published in Social Service Review

Involvement with Child Protective Services and Disconnection at Age 22: Evidence from the Future of Families and Child Wellbeing Study

2025

Abstract

Child protective services (CPS) involvement is common among American families; over a third of all children and more than half of Black children experience at least one investigation by age 18 (Kim et al., 2017). However, studying the causes and consequences of CPS involvement is challenging due to data limitations. National data on children involved with CPS lack a counterfactual group, while state-level administrative data often miss key family and child factors. The Future of Families and Child Wellbeing Study provides detailed data on both CPS involvement and family and child factors but relies on self-reports which may underreport CPS involvement. In this paper, we develop a Bayesian method to correct for this underreporting and estimate the probability of CPS involvement. We demonstrate the utility of the adjusted measure of CPS involvement by analyzing its association with an important outcome for young adults—being disconnected from employment and education.

Involvement with child protective services (CPS) is a pervasive experience for American children and families. Indeed, more than a third of all children and more than half of all Black children in the United States experience one or more CPS investigations by age 18 (Kim et al., 2017). Yet, identifying the causes and consequences of CPS involvement, and of child maltreatment itself, is complicated by substantial data limitations. National administrative data from CPS systems are limited only to children and families that have already become involved with CPS, thereby excluding a necessary counterfactual condition. Linked state-level administrative data systems, while offering greater opportunities for identifying such relations, are limited to data collected as a result of interactions with public systems and typically exclude detailed information on factors such as family functioning, parenting behaviors (including abusive and neglectful behaviors), and many key aspects of child health and development. While several large national panel surveys collect extensive data on family functioning, parenting behaviors, and child health and development, most lack data on CPS involvement.

The Future of (formerly Fragile) Families and Child Wellbeing Study (FFCWS) is an exception. FFCWS is a large, national birth cohort study that has followed nearly 5,000 children and their families since the children's births in 1998-2000. The study collects, at regular intervals, detailed data on parenting behaviors, child health and development, and self-reported CPS involvement, in addition to extensive social, demographic, contextual, biological, and economic data, most recently when the children, now young adults, were age 22. Parents', primary caregivers', and young adults' self-reports of CPS involvement, collected in multiple waves of FFCWS, have the potential to enable researchers to identify those who experience CPS involvement and compare precursors and outcomes for those who do and do not. However, self-reports of CPS involvement may be biased by systematic reporting and measurement errors, including inconsistency in reporting over time and between parents and their young adult children, as well as systematically missing data at the item level or due to interview nonresponse or sample attrition. As such, relative to national estimates from administrative data, estimates of CPS involvement generated from FFCWS suggest substantial underreporting of CPS involvement. To the extent that such underreporting is systematic in nature, it has the potential to bias estimates of the causes and consequences of CPS involvement in studies thereof.

In this paper, we develop and apply a statistical method for adjusting parent and young adult self-reports of CPS involvement. We employ this method to estimate the cumulative prevalence of CPS involvement by ages 5, 9, 15, and 18 for each child in FFCWS. Our approach leverages national and state-level CPS involvement prevalence estimates from administrative data to adjust for underreporting based on a priori expectations. Additionally, we incorporate child-level information to model the probability of CPS involvement. We then illustrate the utility of the adjusted CPS involvement data by conducting analyses of associations between CPS involvement and an important young adult outcome—whether a young adult is neither working nor in school at age 22—which we refer to as disconnection. Specifically, we estimate associations of both initial self-reports of CPS involvement and adjusted measures of CPS involvement with young adults' probabilities of disconnection and assess consistency and differences of the resulting estimates. The adjusted measures will be available to other scholars using FFCWS data for future analyses, thereby facilitating research to enhance our understanding of the causes and consequences of CPS involvement.

Background

In the United States, CPS plays a crucial role in safeguarding children at-risk of or having already experienced child maltreatment by responding to allegations of abuse and neglect and, when deemed warranted, contacting parents or primary caregivers to investigate such allegations. CPS actions include screening reports and making determinations of whether an investigation is warranted, conducting investigations, making abuse and neglect determinations, providing mandated or voluntary support services, and, in severe cases, removing children from their homes or terminating parental rights (see, e.g., Berger and Slack, 2020). In this study, we focus specifically on CPS investigations (referred to as assessments in some states), defined as instances in which a family—including the parent, primary caregiver, or child—has been contacted by CPS, typically through home visitation to investigate alleged abuse or neglect.

As noted above, research aiming to determine the causes and consequences of CPS involvement, as well as of child maltreatment itself, is severely constrained by limitations of existing data. The two national administrative data systems tracking CPS involvement, the National Child Abuse and Neglect Data System (NCANDS) and the Adoption and Foster Care Analysis Reporting System (AFCARS), include state-level administrative data submitted to the federal government but lack data on children and families that are not involved with CPS. Whereas these data have been leveraged to estimate the prevalence of various levels of CPS involvement (Wildeman et al., 2014, Kim et al., 2017, Wildeman et al., 2020), as well as to estimate the effects of variation over time and between states (or counties) in public policies and population characteristics on

CPS involvement rates (Edwards et al., 2021, Yi et al., 2023, Yi and Wildeman, 2023), the lack of counterfactual samples of non-CPS involved children and families precludes individual-level analyses of the causes and consequences of child maltreatment or CPS involvement. Likewise, the National Survey of Child and Adolescent Wellbeing, the only national survey-based study to track CPS-involved children and families, includes only children who have been investigated by CPS and also lacks a counterfactual sample (Berger et al., 2009, Jones et al., 2024).

A small number of linked state-level administrative data systems, such as those for California[1] and Wisconsin,[2] include extensive data on CPS-involved children and families that have interacted with public systems, along with non-CPS-involved counterfactual groups, which facilitates research into the causes and consequences of child maltreatment and CPS involvement. However, such data systems vary considerably in the breadth and scope of programs and data sources included, as well as the span of years covered. Moreover, because they include only data reported by public systems to government agencies, they lack the full range of detailed measures of child and family characteristics and behaviors, which are essential to understanding the etiology, consequences, and mechanisms surrounding CPS involvement, including parental behaviors. Also, because these systems are limited to particular states, they preclude national inquiry, including analyses of between-state variation in policies and population characteristics over time.

Several large national surveys, such as the National Longitudinal Survey of Youth 1979 cohort's

---

[1] California's linked administrative data system is housed by the Children's Data Network (https://www.datanetwork.org/).
[2] The Wisconsin Administrative Data Core is housed by the University of Wisconsin Madison Institute for Research on Poverty (https://www.irp.wisc.edu/wadc/).

Children and Young Adult Supplement (NLSY79-CYAS), the Panel Study of Income Dynamics' Child Development Supplement (PSID-CDS), and the Early Childhood Longitudinal Study's (ECLS) birth and kindergarten cohorts, collect extensive data on family functioning, parenting behaviors, and child health and development, but lack data on CPS involvement. Although a few studies have used the parenting measures available in the NLSY79-CYAS to create measures of substandard parenting or child maltreatment risk to approximate child maltreatment-related behaviors (see, e.g., Berger, 2004, 2007), such measures do not reflect legal thresholds for child maltreatment. Information about behaviors that potentially reach legal thresholds of abuse and neglect is not typically collected in contemporary surveys because identifying such behaviors would require mandated reporting to CPS by study personnel and may also be prohibited due to protection of human subjects (Institutional Review Board) concerns. In addition, the National Longitudinal Survey of Adolescent to Adult Health (Add Health) collects self-reported retrospective data on childhood experiences of child maltreatment and CPS involvement. Because Add Health data collection did not begin until adolescence, however, the data preclude precise estimation of relations of the timing of exposure to maltreatment and CPS involvement, precursors thereto, and consequences thereof, as well as analyses of these relations during early and middle childhood. Finally, a few smaller, localized studies, such as the Illinois Families Study[3] and Wisconsin Families Study,[4] have linked detailed survey data to CPS administrative data. Yet, these studies are characterized by relatively small samples drawn from specific geographic locations for which data were collected over a relatively short time period, thus limiting their utility for understanding the overarching causes and consequences of CPS involvement.

[3] https://profiles.uchicago.edu/profiles/display/33816157.
[4] https://uwsc.wisc.edu/the-wisconsin-families-study-wiscfams/.

FFCWS is the only large-scale survey-based population study in the United States to collect data on CPS involvement throughout childhood and adolescence and, like the NLSY79-CYAS, PSID-CDS, and ECLS studies, FFCWS also includes a wide range of parenting measures that have been used to construct behavioral-approximations of child abuse and neglect (see, e.g., Berger et al., 2005; Berger, Paxson, and Waldfogel, 2009; Slack et al., 2011; Zhai et al., 2013; Berger et al., 2017; Evangelist et al., 2023; Font and Berger, 2015, Ma et al., 2018). Moreover, given that it is an ongoing birth-cohort study that has collected a wide array of extensive social, economic, contextual, biological, and behavioral data on nearly 5,000 children, now young adults, and their parents, since the children's births in 1998-2000, it is exceptionally well-suited to interrogating the causes and consequences of CPS involvement. The study strategically oversampled births to unmarried parents in 20 large U.S. cities, resulting in an extremely diverse sample that is nearly half non-Hispanic Black, a quarter Hispanic, 5 percent multiracial, and a quarter non-Hispanic White. To date, seven waves of data have been collected from mothers, fathers, primary caregivers, and children. As such, FFCWS has been widely used to study the associations between CPS involvement and a range of potential causes and consequences thereof (Berger et al., 2009; Berger et al., 2017; Berger, Paxson, and Waldfogel, 2009; Han et al., 2013; Lee, 2013; Lee et al., 2014; Font and Berger, 2015; Evangelist et al., 2023; Thomas et al., 2023). Indeed, a recent review (Kim, Chung, and Ahn, 2023, p. 7) found that FFCWS is "the most frequently used national dataset" to study the links between income and poverty and child maltreatment, including but not limited to CPS involvement.

While FFCWS offers the benefit of being the only large-scale national study to support individual-level research on CPS involvement, its CPS-involvement data are limited to parent, primary caregiver, and young adult self-reports. This is cause for concern given that CPS involvement is generally considered to be stigmatizing (Berger et al., 2009; Cooley et al., 2022; Fong, 2019; Goodman-Brown et al., 2003; Le Zhang et al., 2020). As such, it is likely that some respondents may refuse to answer CPS-involvement-related survey items or misreport noninvolvement (Negriff et al., 2017), potentially due to social desirability concerns. Moreover, item-specific refusal (missing data), nonresponse to one or more interview waves (missing data), and misreporting patterns may be systematic in nature (Cooley et al., 2022), and may also vary systematically by both actual CPS involvement status and sociodemographic characteristics such as race and ethnicity, education, and income, perhaps as a function of or due to differences in characteristics or perceived stigma among individuals and groups. As discussed below, self-reported prevalence rates of CPS involvement in FFCWS are considerably lower than those produced from administrative data. This is problematic if underreporting is systematic, rather than random, in nature, within either the full FFCWS sample or socio-demographically-defined subsamples thereof, as it may serve to bias estimates of relations between CPS involvement and its potential causes and consequences.

To address underreporting of CPS involvement in FFCWS, we use Bayesian methods to assign each focal child an adjusted probability of having had a CPS investigation, leveraging their self-reported CPS-involvement data (collected from mothers, fathers, primary caregivers, and the focal children themselves, as young adults), child and family characteristics, and a priori expected rates of CPS involvement drawn from prior state and national estimates derived from NCANDS. We use these probabilities to construct adjusted estimates of CPS involvement by focal child ages 5, 9, and 15, the ages at which FFCWS conducted interviews that included questions about CPS involvement, as well as by age 18, by incorporating self-reports from the age 22 survey wave. These adjusted estimates should more closely approximate the population prevalence rates of CPS involvement for the cohort, defined as the proportion of children that has experienced CPS involvement by a given age, than those produced by the unadjusted estimates. We use the terms cumulative rate of CPS involvement and prevalence of CPS involvement interchangeably. After computing the adjusted estimates, we demonstrate how they perform, relative to the unadjusted self-reported indicators of CPS involvement, in regression models estimating associations between CPS involvement and young adult disconnection at age 22. We selected young adult disconnection as a relevant outcome for this exercise given that prior literature has documented that young adults who were involved with CPS as children, on average, have poorer educational (Piescher et al., 2014; Stone et al., 2014) and labor market trajectories than young adults who did not experience CPS involvement (Mersky and Topitzes, 2010; Yoon et al., 2021).

Approach

Data

Our data are drawn from FFCWS, a longitudinal birth cohort study of 4,898 children born between 1998 and 2000 in 20 large U.S. cities located in 15 states (Reichman et al., 2001). Of these 20 cities, 16 (Austin, Baltimore, Boston, Chicago, Corpus Christi, Indianapolis, Jacksonville, Nashville, New York City, Norfolk, Philadelphia, Pittsburgh, Richmond, San

Antonio, San Jose, Toledo) constitute the national sample which, when weighted, is representative of all births in large US cities during the sampling period. Four additional cities are not part of the national sample (Detroit, Milwaukee, Newark, Oakland). We include all 20 cities in our analyses.

FFCWS children and their families have been followed since their births, with interviews with mothers and fathers (or primary caregivers) taking place shortly after the birth and at focal child ages 1, 3, 5, 9, 15, and, most recently, 22. Focal children were assessed at ages 3, 5, 9, 15, and 22, and interviewed at age 9, 15, and 22. We use the entire FFCWS birth cohort sample of 4,897 to produce adjusted estimates of CPS involvement. To estimate associations between unadjusted and adjusted indicators of CPS involvement and disconnection at age 22, we use a subsample of 3,230 young adults who either completed the age 22 interview and provided information on their education and employment status or who did not participate in the Year 22 interview but their PCG participated and provided details about the young adult's education and employment status at age 22.

Measures

CPS involvement. FFCWS explicitly asked mothers, fathers, and primary caregivers (if someone other than the mother or father) whether they had been contacted by CPS due to abuse or neglect concerns about any children in their household in the age 5, 9, and 15 interviews. The young adults (focal children) were asked, in the age 22 interview, whether CPS was ever involved with their family and whether there was ever a period in which they did not live with either of their biological parents as a result of CPS involvement by the time they reached age 18 (see Appendix A1 for verbatim items). We code affirmative responses to any of these items by the mother, father, primary caregiver, or young adult as indicating that CPS involvement occurred by the relevant age. Thus, our measure of CPS involvement indicates whether the child's family was ever investigated by CPS.

In addition, at each wave of data collection from age 1 to age 22, FFCWS asked mothers, fathers, and primary caregivers whether there was a period between the prior and current interview in which the focal child did not live with them and, if so, the reason therefor. Response options vary between interview waves but, in each wave, include options that the child was removed by the court or by CPS (see Appendix A2 for verbatim items). We code affirmative responses to any of these items by the mother, father, primary caregiver, or young adult as also indicating that CPS involvement occurred by the relevant age.

We use affirmative responses to the fore-mentioned items to construct indicators that CPS involvement had occurred by focal child age 5, 9, 15, and 18 (see Appendix A3 for a detailed explanation of how these indicators were constructed at each age). Our coding strategy explicitly assumes that there are no false positive self-reports of CPS involvement. That is, we assume that, if any interview respondent (mother, father, primary caregiver, or young adult) reports that the family experienced CPS involvement, as assessed by any of the fore-mentioned items, the family did experience CPS involvement, regardless of what was reported by other interview respondents or by the same interview respondent on other CPS involvement-relevant items. We argue that this is a sensible assumption given that respondents may have incentives or motivations for nonreporting CPS involvement, due to the stigma associated therewith and associated social desirability, but that they have no incentives or motivation for falsely reporting CPS involvement that did not occur. Furthermore, it is possible that some respondents were not aware or had forgotten that CPS involvement had taken place, but relatively unlikely that they would have sufficient reason to perceive CPS involvement as having taken place when it did not. As such, we code any child for which any respondent reported, in any of the relevant survey items, that CPS involvement occurred as having a 100 percent probability that CPS involvement occurred. For all other children, regardless of whether, at an interview wave, responses to the various CPS involvement-related items indicate noninvolvement or are missing (as indicated by responses of don't know, refusal to answer a specific item, or nonparticipation in the survey wave), we predict a probability of CPS involvement as a function of a priori expectations of their likelihood of being CPS-involved by a certain age (drawn from age-, race/ethnicity-, and state of residence-specific prevalence rates derived from NCANDS), as well as individual child and family characteristics.

Disconnection. We define disconnection as a young adult neither working nor being enrolled in an educational (e.g., college) or training program at approximately age 22. Specifically, a young adult is coded as not being in school or training if they report that they are not attending a program and were not/will not be attending a program, within three months before and after the age 22 interview. They are coded as not working if they report that, during the week prior to the age 22 interview, they did not work for pay, own a business, or serve in the military (those with a job but temporarily absent from work are coded as working).

Race/ethnicity. We define race/ethnicity of the young adults using four mutually exclusive categories: Black, non-Hispanic; Hispanic (non-American Indian/Alaskan Native); White, non-Hispanic; and other race/ethnicity (which includes non-Hispanic Asian and Native Hawaiian/Pacific Islander, Hispanic/non-Hispanic American Indians and Alaska Natives, and those whose race/ethnicity we are unable to determine). We include the “other” category for the sake of completeness, but the sample for that category is small and comprises groups with very different prevalences of CPS involvement. Our categorization for the most part is comparable to that used in NCANDS.

In this study, the race/ethnicity categorization follows the coding rules of prior reference data providers. The categorization prioritizes use of self-reported race/ethnicity data from year 22 and year 15, followed by parental race reported at baseline. Using year 22 data, children were assigned race/ethnicity categorization rule in the following order: (1) Assigned as Native if they self-identified as Native, regardless of Hispanic origin or the number of races indicated, (2) assigned as Hispanic if they had a Hispanic origin and were not Native American, regardless of the number of races indicated, (3) for those with a non-Hispanic origin, non-Native status, and mono-racial identification as White, Black, or Asian, the corresponding race was assigned, (4) for individuals with a non-Hispanic origin, non-Native status, and multi-racial identification, they were assigned as Black if they self-identified as both Black and White, or both Black and Asian, (5) individuals with a non-Hispanic origin, non-Native status, and multi-racial identification were assigned as Asian if they self-identified as both Asian and White.

Year 15 race/ethnicity data were used if race/ethnicity remained undetermined after applying the year 22 data, following the same rules. If race/ethnicity could not be determined after using the year 15 data, parental race reported at baseline was used, following the approach of Thomas et al. (2022). To minimize undetermined race/ethnicity cases, all available parental race/ethnicity data at baseline (variables: cm1ethrace, cf1ethrace, m1h3, f1h3, m1i4) were utilized. Parental race/ethnicity was prioritized in the following order: cm1ethrace and cf1ethrace first, followed by m1h3, f1h3, and m1i4. This parental data resolved race/ethnicity for 21 cases.

Covariates. Because CPS involvement is not randomly distributed but rather systematically associated with a host of child and family characteristics, and also varies across cities and states, we include in our CPS-involvement adjustment models a wide range of covariates that may influence the likelihood that a family becomes involved with CPS (see, e.g., Thomas et al., 2022, 2023).

Child characteristics covariates include the child's race/ethnicity (Non-Hispanic Black, Hispanic, Non-Hispanic White, Other), the child's self-reported gender (male, female), whether the child had low birth weight, the child's age at the Y1, Y5, and Y9 mother interviews (in months), and the child's age at the Y15 PCG interview (in years). See Appendix B1 and B2 for details.

Mother characteristic covariates include the mother's age at baseline, and at the age 5, 9, and 15 interviews, state of residence at the age 5 interview, nativity, whether the mother had more children by the age 5 interview than at baseline, number of children under 18 in the household at baseline and whether mother had more children in the household at the age 5 interview than at baseline, and the mother's education level at baseline and the age 1, 5, and 9 interviews (less than high school, high school or equivalent, some college or technical/trade school, college or graduate/professional school). In addition, we include the mother's marital and cohabitation status at the age 1, 5, 9, and 15 interviews (married and living with the child's father, married and living with a new partner, not married and living with the father, not married and living with a new partner, or not married and not living with any partner), the mother's housing status at baseline and the age 1, 5, 9, and 15 interviews (owns house, rents without assistance, rents with assistance, public housing, or other), as well as other maternal characteristics, including whether the mother ever worked between by the age 5, 9, and 15 interviews; the number of waves in which she experienced severe material hardship by the age 5, 9, and 15 interviews; was her household was ever in income poverty by the age 5, 9, and 15 interviews; whether she ever experienced depression the age 5, 9, and 15 interviews; whether she ever experienced poor health from by the age 5, 9, and 15 interviews; whether she ever experienced interpersonal violence (IPV) at the age 1, 5, 9, and 15 interviews; whether she ever used drugs by the age 5, 9, and 15 interviews; and whether she was ever involved in criminal activity by the age 5, 9, and 15 interviews. See Appendix B1 and B2 for details.

Father characteristic covariates include whether the father had contact with the child more than once per month at the age 1, 5, and 9 interviews, and the father's education level at baseline (less than high school, high school or equivalent, some college or technical/trade school, college or graduate/professional school). See Appendix B1 and B2 for details.

Other covariates included to adjust for CPS involvement are as follows: the missing rate of unadjusted CPS involvement at ages 5, 9, 15, and 18; the predicted probability of CPS involvement at prior waves (e.g. at age 5, 9, and 15 for the model for age 18); and survey participation indicators for the mother's participation in the age 5 and 9 interviews, PCG participation in the age 15 interview, and youth participation in the age 15 interview. See Appendix B1 and B2 for details.

In our analyses of associations between unadjusted and adjusted indicators of CPS involvement and the likelihood of disconnection, we adjust only for a parsimonious set of covariates, including the young adult's age at the age 22 interview, gender, race/ethnicity, and low birth weight status at birth, as well as the mother's education and marital and relationship status with the father at the time of the birth. We also control for the young adult's state of residence unemployment rate in the month of the interview to capture variation in labor market conditions during the period the young adults were interviewed (between June 2020 and January 2024). Detailed definitions of all variables and the timing at which they were assessed vis-à-vis the prediction model for ages 5, 9, 15, and 18, are presented in Appendix B1.

Imputation of missing data

We conduct two sets of imputation models, one to impute missing covariates for our CPS adjustment analyses and a second to impute missing covariates for our regressions estimating associations of CPS involvement with young adult disconnection. We conduct imputations for all 4,897 observations in FFCWS using the statistical package Amelia (Honaker, King, and Blackwell, 2011), which, based on the assumption that data are missing at random and are drawn from a multivariate normal distribution, fits a model to the observed data and generates imputed values for each missing data point multiple times to account for the inherent uncertainty in imputed values. Although Amelia is often used for multiple imputation, we impute missing values only once. We do not use multiple imputation because our primary aim is to adjust for underreporting of CPS involvement in FFCWS using a priori national estimates and a Bayesian latent variable approach, for which we would expect negligible differences in adjusted CPS involvement values across multiple FFCWS data sets with imputed covariates. As such, we decided against adding computational burden to an already computationally demanding approach.

We do not impute missing data on CPS involvement. Rather, we assign a value of zero to missing CPS-involvement data and include in our imputation models an indicator that CPS involvement data were missing. However, reported CPS involvement is included in our first set of imputation models because it is possible that missing values on the covariates may reflect CPS involvement status; as such, not accounting for such in our imputation models may lead to biased results. Although we include the young adult disconnection measures in our second set of imputation models, for the same reason, and impute missing values therefor, we exclude cases with initially missing values on these measures in our regressions of associations of CPS involvement with young adult disconnection.

Empirical Strategy

Adjusted CPS involvement estimation

To adjust for underreporting of CPS involvement in FFCWS, we develop and apply a Bayesian method that uses prevalence rates derived from NCANDS as a priori expectations of CPS involvement prevalence rates in the FFCWS sample. We use data on cumulative prevalence of

CPS involvement in NCANDS from Kim et al. (2017) and Yi et al. (2023).

Our (Bayesian) approach allows us to account for differential misclassification error in estimating the probability of unknown population prevalence rates of CPS involvement, given that we lack validation data to assess their certainty. In addition, the extent of underreporting in FFCWS, relative to our a priori expectations, varies by age, race and ethnicity, and state of residence (as shown in Appendix C). As such, we leverage age-, race/ethnicity-, and region or state of residence-specific NCANDS-derived prevalence rates from Yi et al. (2023), rather than national prevalence rates, in setting a priori expectations. Moreover, an extensive body of research documents that a host of child and family characteristics and behaviors are associated with children's probabilities of CPS involvement (and child maltreatment, itself); see, e.g., Font and Maguire Jack (2020). Thus, we also account for a range of such factors in producing our adjusted estimates. Rather than solely approximating the overall CPS investigation prevalence rate found in NCANDS, this approach allows us to use the a priori probabilities to better estimate the likelihood of CPS involvement for each FFCWS focal child as a function of both observed covariates and a discrete latent variable.

Simulation analyses. We first conducted four simulation analyses based on different prior assumptions of the population distribution of CPS involvement and associated misclassification rates in a random subset of the population, using generated population data. We took this approach to assess how incorporating different prior information helps adjust underestimated prevalence by demographic subgroups, relative to corresponding population prevalence rates, by estimating probabilities of the unknown values of a binary latent variable. The simulation analyses use prior information on the population CPS prevalence rate from the NCANDS population, including (1) the total rate; (2) race/ethnicity-specific rates; (3) region-specific rates (Southwest, Northeast, Midwest, Southeast, West); and (4) race/ethnicity- and region-specific rates. (We use region, rather than state, here for ease of computation; in our subsequent analysis we take advantage of state data, as detailed below.) Motivated by underreported CPS prevalence rates in FFCWS relative to national prevalence rates in NCANDS, the simulated data consists of population values of CPS involvement, z, a binary latent variable; misclassified self-reported CPS involvement, y; and observed covariates X. We denote ψ as the probability of z being 1 given our a priori expectations of the prevalence of z for each age-, race/ethnicity-, and region-specific group.

To reflect the features of real-world data, we generate a data set of 100,000 observations to represent our population and randomly draw 3,000 observations to ensure the subpopulation is representative of the original population. We generate the simulated data in four steps. First, we define the coefficients of regression models of the true outcome z and the observed outcome y to be:

$$\alpha = [-0.1,\ 1,\ 0.2,\ -0.2,\ -0.1,\ -1,\ -0.8,\ -0.9,\ -0.3]$$

$$\beta = [1.1,\ 0.25,\ 0.1,\ -0.1,\ -0.15,\ 0.2,\ -1,\ -0.7,\ -0.8,\ -0.2,\ 0.2]$$

where α is a column vector of 8 coefficients for z and β is a column vector of 9 coefficients for y.

Second, we generate the observed covariates X from the multinomial distributions $M_k(n; p_1, \ldots, p_k)$ as follows:

$$X_{\text{race/ethnicity}} \sim \text{multinomial}(0.15, 0.5, 0.25, 0.1)$$

where p_1 is the probability of a child being non-Hispanic White, p_2 is the probability of a child being non-Hispanic Black, p_3 is the probability of a child being Hispanic, and p_4 is the probability of a child being of another race or ethnicity, and:

$$X_{\text{region}} \sim \text{multinomial}(0.12, 0.18, 0.2, 0.27, 0.23)$$

where p_1 is the probability of a child from the Southwest, p_2 is the probability of a child from the Northeast, p_3 is the probability of a child from the Midwest, p_4 is the probability of a child from the Southeast, and p_5 is the probability of a child from the West. We then generate a normally distributed covariate, such that:

$$X_{continuous} \sim \text{normal}(1,2).$$

Third, we generate the Bernoulli outcome z, conditional on X using the logistic regression model:

$$z|X \sim \text{Bernoulli}\big(\text{expit}(X^T\alpha)\big).$$

Finally, we generate the observed misclassified Bernoulli outcome Y, conditional on X using the logistic regression model:

$$y|X \sim \text{Bernoulli}\big(\text{expit}(X^T\beta + \beta_9 z)\big).$$

After generating these data, we set y to zero if its corresponding value of z is zero, ensuring that misclassified cases arise solely from false negatives, where the true value of z is 1 but the observed value of y is 0. This results in 434 misclassified cases in the 3,000 observations, with no false positives, in which the true value z is 0 but the observed value of y is 1. As previously noted, we assume the FFCWS data do not include false positives since there is no reason to suspect that respondents would report CPS involvement, that is $Pr(y_i = 0|z_i = 0) = 1$, that did not occur. However, there is reason to suspect that some respondents would not report CPS involvement that did occur. Our simulation setup results in large discrepancies in CPS involvement prevalence rates between the population and the random samples across all demographic subgroups. Drawing 3,000 random observations from 100,000 population data sets results in slight discrepancies in the mean values of z by demographic subgroups relative to their population values, which serves to reflect sampling bias in real-world data.

We aim to estimate the probability that the true value of z is 1 given the observed covariates and prior information, that is $Pr(z_i = 1|y_i, X_i, \psi_i)$, and adjust for underreporting in the full FFCWS population as well as within each demographic subgroup using the a priori information of population mean values of z for each subgroup. Unfortunately, however, estimating $Pr(z_i = 1|y_i, X_i, \psi_i)$ is not straightforward because z is unobserved and cannot be regressed on the predictors. We therefore treat z as a latent variable and marginalize over this discrete latent variable. Treating z as a latent variable and estimating $\psi_i = Pr(z_i = 1|\psi_i)$ based on prior information enables us to fit a model to estimate $p(y_i|z_i = 1, X_i, \psi_i)$; marginalizing over the discrete latent variable z gives us $p(y_i|X_i, \psi_i)$. We use this information to estimate $Pr(z_i = 1|y_i, X_i, \psi_i)$ using Bayes' rule:

$$
\begin{aligned}
p(y|X,\psi) &= \sum_{Z=0}^{1} p\,(y,z|X,\psi) \\
&= p(y|z=1,X,\psi)Pr(z=1|X,\psi) + p(y|z=0,X,\psi)Pr(z=0|X,\psi) \\
&= p(y|z=1,X)Pr(z=1|\psi) + p(y|z=0,X)Pr(z=0|\psi)
\end{aligned}
$$

This result gives:

$$p(y|X,\psi) = \begin{cases} Pr(y = 1|z = 1, X)Pr(z = 1|\psi), & \text{if } y = 1 \\ Pr(y = 0|z = 1, X)Pr(z = 1|\psi) + I(y = 0)Pr(z = 0|\psi), & \text{if } y = 0 \end{cases}$$

Let $p = Pr(y = 1|z = 1, X)$ and $\psi = Pr(z = 1|\psi)$, then the results above gives:

$$Pr(z = 1|y, X, \psi) = \begin{cases} \frac{p * \psi}{p * \psi} = 1, & \text{if } y = 1 \\ \frac{(1 - p) * \psi}{(1 - p) * \psi + (1 - \psi)}, & \text{if } y = 0 \end{cases}$$

Assessment of prior distributions using a Bayesian latent variable model. The simulation analysis consisted of four scenarios, each using different prior information for comparing the adjusted prevalence of the demographic subgroups to their population prevalence. The first scenario uses the overall population prevalence; the second applies race/ethnicity-specific prevalences; the third applies region-specific prevalences; and the fourth incorporates both race/ethnicity- and region-specific prevalences.

The a priori information is used to estimate the probability ψ from our prior distribution, a beta distribution with parameters A and B. The value of A is determined by the expected (a priori) number of respondents with CPS involvement based on the population data. The value of B is determined by the expected number of respondents without CPS involvement. For example, under the first scenario, which uses only a priori information on the prevalence rate in the full population, the population prevalence of CPS involvement is 0.43. As such, the expected number of cases with CPS involvement is 1,287 out of 3,000, such that A = 1,287 and B = 1,713. We assigned the same prior distribution to each observation, wherein the expected total prevalence ranges from approximately 0.39 to 0.47. The second scenario incorporates four prior distributions, one for each of the race/ethnicity-specific groups. The expected prevalence for non-Hispanic White children ranges from approximately 0.23 to 0.41; non-Hispanic Black children from 0.48 to 0.60; Hispanic children from 0.28 to 0.43; and those of other race and ethnicity from 0.17 to 0.39. The third scenario includes five region-specific groups, and the fourth scenario includes 20 race/ethnicity- and region-specific groups, each with its own corresponding prior distribution.

We perform the simulation analyses using the Bayesian inference program Stan given its flexibility in specifying priors and fitting models, as well as its high-performance statistical computation. We first fit the following joint model:

$$\begin{aligned} p(y_i, z_i, \psi_i | X_i) &= p(y_i | z_i, \psi_i, X_i) p(z_i | \psi_i, X_i) p(\psi_i | X_i) \\ &= p(y_i | z_i, X_i) p(z_i | \psi_i) p(\psi_i | X_i) \end{aligned}$$

such that that y is estimated as a function of z and X (the covariates) and the prior model, $z \sim \text{Bernoulli}(\psi)$. As shown in the joint model, there are three conditional distributions in our Stan model:

$$\begin{aligned} y_i | z_i, X_i &\sim \text{Bernoulli}(p_i) \text{ where } p_i = \text{expit}(X^T \beta + \beta_9 z) \\ z_i | \psi_i &\sim \text{Bernoulli}(\psi_i) \\ \psi_i | X_i &\sim \text{beta}(A_i, B_i), \text{ where } A_i \text{ and } B_i \text{ are specified in the prior.} \end{aligned}$$

The joint distribution for y and z is summed to marginalize the latent variable z out of the model:

$$\begin{aligned} p(y_i|X_i,\psi_i) &= \sum_{z_i=0}^{1} p\,(y_i, z_i|X_i,\psi_i) \\ &= p(y_i|\mathrm{z}=1, X_i)Pr(z_i=1|X_i) + p(y_i|z_i=0, X_i)Pr(z_i=0|X_i). \end{aligned}$$

$Pr(z_i = 1|y_i, X_i, \psi_i)$ is computed by the estimated likelihood and prior probabilities using Bayes' rule at the final stage of our Stan model.

The results of our simulation analyses, employing each of the four approaches, are presented in Figures 1 and 2. Figure 1 shows the posterior means and one standard deviation intervals of the adjusted prevalence rates._The approach using both race/ethnicity- and region-specific prior information yields adjusted estimates that are much more closely aligned with the population values than the approaches using lesser prior information. Figure 2 illustrates the distributions of misclassification rates for each approach. Here, we see that the approach using race/ethnicity- and region-specific rates performs best, reflecting that using the most detailed prior information results in the most accurate estimation. In other words, our model performs particularly well at capturing the population prevalence rates when we incorporate prior information on all relevant demographic subgroups, as in the fourth scenario.

FFCWS adjustment analyses. To adjust for underreporting of CPS involvement in FFCWS, we apply the same modeling method used in the simulation analyses, at each relevant age (5, 9, 15, and 18), using the FFCWS data. In addition, at each subsequent age, we incorporate in our prediction model the estimated probability of CPS involvement generated by the model estimated for the prior age. As such, we incorporate all information from ages 5, 9, and 15 when predicting the probability of CPS involvement at age 18 (and all information from prior ages when predicting CPS involvement at age 9 and 15). Moreover, rather than assuming a priori population rates at the race/ethnicity- and region-specific level, as we did in the simulation analyses, we assume a priori population rates at the race/ethnicity- and state-specific level when sample sizes permit. We opted to use region rather than state in the simulation analyses because state-specific simulations would have been unnecessarily computationally complex, and we have no reason to expect that reliance on state-specific a priori rates would result in less-accurate predictions than reliance on region-specific a priori rates in the FFCWS data; rather, state-specific rates are likely to improve the accuracy of our estimates. Otherwise, the modeling procedure is consistent for each age-, race/ethnicity, and state-specific group, albeit with some variation in the predictors used at each age (see Appendix B1 and B2).

We first estimate the adjustment model using as prior information the total national CPS investigation prevalence rates for four racial and ethnic groups (Non-Hispanic Black, Hispanic, Non-Hispanic White, and other race/ethnicity) at each age (5, 9, 15, and 18), derived from Kim et al (2017). The national models incorporate 16 age- and race/ethnicity-specific a priori expectations of population CPS involvement rates. We estimate these models, which exclude state-specific a priori expectations, because some age-, race/ethnicity- and state-specific subgroups in FFCWS lack adequate sample size for prediction. Specifically, we adjusted any age-, race/ethnicity-, and state-specific subgroup with fewer than 20 observations in the FFCW data using national a priori expected prevalence rates. The subgroups for which we use national rather than state-specific estimates are those without corrected state estimates and intervals in Appendix D1-D6.

The 20 FFCWS cities are clustered in 15 states, and our analyses focus on estimates for four racial and ethnic groups at each age, resulting in a set of 240 age-, race/ethnicity-, and state of residence-specific subgroups. We assign each child in FFCWS a prior distribution based on their race/ethnicity and state of residence at each age, in which the value of the latent probability of having experienced a CPS investigation, ψ, is randomly sampled. We fit models for each age, race/ethnicity, and state subgroup, continuously updating the national CPS investigation prevalence estimate with each iteration. We also incorporate predicted probabilities of CPS involvement produced by the model at the previous age as predictors for the subsequent age model. In all, we fit 64 models using 256 prior distributions across subgroups.

Appendix D1 presents the full-sample estimated probability distributions for FFCWS at each age. State-specific unadjusted and adjusted CPS investigation prevalence rates for FFCWS, along with the a priori expectations, are presented in AppendixD2-D6. As discussed in the Results section below, the adjusted CPS prevalence rates are often higher than the associated a priori expectations when compared to national rates. This is not surprising given that FFCWS is an urban sample with an over-sample of children born to unmarried parents.

Associations of unadjusted and adjusted CPS involvement with young adult disconnection estimation

We estimate associations of unadjusted and adjusted indicators of CPS involvement using standard ordinary least squares regressions in which we regress an indicator of disconnection on an (unadjusted or adjusted) indicator that a child's family was investigated by CPS and the parsimonious set of covariates described above. We estimate linear probability models rather than logit or probit models for ease of interpretation. Our adjustment procedure assigns each child an estimated probability of having had a CPS investigation but does not assign them a dichotomous indicator (1 or 0 value) of such. We use two separate approaches to assign each child an indicator of having experienced a CPS investigation, which we refer to as fixed and random methods.

In the fixed method, we assign a child a value of 1 (having experienced a CPS investigation) or 0 (not having experienced a CPS investigation) using a threshold for assignment derived from the posterior mean probabilities of the age-, race/ethnicity-, and state-specific subgroup to which the child belongs, such that the overall CPS investigation rate in FFCWS approximates the a priori CPS investigation rate for that subgroup as closely as possible. For example, if the cumulative CPS investigation rate by age 18 for non-Hispanic Black youth in California has a posterior mean probability of 0.60, we assume that the true prevalence rate for this subgroup in the population represented by the FFCWS data is 60 percent. We therefore dichotomize the continuous variable for non-Hispanic Black youth in California so that approximately 60 percent are classified as having experienced CPS involvement and 40 percent as not having experienced CPS involvement. Specifically, individuals who self-report a value of 1 already have posterior mean probabilities of 1, under the assumption of no false positives. Individuals who self-report a value of 0 (indicating no CPS involvement) but whose posterior mean probabilities are the highest are then reclassified as 1 (indicating CPS involvement) until a total of 60 percent non-Hispanic Black youth in California have a value of 1.

In the random method, we randomly assign each child a value of 1 or 0 by sampling these binary values from a Bernoulli distribution, where the parameter is the estimated posterior probability of CPS involvement for that child. This random assignment simulates the uncertainty inherent in the process of converting continuous posterior probabilities into binary outcomes. Through this method, we generate thousands of different combinations of newly estimated CPS predictors, each representing a possible realization of the CPS involvement for each child. These combinations serve as alternative representations of the data, incorporating the variability in the CPS predictor estimates. Once the binary combinations are generated, we fit a regression model for each combination to estimate the relations between the predictors and the outcome. After fitting these models, we select the combination that produces regression results most closely aligned with those obtained when fitting a model with the continuous posterior probabilities, which represent our best estimate because continuous posterior probabilities offer greater flexibility in estimating the exposure effect compared to binary classifications. Converting probabilities into binary outcomes introduces additional sources of error, which can distort the accuracy of the estimated effect. Therefore, we prioritize finding the binary combination that best approximates the results from our preferred continuous model. Appendix E further illustrates that the coefficients generated by the fixed method, which uses a predetermined binary classification, fall reasonably within the distribution of coefficients produced by the random method.

Results

Adjusted CPS involvement estimates

Figure 3 presents overall and race/ethnicity-specific unadjusted and adjusted (using the fixed method) cumulative prevalence rates of self-reported CPS investigations in FFCWS, and cumulative national prevalence rates of CPS investigations derived from NCANDS, at ages 5, 9, 15, and 18. We present both weighted and unweighted FFCWS estimates because, whereas the weighted estimates are more appropriate for comparison to the national estimates, FFCWS assigned weights to respondents only in 16 of the 20 cities that constitute the national sample. Thus, we present weighted estimates for the national sample of 3,442 focal children and unweighted estimates for the full sample of 4,897 focal children.

On the whole, self-reported CPS investigation rates in FFCWS are substantially underreported relative to national rates. The unadjusted weighted FFCWS prevalence rates range from 49 percent (at age 18) to 60 percent (at age 15) smaller than the national prevalence rates, and the unadjusted unweighted FFCWS prevalence rates range from 27 percent (at age 18) to 41 percent (at age 15) smaller. It is unsurprising that these differences are larger when weighted than when unweighted given that FFCWS is drawn from large cities and oversampled, by a three-to-one ratio, nonmarital births, which disproportionately occur to low-income and racial- and ethnic-minority families, to marital births. As such, the unweighted data overrepresent low-income and racial and ethnic minority families, who are also at highest risk of CPS involvement. As a result, the most advantaged families in the sample—those that are at lowest risk of CPS involvement—receive the largest weights and those at highest risk receive the smallest weights. Our adjustment strategy serves to bring FFCWS estimates of CPS involvement substantially more in line with national estimates ranging, in the weighted data, from 14 percent smaller (at age 5) to 10 percent larger (at age 18) and, in the unweighted data, from 20 percent (at age 15) to 32 percent (at age

18) larger. It makes sense that we find higher cumulative prevalence rates of CPS involvement in the FFCWS sample of families (births) in large cities than among the full U.S. population. It also makes sense, given the composition of the FFCWS sample, that we find higher rates of CPS involvement in the unweighted data than in the weighted data.

Figure 3 further reveals considerable incongruence between the FFCWS and national estimates in each of the racial and ethnic groups we consider, though patterns thereof differ substantially when considering weighted and unweighted FFCWS data. The unweighted data suggest that non-Hispanic Black and Hispanic children and families are considerably more likely to underreport CPS involvement than non-Hispanic White children and families, and that children and families in the other race/ethnicity group overreport CPS involvement. Specifically, relative to national estimates, unweighted FFCWS cumulative prevalence estimates at age 18 are 9 percent lower for non-Hispanic White, 32 percent lower for non-Hispanic Black, and 25 percent lower for Hispanic children; they are 57 percent higher for children of another race or ethnicity. However, this pattern reflects the composition of the unweighted sample. Once the data are weighted, we find relatively similar patterns of underreporting for non-Hispanic White (46 percent lower than national estimates), non-Hispanic Black (43 percent lower), and Hispanic (46 percent lower) children, as well as for children of another race or ethnicity (29 percent lower). As in the full sample, for non-Hispanic White, non-Hispanic Black, and Hispanic children, our adjusted FFCWS cumulative prevalence rates are considerably more consistent with, though modestly higher than, national estimates (again, reflecting that FFCWS is an urban and low-income sample), with adjusted weighted FFCWS cumulative prevalence rates at age 18 for non-Hispanic White, non-Hispanic Black, and Hispanic children being 19 percent, 13 percent, and 16 percent higher than national prevalence rates, respectively.

Our cumulative estimates for children of the “other” race/ethnicity category are substantially higher than the national estimates, with FFCWS adjusted cumulative CPS investigation rates at age 18 being 86 percent higher when weighted and 110 percent higher when unweighted. This reflects that the “other” race/ethnicity group in the FFCWS sample is both small and heterogeneous, consisting of Asian populations, which are typically underrepresented in CPS caseloads, American Indian/Native American populations, which are substantially overrepresented in CPS caseloads, and other populations. This other race/ethnicity group comprises just 4.5 percent of the unweighted (full) FFCWS sample and 8.6 percent of the weighted (national) sample, reflecting just 220 and 295 observations in each sample, respectively. Given the limited number of observations for this group, combined with its heterogenous composition, we cannot be confident in the precision or accuracy of our adjusted estimates therefor. As such, these estimates should be viewed with extreme caution. While our approach to coding race/ethnicity is largely consistent with the framework used by Kim et al. (2017), we combined Asian, Native American, and “unable to determine” into a single “Other” category. In contrast, Kim et al. (2017) used distinct categories for Native American and Asian/Pacific Islander.

Associations of unadjusted and adjusted CPS involvement with young adult disconnection

To examine whether underreporting of CPS involvement in FFCWS may result in biased estimates of associations of CPS involvement with outcomes, we estimate regressions of the unadjusted self-reported indicator, fixed method adjusted indicator, random method adjusted indicator, and continuous adjusted measure of CPS involvement with young adults' disconnection at approximately age 22, and assess consistency and differences among the resulting estimates. These results are shown in Table 1, in which each cell presents the coefficient and standard error for the CPS investigation variable from a single regression for the unadjusted, fixed adjusted, and continuous adjusted methods, and the mean of the coefficients and mean of the standard errors for the CPS investigation indicators for the random adjusted method. We include results for the other race/ethnic group in the table for completeness but do not discuss them due to the small sample size (N=63) for this group.

On the whole, these results indicate that underreporting of CPS involvement in FFCWS may result in underestimates of associations of CPS involvement with disconnection. This is particularly apparent when using our preferred continuous adjusted measure, which makes fuller use of the available information on the probability of involvement than any of the binary measures.

Considering the full sample results, we find using the unadjusted measure that having experienced CPS involvement is associated with an approximately 5-percentage-point (212 percent relative to the unadjusted mean among non-CPS involved youth) greater probability that a young adult is disconnected. However, while the estimated association of CPS involvement with disconnection is smaller and nonsignificant when estimated using the fixed adjusted approach, it is slightly larger and significant in the random adjusted and continuous adjusted approach (with effect sizes of 5 and 6 percentage points, respectively). Considering the racial and ethnic subgroups, we find null or small associations for non-Hispanic Black young adults, but significant negative associations for both Hispanic young adults (ranging from -8 percentage points using the fixed adjusted measure to -17 percentage points using the continuous adjusted measure) and non-Hispanic White young adults (ranging from -5 percentage points using the fixed adjusted measure to -9 percentage points using the continuous adjusted measure).

We also find variation in these associations by young adult gender, both for the full sample and for the racial and ethnic subgroups. For the full sample, we find no significant associations of CPS involvement with disconnection for men. For women, we find that CPS involvement is associated with a greater likelihood of disconnection, of varying magnitude using the unadjusted (roughly 7 percentage points), fixed adjusted (6 percentage points), random adjusted (8 percentage points), and continuous adjusted (9 percentage points) approaches.

Disaggregating the sample by both gender and race/ethnicity provides further insights. For Black male young adults, although the estimates from the unadjusted and random adjusted approach are nonsignificant, we find CPS involvement to be associated with a lower likelihood of disconnection using both the fixed adjusted (roughly 8 percentage points) and continuous adjusted (10 percentage points) approaches. We find no associations of CPS involvement with disconnection for Black women.

Consistent with the full sample results, we find large and statistically significant associations of CPS involvement with an increased likelihood of disconnection for both Hispanic men and Hispanic women, which is robust to each of the four approaches. The magnitudes of association produced by approaches differ, however, with the continuous measure providing the largest estimated associations (18 percentage points for men and 16 percentage points for women). In contrast, we find less consistent evidence of associations for non-Hispanic White young men or women, with most estimates of modest size and statistically nonsignificant.

To provide further insight on our preferred continuous measure, and in particular to check for non-linearities, we estimated supplemental models for which we created and entered indicators for quintiles of the probability of CPS involvement. Results for these supplemental models are shown in Appendix F and suggest that, for most groups, results for the full sample are driven by those with the highest probability of CPS involvement (i.e., those from the highest quintile).

Discussion

The purpose of this study is twofold: to develop and test a method for correcting underreporting of CPS involvement by young adults and their families, and to demonstrate the utility of the correction by estimating associations between CPS involvement and young adult disconnection after correcting for underreporting, with a focus on whether the results using corrected measures differ from estimates using uncorrected CPS involvement measures. This endeavor is particularly important given that limited data are available for comparing children and families involved with CPS to their peers who have not had such involvement. FFCWS provides unique opportunities to examine the causes and consequences of both child maltreatment and CPS involvement by offering detailed longitudinal data, measured at regular intervals, spanning social, demographic, contextual, biological, and economic factors, including parenting behaviors, CPS involvement, and child health and development, for a population-based sample. Indeed, it is the only large-scale population-based study to do so. However, CPS involvement in FFCWS is self-reported by youth, their parents, and primary caregivers, and reflects substantial underreporting relative to national CPS involvement prevalence estimates. This underreporting does not appear to be random. As such, it has the potential to bias estimates of relations of CPS involvement with potential causes and consequences thereof.

Our Bayesian approach, which incorporates age-, race/ethnicity-, and state of residence-specific a priori information on CPS investigation prevalence, as well as observed child and family characteristics that are associated with CPS involvement risk, enables us to adjust for underreporting for the full FFCWS sample and demographically defined subgroups thereof. Our adjustments result in CPS involvement rates in FFCWS that are considerably more aligned with, though modestly higher than, national estimates. Indeed, our weighted adjusted cumulative CPS involvement rate by age 18 is 10 percent higher than the national estimate for the full sample, and 19 percent, 13 percent, 16 percent higher than national estimates for the non-Hispanic White, non-Hispanic Black, and Hispanic samples, respectively. It is 86 percent higher for the "other" race/ethnicity sample, however, as discussed above we have little confidence in this estimate given both considerable heterogeneity within, and the small number of observations in, this sample. That our adjusted estimates are larger in magnitude than national estimates attests to the efficacy of our approach: FFCWS is an economically precarious, urban sample and poor and urban families are more likely than non-poor and non-urban families to experience CPS involvement.

In addition to developing and testing these adjusted measures, we will make both the predicted probability of CPS involvement and the adjusted (fixed) indicator of CPS involvement for each focal child, at each age, publicly available in future FFCWS data releases to facilitate their use by other researchers.

We leverage our adjusted measures to examine whether CPS involvement is associated with disconnection among young adults at approximately age 22 and compare these results to those produced using unadjusted measures. On the whole, our findings indicate that estimates using unadjusted self-reported measures may be biased, in this case potentially understating the association between CPS involvement and disconnection among young adults. This underestimation is consistent with measurement error attenuating estimates using the unadjusted measure.

When stratifying our sample by race and gender we find considerably heterogeneity in the association of CPS involvement with disconnection using both unadjusted and adjusted measures. Substantively, estimates using the adjusted measures indicate that CPS involvement is associated with a greater likelihood of disconnection primarily for Hispanic young adults, both men and women. We also find some evidence from the unadjusted and fixed adjusted approaches that CPS involvement is associated with a lower likelihood of disconnection for non-Hispanic Black males. We find less evidence of significant association of CPS involvement for non-Hispanic White men or women, though this may, at least in part, reflect smaller sample sizes for non-Hispanic White men and women compared to non-Hispanic Black and Hispanic men and women, who make up the majority of the FFCWS sample.

For Hispanic men and women, CPS involvement is consistently associated with an increased likelihood of disconnection across all model specifications. This pattern is consistent with prior scholarship that has documented an inverse relation between CPS contact and wellbeing among Hispanic children and families (Garcia et al., 2012; John, 2023). Scholars have noted disparate outcomes for Hispanic children, relative to non-Hispanic White children, in the U.S. child welfare system, which potentially stem from inequitable service administration and bias (John, 2023). Hispanic children are more likely than non-Hispanic White children to be reported at a younger age, to experience out-of-home placement, and to spend longer periods in foster care (Ayón, 2011; Ayón et al., 2011; Davidson et al., 2019)). These patterns for Hispanic children are attributed to limited access to resources, fewer culturally competent caseworkers, and higher likelihoods of low-income status—especially for immigrant families (Chenot et al., 2019; Garcia et al., 2012; John, 2023). They may also reflect, at least in part, that CPS efforts are often attenuated by constrained resources and culturally incongruent services. Considering that Hispanic children represent the fastest growing population of children in the child welfare system (Ayón, 2011; Ayón et al., 2011), it is important to understand both risk and protective factors that may influence their successful transition into adulthood following contact with CPS.

Conversely, our findings for non-Hispanic Black men indicate that CPS contact may be associated with decreased likelihood of disconnection. This finding is somewhat surprising given prior results in other data that CPS contact is associated with adverse outcomes for youth, including non-Hispanic Black youth (e.g. Fong, 2020; Roberts, 2002; Roberts, 2012). It is possible that this finding reflects that FFCWS oversamples low-income racially marginalized families in large cities. That is, non-Hispanic Black males in our sample may have increased exposure to adverse circumstances, such as neighborhood violence and poverty, such that CPS involvement provides an avenue to support and better care. In more extreme cases, that necessitate child removal, non-Hispanic Black children within our sample may be more likely than other children involved in CPS to be placed with relatives as opposed to strangers, mitigating the distress that is often an attendant consequence of out-of-home placements following CPS investigations. In recent years, CPS has emphasized both family reunification and preservation of families through increased reliance on formal kinship care for out-of-home placements (McDaniel, 2020). Evidence suggests that, when child removal is necessary, formal kinship care—especially when coupled with financial support to caregivers—is more advantageous to child wellbeing than placement with strangers (Wu et al., 2024). Data from the Administration for Children & Families indicate that non-Hispanic Black children are more likely to be placed in formal kinship care compared to children of other races (Administration for Children & Families, 2022). Further research should investigate these and other potential mechanisms by which CPS may positively or negatively influence young adult outcomes.

Several limitations should be considered in interpreting and contextualizing our findings. First, although we employed the best available empirical approach for adjusting for underreporting of CPS involvement, including estimating a predicted probability of involvement and adjusted indicators of involvement for each FFCWS child, we cannot be certain that we have correctly identified which children did and did not actually experience CPS involvement. For this reason, our preferred measure is the continuous one (rather than a binary indicator which would be more prone to error). Second, our analyses of associations of CPS involvement with young adult disconnection are purely descriptive in nature and do not lend themselves to causal interpretation. We recognize that there are many factors associated with both CPS involvement and young adult outcomes that we are not able to capture, even in an extremely rich dataset such as FFCWS. Third, we examine only whether a family was investigated by CPS and do not consider whether families were more deeply involved with the child welfare system. Only a minority of investigations lead to a substantiated report or an offer of services, and only a small share of investigated children are placed out of home, and we would expect heterogeneity in associations of CPS involvement with disconnection by subsequent CPS actions. Future research would do well to examine associations between various levels of CPS involvement and young adult outcomes, as well as examining potential heterogeneity in such associations by the age at which children experienced these actions. Fourth, we examine associations of CPS involvement with only one young adult outcome, disconnection. This is, arguably, a core component of a successful transition to adulthood but is, of course, not the only outcome of import. Future research should examine additional outcomes, such as health, mental health, criminal justice involvement, and family formation. Relatedly, future research should leverage the longitudinal data in FFCWS to examine potential mechanisms linking CPS involvement with young adult wellbeing. Moreover, CPS is not the only consequential system with which young people may be involved. Many of the young people in our sample have had contact with the police or other parts of the criminal legal system during childhood, adolescence, and young adulthood, and some young people have been involved with both CPS and the criminal legal system. Future research should also examine the associations between multi-system involvement and outcomes for young adults.

Despite these limitations, this study illustrates the utility of employing Bayesian methods to correct for underreporting of CPS involvement by survey respondents and provides evidence that doing so may illuminate potential bias in empirical analyses using underreports thereof. Indeed, we tend to find larger associations of CPS involvement with young adult disconnection using adjusted measures than unadjusted measures. Taken together, our results point to potentially adverse associations between CPS involvement and connections to school and work for Hispanic young adults, as well as potentially beneficial associations between CPS involvement and such connections for non-Hispanic Black male young adults. These results, while descriptive, warrant further attention in future research.

References

Administration for Children & Families. (2022). With a focus on prevention and kinship care, number of children entering foster care decreases for the fourth consecutive year. U.S. Department of Health and Human Services, 4 Nov.

Ayón, C. (2011). Latino child welfare: Parents' well-being at the time of entry. *Families in Society,* 92(3), 295-300.

Ayón, C., Krysik, J., Gerdes, K., Androff, D., Becerra, D., Gurrola, M., Moya-Salas, L., & Segal, E. A. (2011). The mental health status of Latino children in the public child welfare system: A look at the role of generation and origin. *Child and Family Social Work*, 16(4), 369-379.

Berger, L. M. (2004). Income, family structure, and child maltreatment risk. *Children and Youth Services Review*, *26*(8), 725-748.

Berger, L. M. (2007). Socioeconomic factors and substandard parenting. *Social Service Review*, *81*(3), 485-522.

Berger, L. M., Bruch, S. K., Johnson, E. I., James, S., & Rubin, D. (2009). Estimating the "impact" of out-of-home placement on child well-being: Approaching the problem of selection bias. *Child Development*, 80(6), 1856-1876.

Berger, L. M., Font, S. A., Slack, K. S., & Waldfogel, J. (2017). Income and child maltreatment in unmarried families: Evidence from the earned income tax credit. *Review of Economics of the Household*, *15*, 1345-1372.

Berger, L. M., McDaniel, M., & Paxson, C. (2005). Assessing parenting behaviors across racial groups: Implications for the child welfare system. *Social Service Review*, 79(4), 653-688.

Berger, L. M., Paxson, C., & Waldfogel, J. (2009). Mothers, men, and child protective services involvement. *Child Maltreatment*, *14*(3), 263-276.

Berger, L. M., & Slack, K. S. (2020). The contemporary US child welfare system (s): Overview and key challenges. *Annals of the American Academy of Political and Social Science*, *692*(1), 7-25.

Chenot, D., Benton, A. D., Iglesias, M., & Boutakidis, I. (2019). Ethnic matching: A two-state comparison of child welfare workers' attitudes. *Children and Youth Services Review*, 98, 24-31.

Cooley, D. T., & Jackson, Y. (2022). Informant discrepancies in child maltreatment reporting: A systematic review. *Child Maltreatment*, 27(1), 126-145.

Davidson, R. D., Morrissey, M. W., & Beck, C. J. (2019). The Hispanic experience of the child welfare system. *Family Court Review*, 57(2), 201-216.

Edwards, F., Wakefield, S., Healy, K., & Wildeman, C. (2021). Contact with Child Protective Services is pervasive but unequally distributed by race and ethnicity in large US counties. *Proceedings of the National Academy of Sciences*, 118(30), e2106272118.

Evangelist, M., Thomas, M., & Waldfogel, J. (2023). Child Protective Services contact and youth outcomes. *Child Abuse and Neglect,* 136, 105994.

Fong, K. (2019). Concealment and constraint: Child protective services fears and poor mothers' institutional engagement. *Social Forces*, 97(4), 1785-1810.

Fong, K. (2020). Getting eyes in the home: Child protective services investigations and state surveillance of family life. *American Sociological Review*, 85(4), 610-638.

Font, S. A., & Berger, L. M. (2015). Child maltreatment and children's developmental trajectories in early to middle childhood. *Child Development*, *86*(2), 536-556.

Garcia, A., Aisenberg, E., & Harachi, T. (2012). Pathways to service inequalities among Latinos in the child welfare system. *Children and Youth Services Review*, 34(5). https://doi.org/10.1016/j.childyouth.2012.02.011

Goodman-Brown, T. B., Edelstein, R. S., Goodman, G. S., Jones, D. P., & Gordon, D. S. (2003). Why children tell: A model of children's disclosure of sexual abuse. *Child Abuse and Neglect*, 27(5), 525-540.

Han, W. J., Huang, C. C., & Williams, M. (2013). The role of parental work schedule in CPS involvement. *Children and Youth Services Review*, 35(5), 837-847.

Honaker, J., King, G., & Blackwell, M. (2011). Amelia II: A program for missing data. *Journal of Statistical Software*, 45, 1-47.

John, R. S. (2023). Latinx children in the child welfare system. In *Children of Color in the Child Welfare System: Psychological Research and Best Practices*, ed. Y. R. Harris and G. J. O. Carpenter, 99-117. American Psychological Association.

Jones, D., Drake, B., Kim, H., Chen, J. H., Font, S., Putnam-Hornstein, E., Barth, R. P., Huang, T. Z., & Jonson-Reid, M. (2024). Poverty indicators in the National Child Abuse and Neglect Data System Child File: Challenges and opportunities. *Research on Social Work Practice*, 34(3), 325-337.

Kim, J., Chung, Y., & Ahn, H. (2024). Poverty and child maltreatment: A systematic review. *Journal of Public Child Welfare*, *18*(4), 882-914.

Kim, H., Wildeman, C., Jonson-Reid, M., & Drake, B. (2017). Lifetime prevalence of investigating child maltreatment among US children. *American Journal of Public Health*, *107*(2), 274-280.

Lee, S. J. (2013). Paternal and household characteristics associated with child neglect and child protective services involvement. *Journal of Social Service Research*, 39(2), 171-187.

Le Zhang, M., Boyd, A., Cheung, S. Y., Sharland, E., & Scourfield, J. (2020). Social work contact in a UK cohort study: Under-reporting, predictors of contact and the emotional and behavioural problems of children. *Children and Youth Services Review*, 115, 105071.

Lee, S. J., Grogan-Kaylor, A., & Berger, L. M. (2014). Parental spanking of 1-year-old children and subsequent child protective services involvement. *Child Abuse and Neglect*, 38(5), 875-883.

Ma, J., Grogan-Kaylor, A., & Klein, S. (2018). Neighborhood collective efficacy, parental spanking, and subsequent risk of household child protective services involvement. *Child Abuse and Neglect*, 80, 90-98.

McDaniel, S. L. (2020). Transforming child welfare: Seeing kinship care through a racialized, *c*ultural context and community. *Children's Bureau Express*, 21(8).

Mersky, J. P., & Topitzes, J. (2010). Comparing early adult outcomes of maltreated and non-maltreated children: A prospective longitudinal investigation. *Children and Youth Services Review*, 32(8), 1086-1096.

Negriff, S., Schneiderman, J. U., & Trickett, P. K. (2017). Concordance between self-reported childhood maltreatment versus case record reviews for child welfare–affiliated adolescents: Prevalence rates and associations with outcomes. *Child Maltreatment*, *22*(1), 34-44.

Piescher, K., Colburn, G., LaLiberte, T., & Hong, S. (2014). Child Protective Services and the achievement gap. *Children and Youth Services Review*, 47(Part 3), 408–415.

Reichman, N. E., Teitler, J. O., Garfinkel, I., & McLanahan, S. S. (2001). Fragile families: Sample and design. *Children and Youth Services Review*, 23(4-5), 303-326.

Roberts, D. (2002). *Shattered Bonds: The Color of Child Welfare*. Basica Civitas Books.

Roberts, D. E. (2012). Prison, foster care, and the systemic punishment of black mothers. *UCLA Law Review*, 59(6), 1474–1500.

Slack, K. S., Berger, L. M., DuMont, K., Yang, M. Y., Kim, B., Ehrhard-Dietzel, S., & Holl, J. L. (2011). Risk and protective factors for child neglect during early childhood: A cross-study comparison. *Children and Youth Services Review*, 33(8), 1354-1363.

Stone, S., & Zibulsky, J. (2015). Maltreatment, academic difficulty, and systems-involved youth: Current evidence and opportunities. *Psychology in the Schools*, 52(1), 22-39.

Thomas, M. M., & Waldfogel, J. (2022). What kind of "poverty" predicts CPS contact: Income, material hardship, and differences among racialized groups. *Children and Youth Services Review*, 136, 106400.

Thomas, M. M., Waldfogel, J., & Williams, O. F. (2023). Inequities in child protective services contact between Black and White children. *Child Maltreatment*, 28(1), 42-54.

Wildeman, C., Edwards, F. R., & Wakefield, S. (2020). The cumulative prevalence of termination of parental rights for US children, 2000–2016. *Child Maltreatment*, 25(1), 32-42.

Wildeman, C., Emanuel, N., Leventhal, J. M., Putnam-Hornstein, E., Waldfogel, J., & Lee, H. (2014). The prevalence of confirmed maltreatment among US children, 2004 to 2011. *JAMA Pediatrics*, 168(8), 706-713.

Wu, Q., Zhu, Y., Brevard, K., Wu, S., & Krysik, J. (2024). Risk and protective factors for African American kinship caregiving: A scoping review. *Children and Youth Services Review*, 156, 107279.

Yi, Y., Edwards, F., Emanuel, N., Lee, H., Leventhal, J. M., Waldfogel, J., & Wildeman, C. (2023). State-level variation in the cumulative prevalence of child welfare system contact, 2015–2019. *Children and Youth Services Review,* 147, 106832.

Yi, Y., & Wildeman, C. (2023). How the AFCARS and NCANDS can provide insight into linked administrative data. In *Strengthening Child Safety and Well-Being Through Integrated Data Solutions*, ed. C. M. Connell and D. M. Crowley, 13-31. Springer International Publishing.

Yoon, S., Quinn, C. R., Shockley McCarthy, K., & Robertson, A. A. (2021). The effects of child protective services and juvenile justice system involvement on academic outcomes: Gender and racial differences. *Youth and Society*, 53(1), 131-152.

Zhai, F., Waldfogel, J., & Brooks-Gunn, J. (2013). Estimating the effects of Head Start on parenting and child maltreatment. *Children and Youth Services Review*, 35(7), 1119-1129.