7 per 1,000. There was also a relatively high nonmatch rate between the census and the post-enumeration survey for young children living in these types of households.

Clearly there is some ambiguity for grandparents about whether to include their grandchild on the census form. We also find significant coverage issues for skip generation households, which contain

a grandparent and grandchild but no parent of the child. Our research shows that skip generation households, while not one of the more common household types, have relatively high positive response rates, CFU add rates, and CCM nonmatch rates. Strategies to improve the count of young children in future censuses should target grandparents either though the residence rules, instructions on the instrument, or the informational campaigns.

Family with other relatives

Young children are more likely than older children or adults to live in family households with other relatives. Nearly 5 percent of households with young children and 6 percent of the population aged 0 to 4 live in this type of household. The percent of young children living in family households with other relatives is highest for the NHPI and Hispanic populations, 18 percent and 10 percent in Table 2, respectively[8]. NHPI also had the highest rates of any race or Hispanic origin group for complex families with other relatives for both positive responses to the child undercount probe (17 percent in Table 5) and for actual young child CFU adds (33 percent in Table 7).

Just under half (49 percent) of all young children in these households are the biological or adopted child of the householder, while 37 percent are another relative and 13 percent are a grandchild of the householder. Family households with other relatives account for 6 percent of positive responses to the child undercount probes while representing only 2 percent of occupied housing units. The positive-response rate was high at 16 per 1,000. These households also account for 15 percent of the young children added through CFU. This household type had one of the highest CFU add rates of 10 per 1,000. In addition, the CCM nonmatch rate for this household type was relatively high (16.0).

Family household with unmarried partner

In many ways, the coverage issues for young children in family households with an unmarried partner are more similar to nuclear families than to other complex household types. In these households, 95 percent of young children are a biological or adopted child of the householder, the remaining are stepchildren and nonrelatives. Only 2 percent of occupied housing units are in this category, but they make up 5 percent of households that responded positively to the child undercount probes resulting in a high positive-response rate of 11 per 1,000. While 8 percent of

[8] Native Hawaiians and Hispanics have cultural practices, beliefs and obligations toward wider sets of kin than other groups, such as non-Hispanic Whites. For Native Hawaiians, the fundamental unit of social organization is the *'ohana*, a network of relatives by blood, marriage or adoption that is the core economic unit supporting household members and other relatives. Some Native Hawaiians have units attached to, or near, their houses for 'ohana members who may come to live or stay there from their usual residences in other housing units (see Daniggelis 2012, Schwede, Terry, and Childs 2014, and Schwede and Terry 2013). Many Hispanics feel an obligation to take in relatives, friends, and even unrelated people from the same village in the home country as part of chain migration (see Goerman, 2006). Both groups are more likely to include distant relatives that fall into the generic "other relative" category that cannot be disaggregated from census statistics, such as, but not limited to, brother-in-law, cousin, niece, nephew, aunt. They also have informal adoption practices for real and fictive kin, as do American Indians and Alaska Natives. For more on cultural differences among race and Hispanic groups in terms of household structure and census enumeration, see Schwede, Blumberg and Chan (2006).

young children live in family households with an unmarried partner, they account for just 4 percent of the young children that were added through the CFU operation (CFU add rate of less than 2 per 1,000). The relatively high positive-response rate to the child undercount probes coupled with the low add rate of less than 2 might be due, in part, to the very high proportion of biological or adopted children in these households who are core household members and are less likely to be omitted than stepchildren or nonrelatives. Several other factors that may be contributing to high positive-response rates but low CFU add rates are 1) the relationship question only asking for relationships of each person to the householder (which results in no information on how the unmarried partner is related to any young children in the household); 2) the method for distinguishing family from nonfamily households (whether any of the children are related by birth or adoption to the householder), 3) whether the householder on the questionnaire (Person 1) is related to the children rostered or not, and 4) gender of the respondent[9].

The CCM results were not tabulated for this specific category. However, the nonmatch rate for family households with unmarried partner and other nonrelative was 14, which was not significantly different from the average for all complex household types (14). Again, the coverage patterns for young children living in these households are more similar to those living in nuclear family households than other complex types.

Family household with other nonrelatives

Young children are more likely than other age groups to live in family households with other nonrelatives. While nearly 8 percent of young children lived in family households with other nonrelatives, this rate exceeded 12 percent for AIAN, NHPI, and Hispanic populations. There was more variation in the relationship to householder for young children living in these households with 52 percent biological or adopted children, 25 percent grandchildren, 12 percent nonrelatives, and 9 percent other relatives. Less than 3 percent of occupied housing units were family households with nonrelatives, but they account for 10 percent of households that responded positively to the child undercount probes and had the highest positive-response rate of 19 per

[9] For example, consider a household with a woman, her son and her unmarried male partner. If she is listed as Person 1 (the householder), the mother-son relationship classifies this as a "female-householder family household with unmarried partner." As Brown and Manning (2011) note, the paternal status of the unmarried partner is not clear – he may or may not be the father of the child and may or may not be cohabiting. However, if the unmarried partner is listed as Person 1 and is not the other biological parent of the child, then both the woman and her child would be marked as nonrelatives of the householder. In this case, the household is classified very differently as a "male householder nonfamily household with unmarried partner." About 36 percent of young children under age 1 who are living in unmarried couple households are living with both parents, while 61 percent live with just their mothers and 3 percent were living just with the fathers (Kreider and Elliott 2009, using 2008 Annual Social and Economic Supplement data from the Current Population Survey). Further, women may be more likely to be the respondents, which might be part of the reason why we find a much higher number of complex families with young children than complex nonfamily households with children. Nonfamily households with unmarried partners constitute nearly 4 percent of occupied housing units with about 2 percent of total positive responses to the child undercount probe with a positive-response rate of nearly 4 percent. Young children in these households were less than 1 percent of all young children, but represented almost 2 percent of CFU young child adds. The CFU add rate for children in these households is just under 7 percent, which is about halfway between the add rates for nuclear families (just over 1 percent) and family with other nonrelatives (over 11 percent).

1,000. Young children living in this type of household made up a disproportionately high 26 percent of those added through the CFU operation; this is the largest percentage of any household type. The percentage CFU young child adds within each race group ranged from 16 percent for Asians through 24 percent for Whites and Blacks to above 30 percent for AIAN, and Hispanics. Again, in the CCM analysis, this category was not tabulated separately from family households with unmarried partners; therefore, we do not have the nonmatch rate for young children in these households.

7. CONCLUSIONS

This report focuses on the relationship between household structure and the undercount of young children in the 2010 Census. Using the complex household typology, we have documented that three types of complex households comprising just 23 percent of all households in the 2010 Census (multi-generation households, family households with other relatives, and family households with other nonrelatives) have higher positive response rates to child undercount probes and higher CFU add rates for young children. These three types of complex households account for the majority of young child adds both overall and within each of the eight Race and Hispanic Origin groups. These three types of complex households could be targeted in areas with high proportions of NHPI, Black, and AIAN populations for special outreach and evaluation purposes in the 2020 Census because of their high CFU young child positive responses and high add rates in the 2010 Census. Stem households could be considered for targeting Black households, but not those of other groups. The case for targeting nuclear households is less clear; the low rates of positive responses to the young child undercount probe (4 percent) and the even lower rate of CFU young child adds (1 percent) coupled with the very large number of nuclear households in the country would seem not to be cost efficient, even for White and Asian households. The Census Bureau can apply these findings by using 2010 Census and American Community Survey data on these variables in the Planning Database to identify, map, and target tracts at higher risk of young child omissions.

8. NEXT STEPS

The Census Bureau can apply these findings for household types overall and by race and Hispanic origin in more depth for 2020 Census outreach, targeted mailings, and evaluation research by using 2010 Census and recent ACS data to add key variables to a special internal version of the Planning Database to identify, map, and target tracts at higher risk of young child omissions. For example, a sample of tracts with high incidences of these household types could be used before the 2020 Census to target advertising and education campaigns to households at high risk of child undercoverage to try to reduce the number of young children who are undercounted, with culturally appropriate variations in messages and images for different race and Hispanic origin groups. They could also be used during the data collection period to target additional mail materials to areas with high densities of complex households. The sample could also be used to identify specific high-risk areas within tracts for ethnographic field observations during live interviews or in special followup interviews to debrief respondents who may have been confused about whether

children in their household should be rostered or not. An additional option would be to oversample tracts with these characteristics in the 2020 post-enumeration survey (the equivalent of the 2010 CCM operation) so that households at higher risk of undercounting young children would be matched back to their census forms to enable researchers to assess how accurately and completely the 2020 Census and the post-enumeration survey count young children.

At the very least, the complex household typology should be used to analyze trends in the living situations of young children in the 2020 Census. Where applicable, the complex household typology should be used in research on the coverage of young children after the 2020 Census. Schwede et al. (2017) documented that the percent of households that are complex increased from 2000 to 2010. Further, the percent of young children living in complex households increased over that period. The 2020 Census data will allow researchers to see if households are continuing to become more complex in structure and how that complexity is related to the coverage of young children in the census.

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Detailed Descriptions of Complex Household Typology

NONCOMPLEX HOUSEHOLDS

Nuclear family
Householder + spouse + natural child
Householder + spouse

Stem family (no spouse present)
Householder + natural child

Noncomplex nonfamily
Householder (lives alone)

COMPLEX HOUSEHOLDS

Blended family (with spouse)
Householder + spouse + natural child + stepchild
Householder + spouse + stepchild

Multi-generation family
3-generation: own kin only
Householder + natural child + grandchild
Householder + spouse + natural child + grandchild
Householder + natural child + parent
Householder + spouse + natural child + parent
3-generation: includes in-laws
Householder + spouse + natural child + parent-in-law
Householder + spouse + natural child +grandchild + child-in-law
Householder + natural child + grandchild + child-in-law
4-generation: own kin only
Householder + spouse + natural child + grandchild + parent
Householder + natural child + grandchild + parent
4-generation: includes in-laws
Householder + spouse + natural child + grandchild + parent-in-law
Householder + natural child + grandchild + parent-in-law

Complex family household with unspecified other relative(s)
Householder + spouse + natural child + other relatives
Householder + natural child + other relatives
Householder + spouse + other relatives
Householder + other relatives
Householder + sibling + other relatives
Householder + natural child +sibling + other relatives
Householder+ grandchild + other relatives
Householder+ not already categorized family + other relatives

Skip generation family household
Householder + grandchild
Householder + spouse + grandchild

Family household with unmarried partner
Householder + unmarried partner + natural child
Householder + unmarried partner + natural child + stepchild
Householder + unmarried partner + natural child + other nonrelative
Householder + unmarried partner + stepchild

Family household with other nonrelative(s)
Householder + spouse + natural child + roomer
Householder + spouse + natural child + other nonrelative
Householder + natural child + roomer
Householder + natural child + other nonrelative
Householder + spouse + natural child + housemate
Householder + natural child + housemate
Householder + spouse + natural child + other relatives + nonrelatives
Householder + spouse + other relatives + nonrelatives
Householder + natural child + other relatives + nonrelatives
Householder + other relatives + nonrelatives
Householder + spouse + other nonrelative
Householder + not already categorized family + nonrelatives

Nonfamily household with unmarried partner
Householder + unmarried partner
Householder + unmarried partner + other nonrelative
Householder + unmarried partner + housemate

Nonfamily household with other nonrelative(s)
Householder + housemate
Householder + roomer
Householder + other nonrelative
Householder + not already categorized nonrelative

Other complex households

2-generation ascending

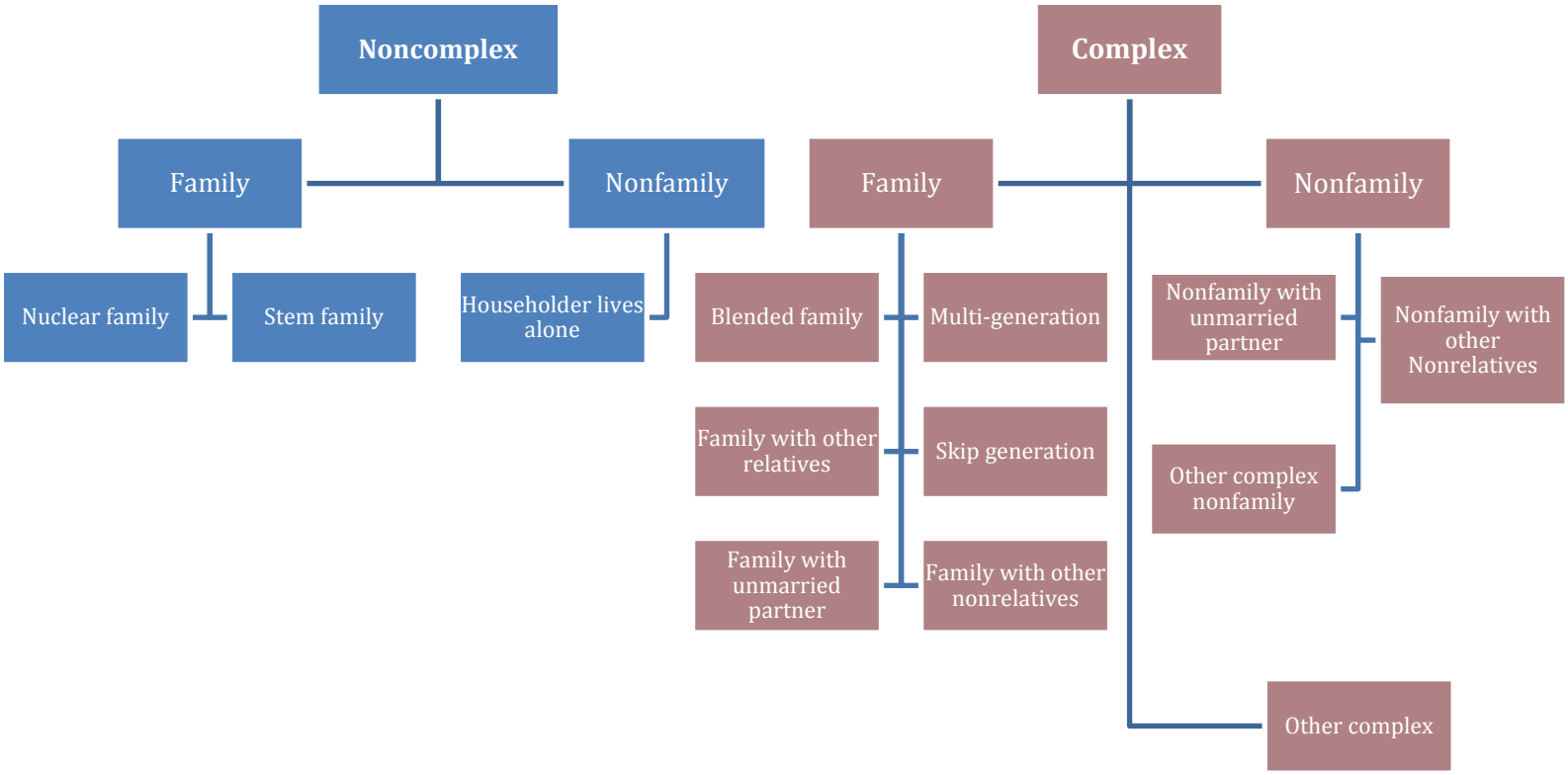
Householder + parent
Householder + spouse + parent
Householder + spouse + parent-in-law
Householder + sibling + parent

2-generation in-law descending

Householder + spouse + natural child + child-in-law
Householder + natural child + child-in-law

Laterally extended: with siblings

Householder + sibling
Householder + spouse + natural child + sibling
Householder + natural child + sibling

Appendix 2

Complex Household Typology Diagram