

Overview of California's Child Welfare Indicator Data

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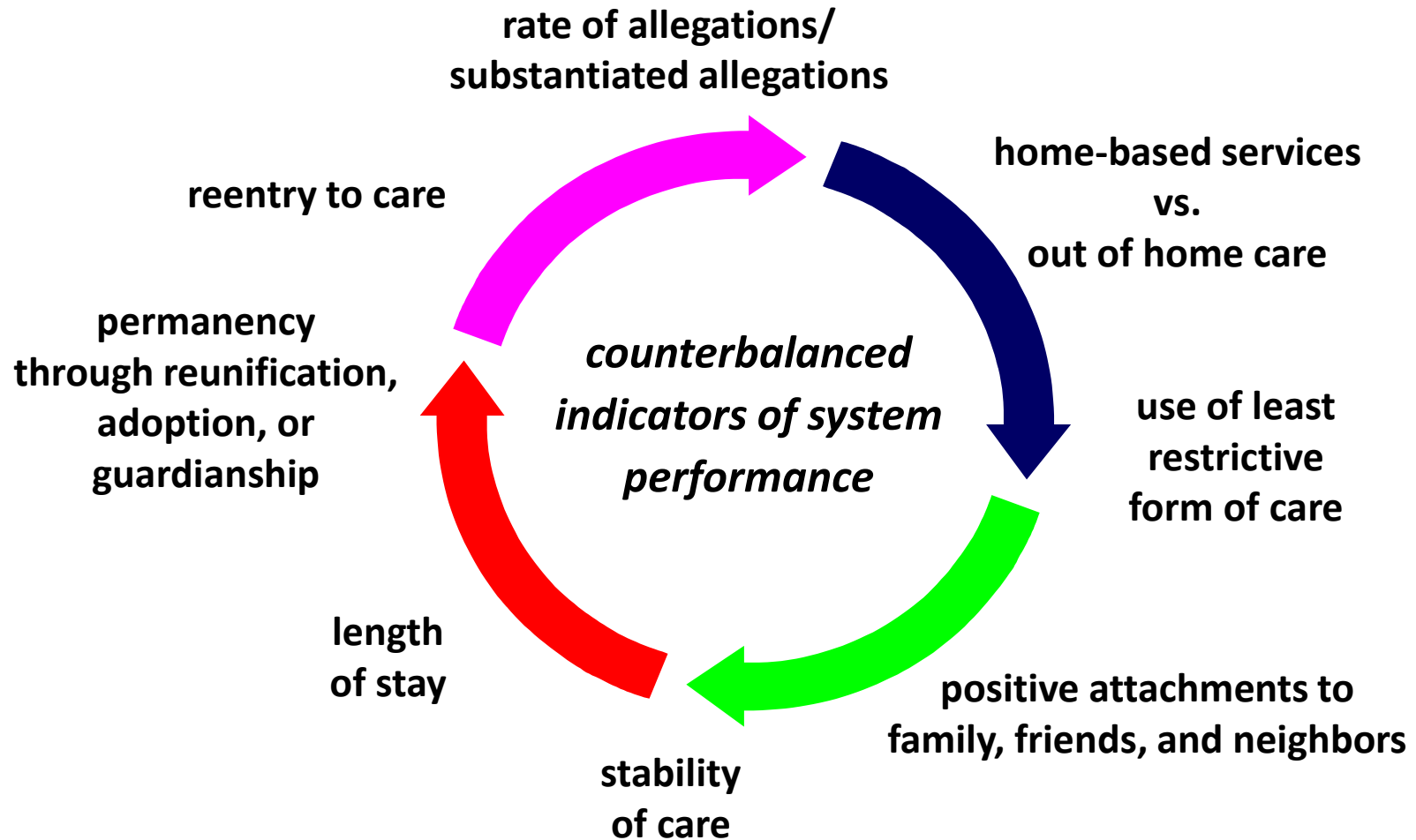
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The California Child Welfare Indicators Project (CCWIP) is a collaboration of the California Department of Social Services and the School of Social Welfare, University of California at Berkeley, and is supported by the California Department of Social Services and the Stuart Foundation



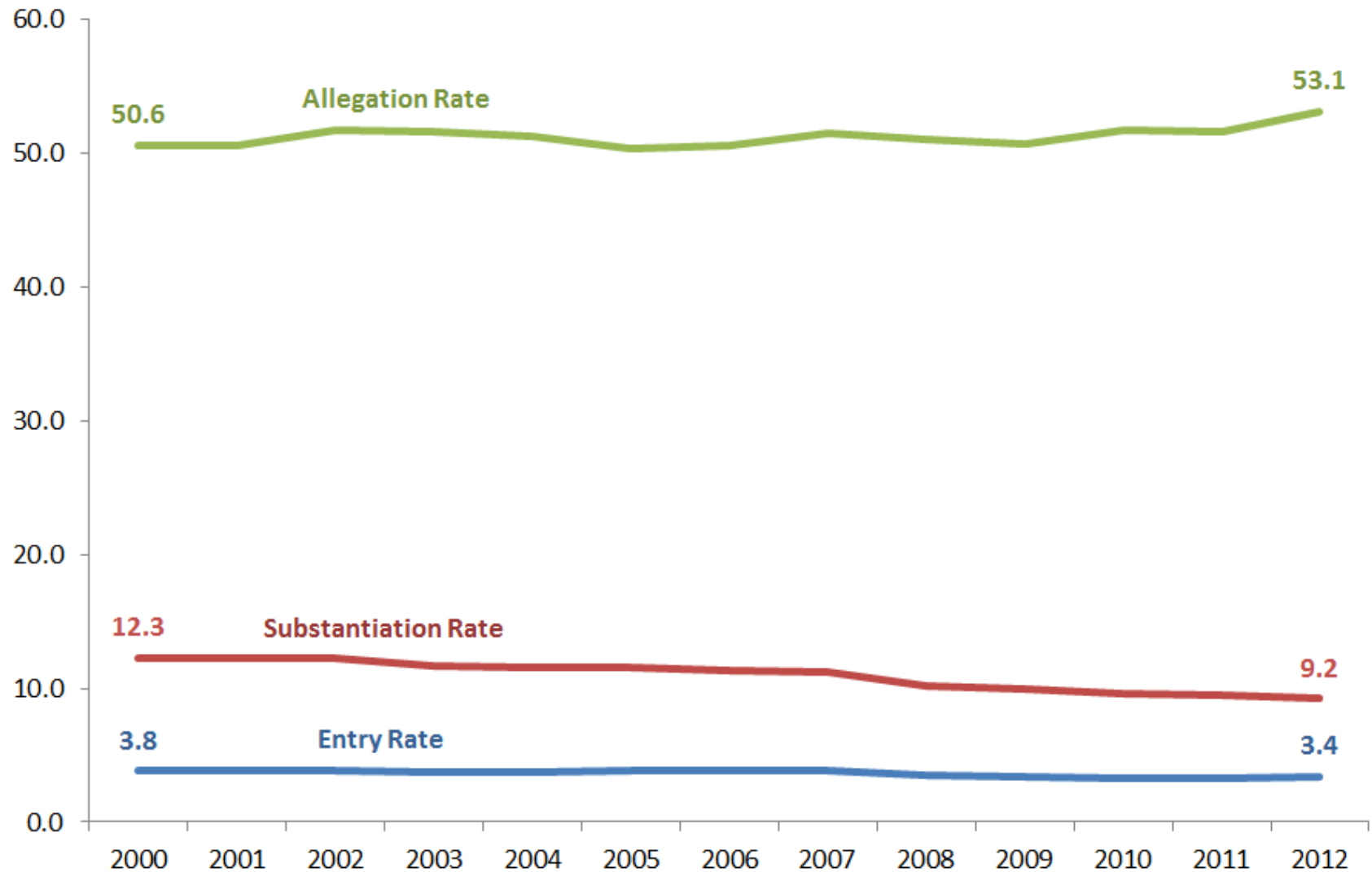
STUART FOUNDATION

Tracking Child Welfare Outcomes



Source: Usher, C.L., Wildfire, J.B., Gogan, H.C. & Brown, E.L. (2002). Measuring Outcomes in Child Welfare. Chapel Hill: Jordan Institute for Families

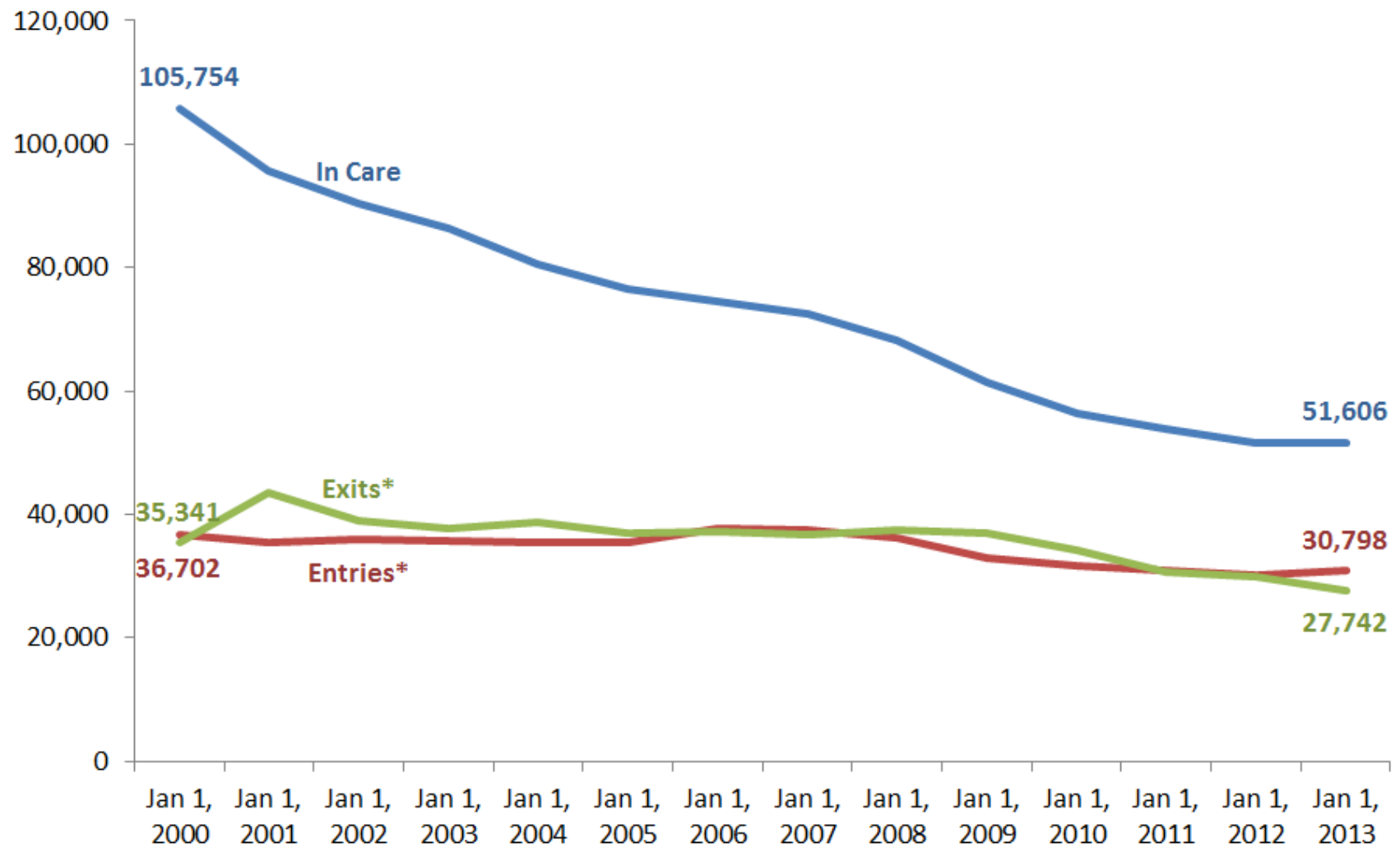
Allegation, Substantiation, and Entry Rates (per 1,000): 2000-2012, Children 0-17



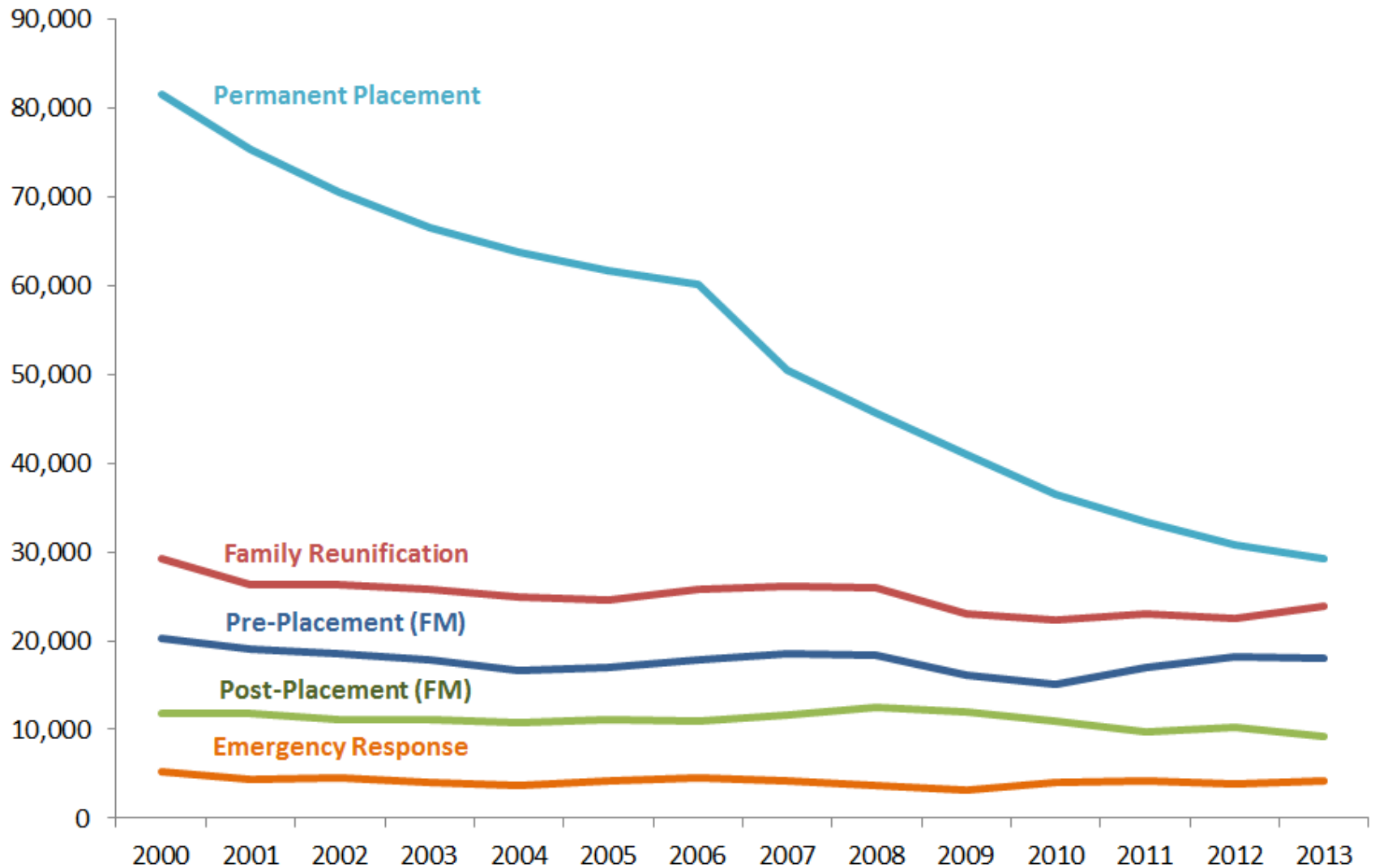
Number of Children Entering, Exiting, and In Care: 2000-2013

Children 0-17 (Exits 0-18+60 days)

*Entries and Exits from previous year

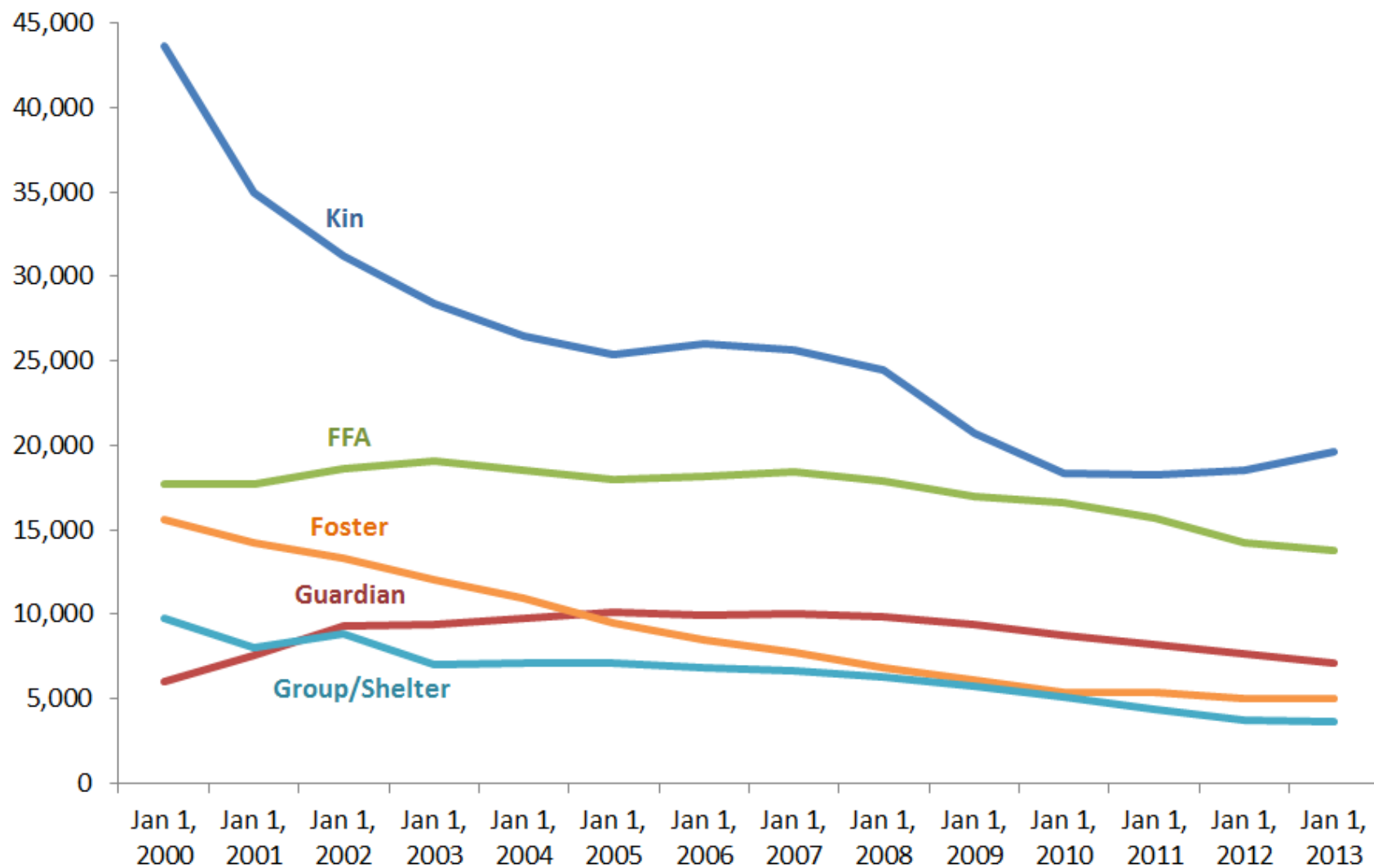


Number of Children Receiving Services, By Case Service Component: 2000-2013



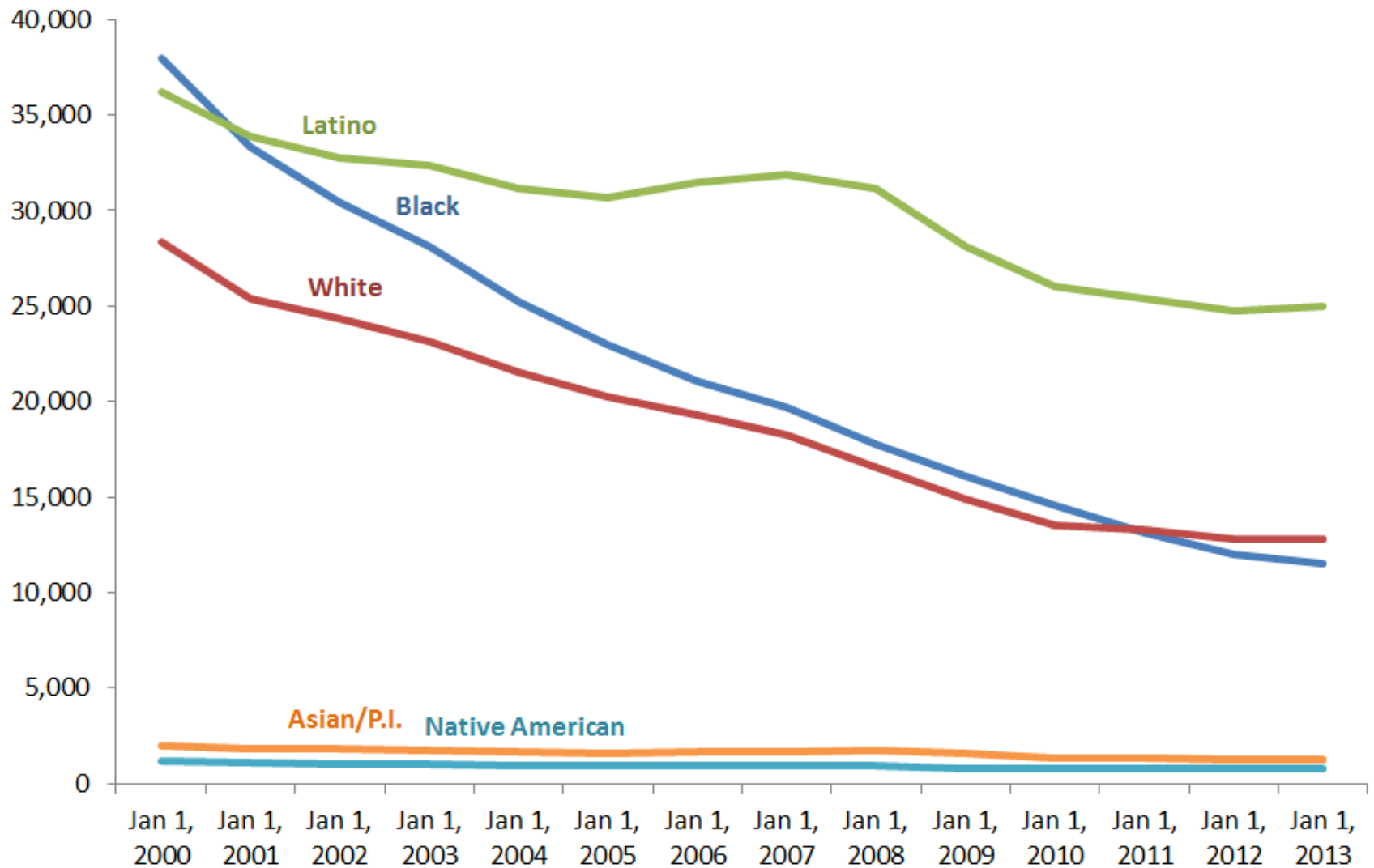
Number of Children in Care, By Placement Type: 2000-2013

Children 0-17

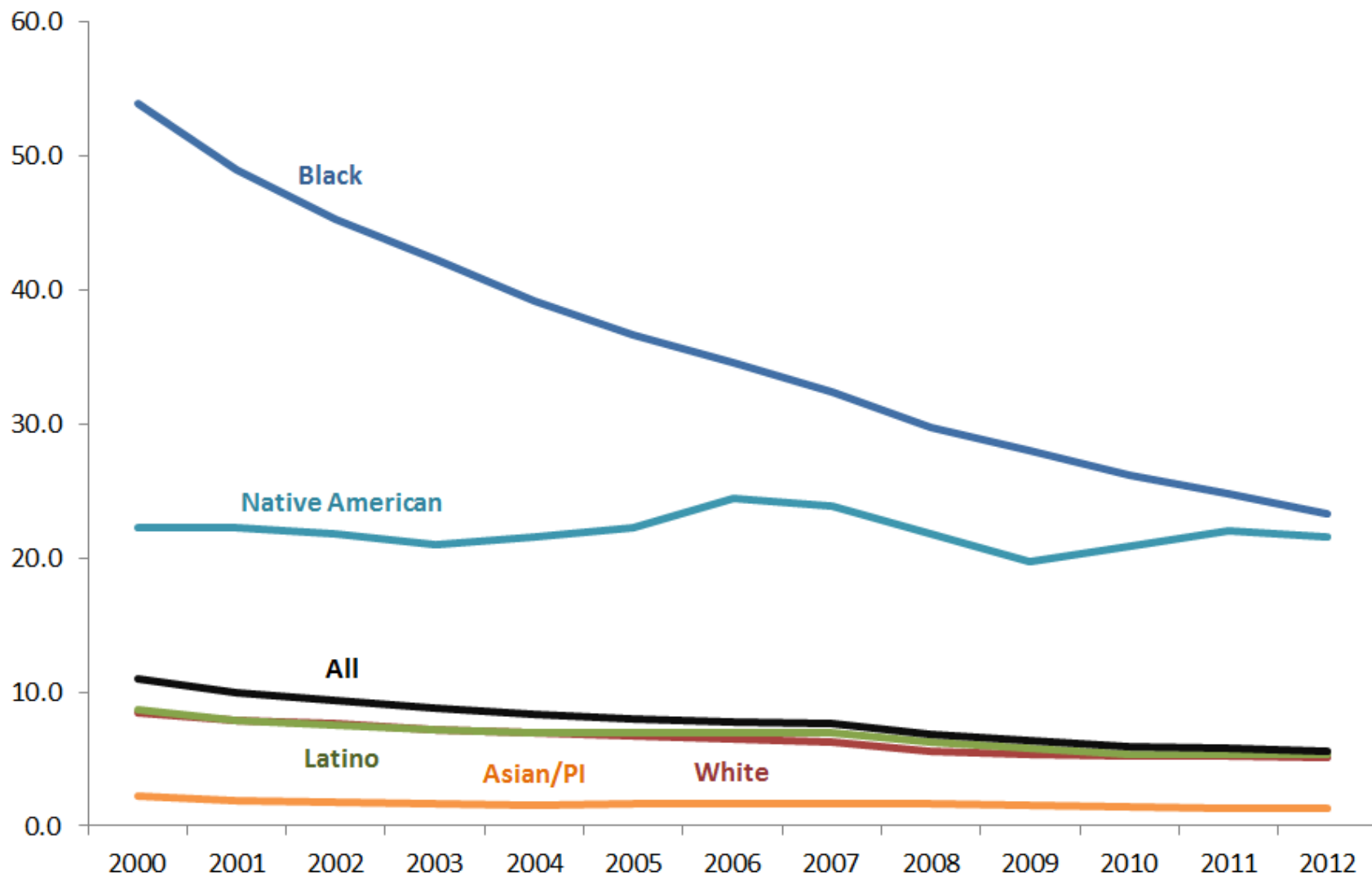


Number of Children in Care, By Race/Ethnicity: 2000-2013

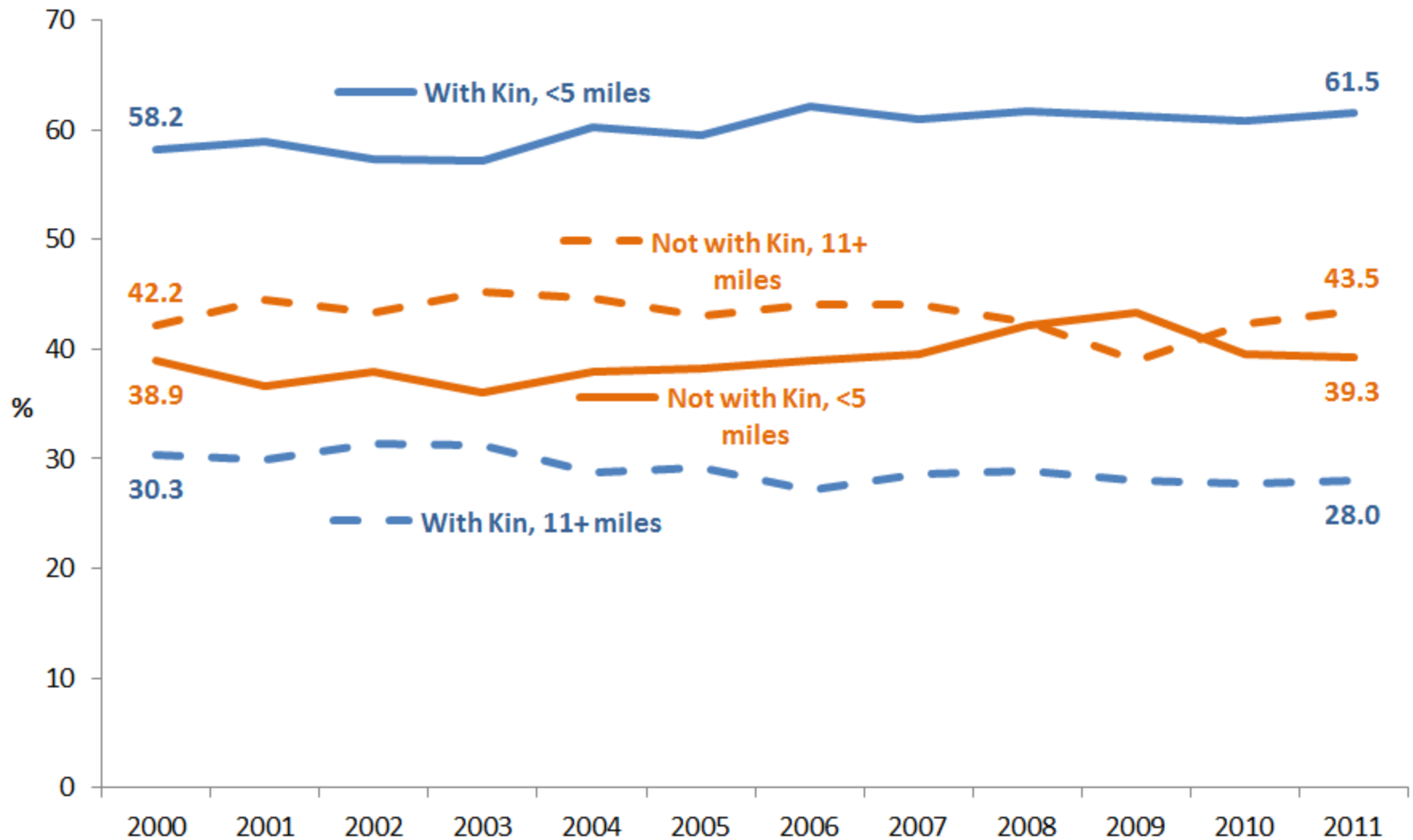
Children 0-17



In Care Rates Over Time (per 1,000), By Race/Ethnicity: 2000-2012

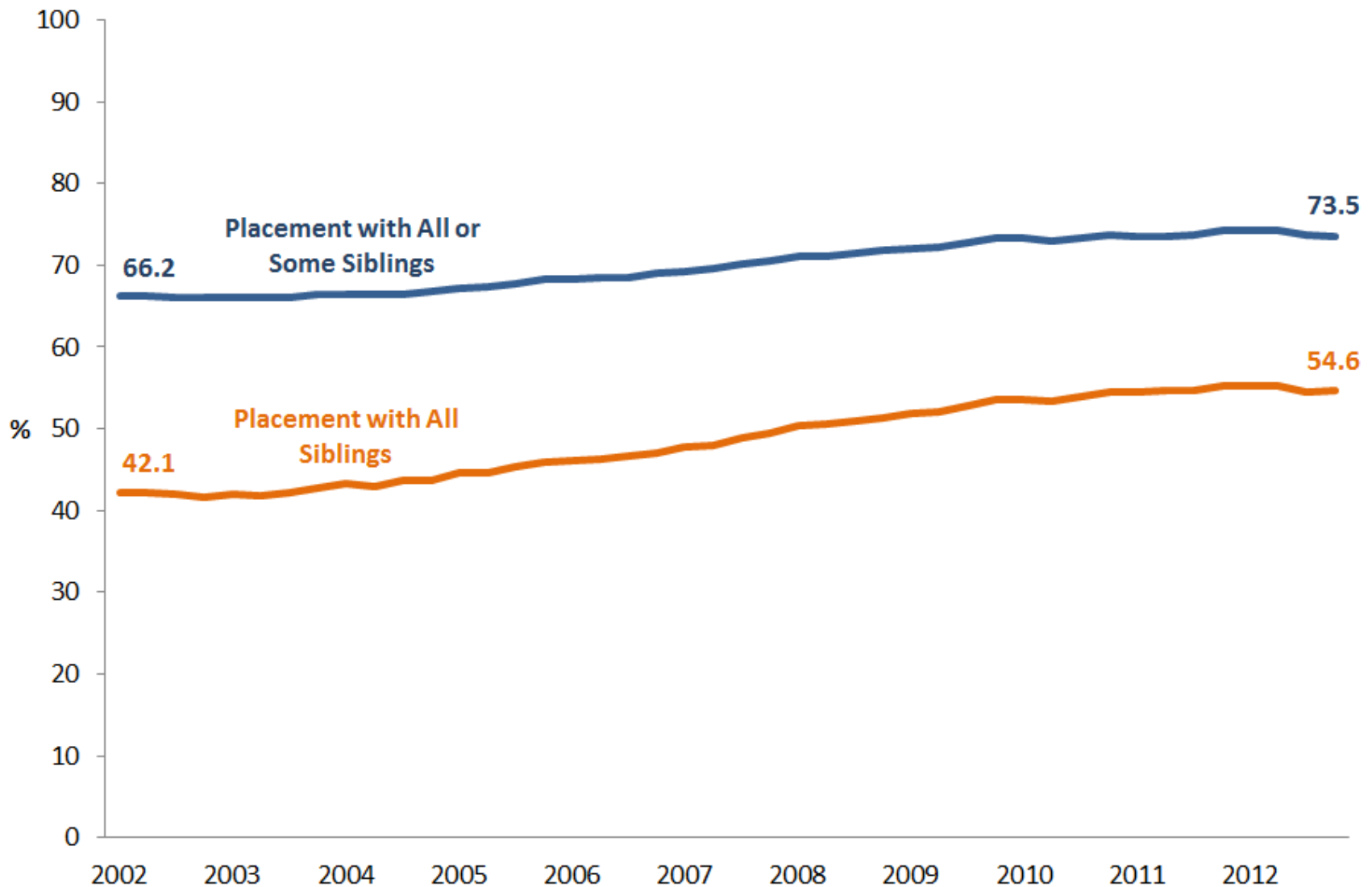


Children Still in Care 12m After Entry Placement Distance from Home, by Kin vs. Non-Kin: 2002-2011

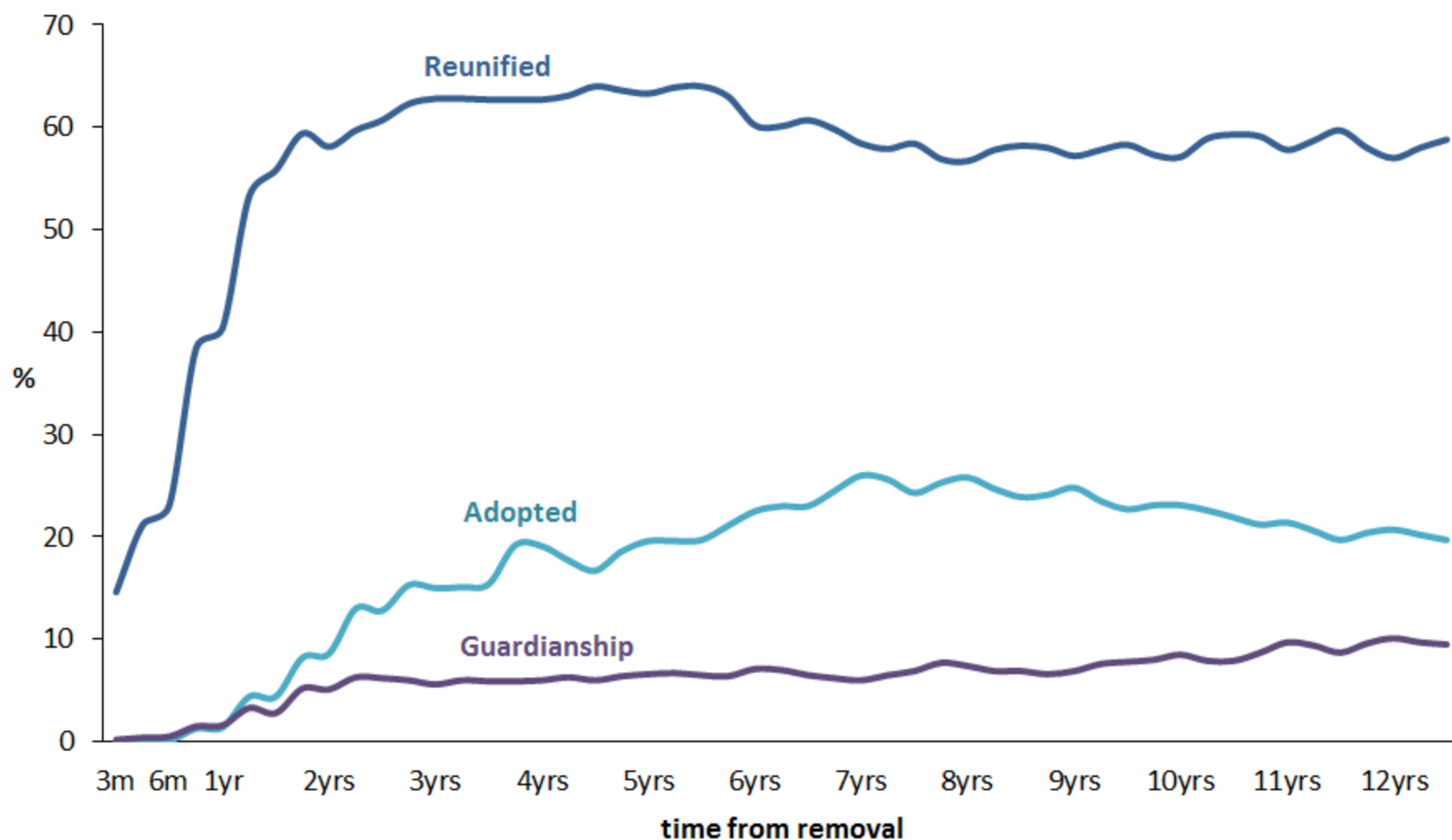


Out of Home Caseload: Children Placed with Siblings, 2002-2012

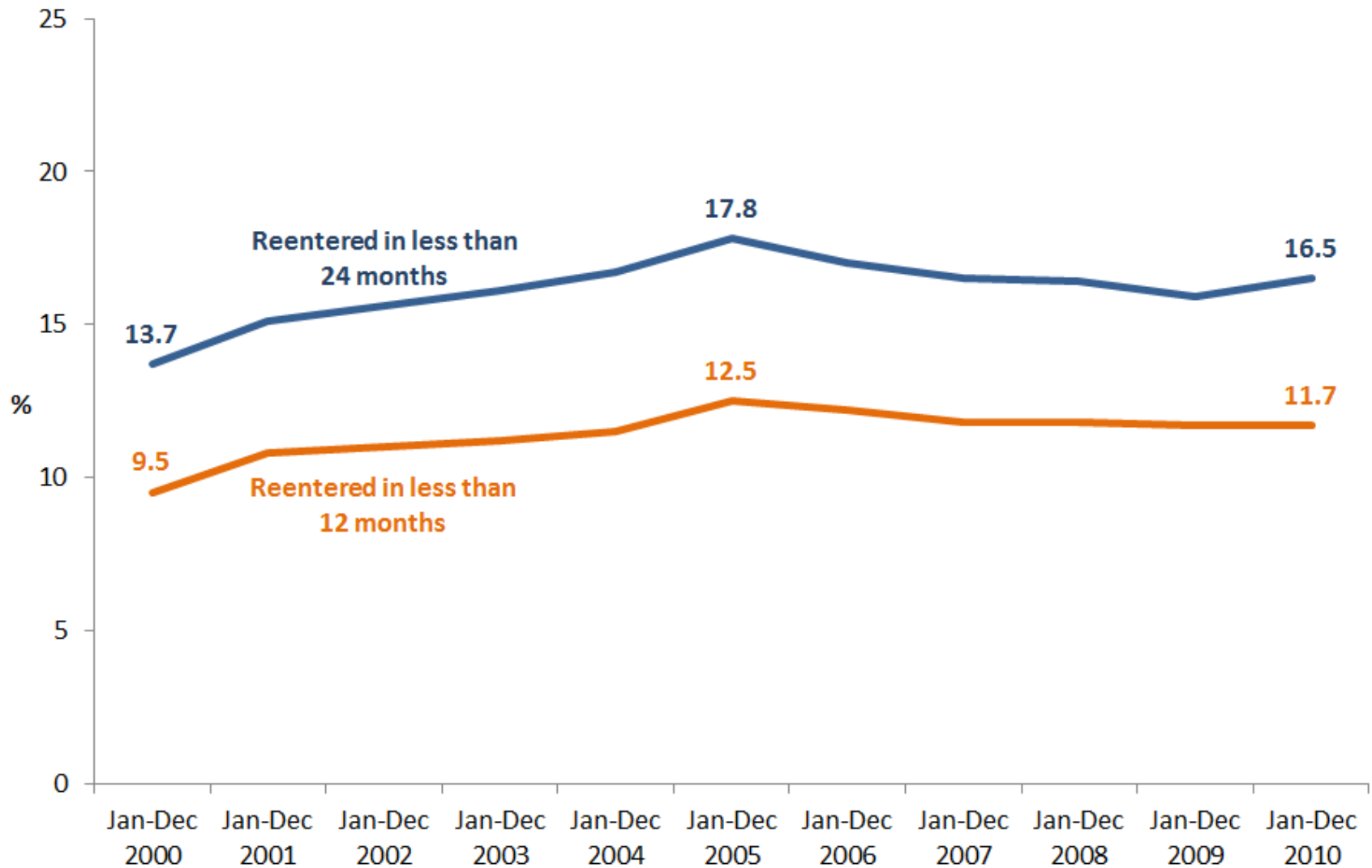
(includes only those children who have siblings in care)



Exiting to Permanency Over Time (First Entry Cohorts, 8 Days+ in Care, 2000-2012)



Reentry Following Reunification: Children Reentering Care after Exit to Reunification at 12 and 24 Months: 2000-2012



Thinking about Prevention

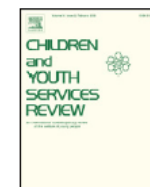
Children and Youth Services Review 33 (2011) 2400–2407



Contents lists available at ScienceDirect

Children and Youth Services Review

journal homepage: www.elsevier.com/locate/childyouth



Predictors of child protective service contact between birth and age five: An examination of California's 2002 birth cohort

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ARTICLE INFO

Available online 1 September 2011

Keywords:

Child Welfare
Child Maltreatment
Birth Cohort
Risk Assessment
Racial Disparities

ABSTRACT

This study utilizes population-level birth data to describe those children who may be at greatest risk of maltreatment during the first five years of life. Based on a unique dataset constructed by linking California's administrative child welfare data to statewide vital birth records, a cohort study design was employed to track reports of maltreatment involving children born in 2002. Twelve variables captured in the birth record were selected for analysis. Generalized Linear Models were used to estimate adjusted risk ratios (RR) for each independent variable. Predicted probabilities of CPS contact were computed based on the count of risk factors present at birth. Results suggest that many of the associations previously observed between birth variables and subsequent maltreatment have sustained value in foretelling which children will be reported to CPS beyond infancy. Of the 531,035 children born in California in 2002, 14% (74,182) were reported for possible maltreatment before the age of five. Eleven of the twelve birth variables examined presented as significant predictors of contact with child protective services.

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Birth Record Linkages: Selected Findings

- 14% of children in birth cohort were reported to CPS by age 5
 - lower bound estimate...could not match 16% of CPS records
 - 25% of these children were reported within the first 3 days of life
 - 35% of all reported children were reported as infants
- 11 of 12 variables were significantly associated with CPS contact
 - crude risk ratios >2 were observed for 7 variables
- Contact with CPS is hardly a rare event for certain groups
 - 30% of black children reported
 - 25% of children born to teen mothers

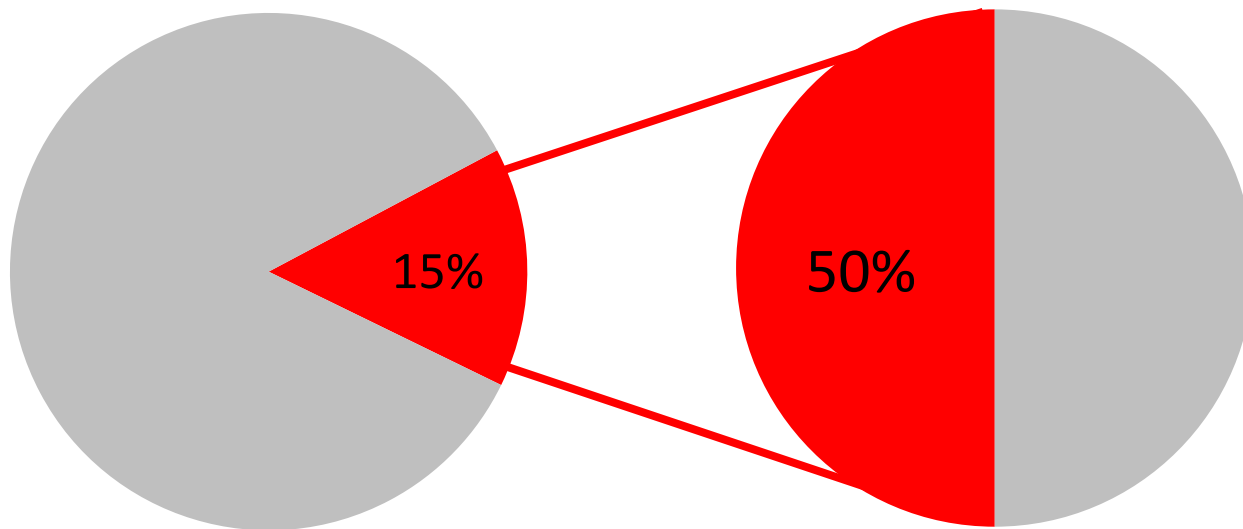
Birth Record Variables

| | | | |
|----------------------|---|-----------------------------|---|
| sex | <ul style="list-style-type: none">• female• male | maternal age | <ul style="list-style-type: none">• <=19• 20-24• 25-29• 30+ |
| birth weight | <ul style="list-style-type: none">• 2500g+• <2500g | maternal education | <ul style="list-style-type: none">• <high school• high school• some college• college+ |
| prenatal care | <ul style="list-style-type: none">• 1st trimester• 2nd trimester• 3rd trimester• no care | pregnancy termination hx | <ul style="list-style-type: none">• prior termination• none reported |
| birth abnormality | <ul style="list-style-type: none">• present• none | named father | <ul style="list-style-type: none">• missing• named father |
| maternal birth place | <ul style="list-style-type: none">• US born• non-US born | # of children in the family | <ul style="list-style-type: none">• one• two• three+ |
| race | <ul style="list-style-type: none">• native american• black• Hispanic• white• asian/pacific islander | birth payment method | <ul style="list-style-type: none">• public/med-cal• other |

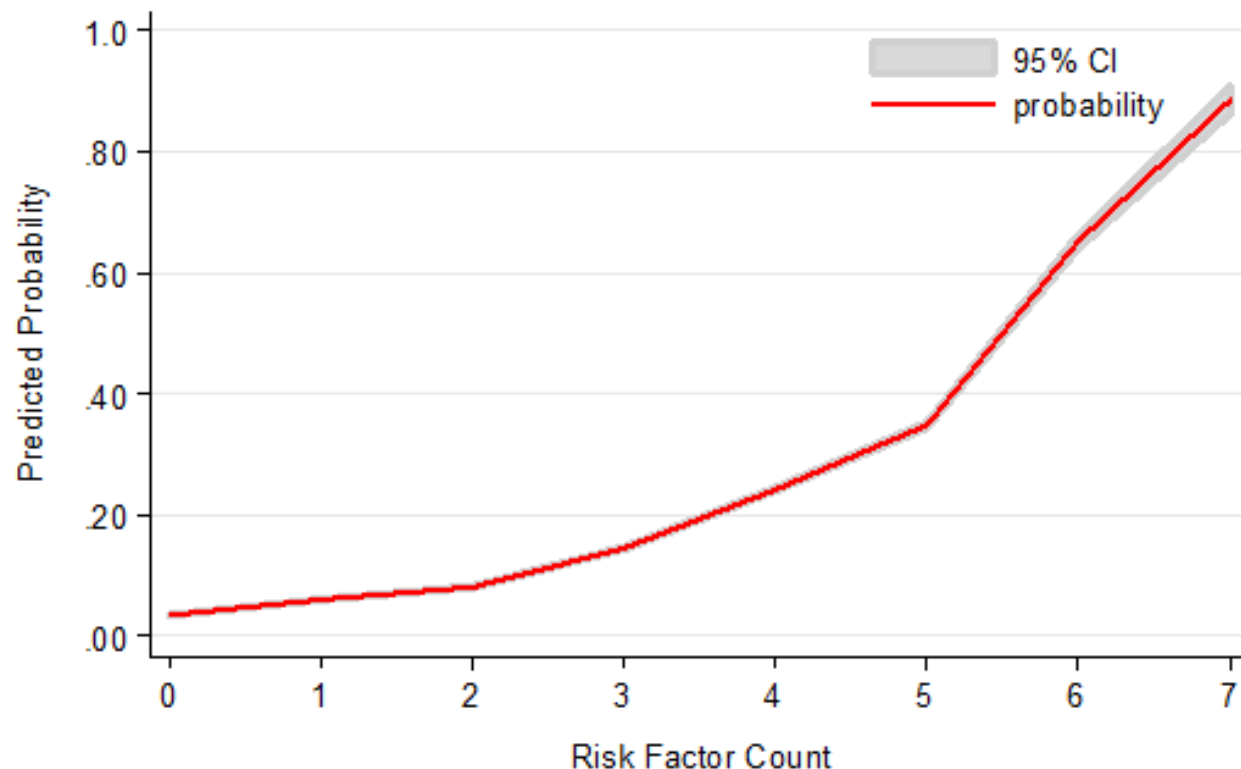
Assessing Risk at Birth?

Full Birth Cohort

Children Reported to CPS



Recognizing the Risk Associated with the Presence Of Multiple Risk Factors...



High Risk on Every
Modifiable Risk
Factor: **89%**
probability of CPS
report

Low Risk on Every
Modifiable Risk
Factor: **3%**
probability of CPS
report

1. Included risk factors are those considered "modifiable", at least in theory.
2. Risk factors are unweighted and ordered based upon cohort rates (from most to least common).
3. Variables not included are set at the group mean.

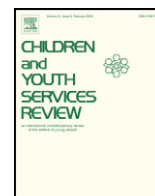
Questions? Comments?

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1. Introduction

The maltreatment of children, including neglect and various forms of physical, sexual, and emotional abuse, endures as a societal problem of significant scope. In 2008, referrals involving approximately 6 million children believed to have been harmed or at risk of harm were made to child protective service agencies (CPS) in the United States (U.S. Department of Health and Human Services, 2010). Of these children, an estimated 3.7 million were included in an investigation and over 700,000 (10.6 per 1000) were subsequently deemed victims of maltreatment. Among maltreated children, the nation's youngest children were disproportionately represented: 33% of all victims were under four years of age; the highest rate of maltreatment was observed during the first year of life (21.7 per 1000).

The profound vulnerability of these youngest children cannot be understated. Not only are they at greatest risk of death from maltreatment (Schnitzer & Ewigman, 2005; U.S. Department of Health and Human Services, 2010), but research suggests that the negative developmental consequences of non-fatal maltreatment manifest in multiple domains of later life functioning (Currie & Widom, 2010; Felitti et al., 1998; Glaser, 2000; Springer, Sheridan, Kuo, & Carnes, 2007), with outcomes often observed to be most severe

and intractable for children with an onset of abuse or neglect during the first few years of life (English, Graham, Litrownik, Everson, & Bangdiwala, 2005; English et al., 2005; Kotch et al., 2008; Wulczyn, Barth, Yuan, Harden, & Landsverk, 2005).

The high rates at which these youngest children are reported to child protective service agencies suggest that a renewed focus on primary prevention through various early intervention activities prenatally and shortly after birth may prove particularly impactful. Successful efforts have the potential to result in large and rather immediate declines in the number of children subjected to abuse and neglect. This paper explores how population-level birth data may be employed to identify those children who are at greatest risk of maltreatment.

1.1. Studies linking child welfare data and birth records

Prior studies have examined the relationship between birth indicator variables and a verified or substantiated case of infant maltreatment (Wu et al., 2003), maltreatment among children who received home visiting services (Murphey & Braner, 2000), as well as infant entries to foster care following a maltreatment substantiation (Needell & Barth, 1998). A body of literature linking child welfare and birth records also arises from Europe, where linkages between administrative data sources are more common (Murphy, Jenkins, Newcombe, & Sibert, 1981; Sidebotham & Heron, 2006; Spencer, Wallace, Sundrum, Bacchus, & Logan, 2006). Additionally, ecological studies examining associations between child maltreatment risk and

DOI of original article: [10.1016/j.childyouth.2011.04.006](https://doi.org/10.1016/j.childyouth.2011.04.006).

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perinatal characteristics at the community level have also been conducted (Lee & Goerge, 1999; Zhou, Hallisey, & Freymann, 2006).

From these separate empirical streams, a stable list of child and family characteristics at birth has emerged for their association with subsequent maltreatment. Pregnancy variables with prior predictive value include low birth weight (Murphy et al., 1981; Needell & Barth, 1998; Spencer et al., 2006; Wu et al., 2003), a birth abnormality (Murphy et al., 1981; Needell & Barth, 1998), late or an absence of prenatal care (Murphy & Braner, 2000; Murphy et al., 1981; Needell & Barth, 1998; Wu et al., 2003; Zhou et al., 2006), and a prior pregnancy termination (Parrish & Gessner, 2010; Wu et al., 2003).

Strong associations have also been observed between a child's report to child protective services and several sociodemographic variables captured on the birth record including maternal race/ethnicity (Lee & Goerge, 1999; Needell & Barth, 1998), young maternal age at birth (Lee & Goerge, 1999; Murphy & Braner, 2000; Murphy et al., 1981; Needell & Barth, 1998; Sidebotham & Heron, 2006; Wu et al., 2003; Zhou et al., 2006), low levels of maternal education (Murphy & Braner, 2000; Needell & Barth, 1998; Sidebotham & Heron, 2006; Wu et al., 2003), single parent status (Murphy & Braner, 2000; Murphy et al., 1981; Needell & Barth, 1998; Wu et al., 2003; Zhou et al., 2006), the number of children born to the mother (Lee & Goerge, 1999; Murphy & Braner, 2000; Needell & Barth, 1998; Wu et al., 2003; Zhou et al., 2006), and the receipt of public insurance (Lee & Goerge, 1999; Murphy & Braner, 2000; Murphy et al., 1981; Needell & Barth, 1998; Wu et al., 2003; Zhou et al., 2006).

In this study, we utilize 12 birth record variables to predict a child's risk of being reported for maltreatment before the age of five. Although variables were chosen based on their previously demonstrated value in predicting maltreatment during infancy, to the best of our knowledge this is the first study to extend this method of population-based birth record linkage and inquiry to all children reported for maltreatment 1) through the age of five, 2) regardless of report disposition, and 3) inclusive of reports that were screened out and therefore not investigated.

1.2. Research objectives

This study serves as a preliminary examination of birth variables that predict which children will be reported for maltreatment by age five. The potential usefulness of using birth data to construct an epidemiologic risk-assessment tool was argued by Wu and colleagues who were able to identify 50% of all substantiated infant maltreatment cases from 13% of Florida's 1996 birth cohort, using just three variables from the birth record (2003). Other researchers have found that many risk factors measured in the neonatal period continue to predict CPS referrals through the fourth year of life (Kotch, Browne, Dufort, Winsor, & Catellier, 1999). In this paper, we seek to both describe a recent birth cohort of children who were reported for maltreatment during early childhood and explore the utility of birth variables for predicting a CPS referral throughout the years of peak child maltreatment vulnerability.

2. Methods

2.1. Data

This study utilizes a unique dataset constructed by linking California's administrative child welfare data to statewide vital birth records. Child welfare records were extracted from the state's Child Welfare Services Case Management System (CWS/CMS)—the statewide database for tracking children reported for possible abuse or neglect. CWS/CMS data are hosted at the Center for Social Services Research at the University of California at Berkeley through a longstanding interagency agreement with the California Department of Social Services. These child welfare records were linked to

confidential vital birth records obtained from the California Department of Public Health's Center for Health Statistics. This study received approval from the Committees for the Protection of Human Subjects at both the University of California at Berkeley and the California Health and Human Services.

2.2. Study population & design

This analysis captures the full population of children born in California in 2002. Using a prospective birth cohort study design, CPS contacts for all children were tracked from the time of birth up until each child's fifth birthday.

2.3. Base datasets

The records of all children who were born in 2002 and reported for possible maltreatment in California before the age of 5 were downloaded from the Quarter 1, 2009 extract of CWS/CMS (91,520). While some fraction of these children were born outside of California and therefore did not meet study criteria, the field capturing the state or country of birth was missing in nearly all records. For those children explicitly coded as born outside of California, that information was treated as reliable and those children were excluded. In addition, for those children for whom the Social Security Number (SSN) was recorded (51%), the first three digits of the SSN were examined and the child was excluded if the code indicated that the child was born outside of California according to state digit assignments published by the Social Security Administration. After these efforts, 88,052 child-records remained for linkage with vital birth records. The 2002 vital birth file consisted of 533,992 birth records. Upon exclusion of those birth records associated with fetal deaths, 531,035 remained for linkage with child welfare records.

2.4. Record linkages

Record linkages were completed using probabilistic matching software which established linkages based on a combination of unique (e.g., Social Security Number) and non-unique (e.g., first name, date of birth) child and parent identifiers common to both data sources (LinkPlus, Version 2.0). Based on a prior analysis of vital record birth files by the authors, including a manual examination of a random sample of comparison pairs falling within each 10-point score strata, lower bound and upper bound cut-off scores were established. For those comparison pairs with a score falling in the established "gray area" between the lower and upper bound cut-off scores, a clerical review was completed to determine match-status (Clark, 2004; Fellegi & Sunter, 1969; Herzog, Scheuren, & Winkler, 2007). Among pairs falling toward the upper end of this gray area, the review conducted was relatively cursory and merely involved a scan of the fields to ensure that the information aligned. As the scores dropped, the reviews became increasingly thorough and included manual searches in the full birth file to confirm that there were no other possible matches.

This methodology resulted in 84% of the child welfare records successfully linked to a birth record. Some notable differences were observed in the variable distributions of matched versus unmatched children. Missing data were consistently observed for children for whom no birth record match was established, and data were not missing at random. Report disposition (a measure of a child's level of contact with the child welfare system) differed significantly by match status ($\chi^2(3) = 5.6e + 03, p < 0.001$). Successfully matched children were much more likely than unmatched children to have had a report substantiated (37% vs. 18%) and much less likely to have been evaluated out prior to an investigation (9% vs. 27%), with no differences observed between matched and unmatched children

who had unsubstantiated or inconclusive allegations. Racial differences also emerged ($\chi^2(4) = 205.9, p < 0.001$). Matched children were somewhat less likely to be White (26% vs. 32%) and Asian/PI (4% vs. 5%), somewhat more likely to be Hispanic (54% vs. 48%), with no differences observed for Black (14% vs. 14%) or Native American children (0.8% vs. 0.8%). There were no differences between matched and unmatched records by allegation type: roughly 52% were reported for neglect, 12% for physical abuse, 10% for emotional abuse, 5% for sexual abuse, and 20% were reported for being at substantial “risk” of maltreatment.

2.5. Dependent variable

The outcome of interest in this study was an allegation of maltreatment before the age of five, captured as a dichotomous variable indicating whether or not a child had been reported. We included both maltreatment reports that resulted in an investigation and disposition (i.e., unfounded, inconclusive, or substantiated) as well as those that were screened out over the phone and received no in-person investigation. Our decision to include all children reported for maltreatment was based on data from California demonstrating that over 40% of children reported for maltreatment are re-reported within two years, regardless of whether or not the first allegation was substantiated, unfounded, inconclusive, or screened out (Needell et al., 2010).

Supporting the inclusion of all reported children is a body of literature that highlights the fallibility of correctly ascertaining whether a child has been maltreated (Drake, 1996; Drake, Jonson-Reid, Way, & Chung, 2003; Giovannoni, 1989). Additional research has failed to distinguish differences in children with a substantiated vs. unsubstantiated allegation of maltreatment when behavioral measures were examined subsequent to the alleged maltreatment (Hussey et al., 2005; Leiter, Myers, & Zingraff, 1994). As such, we chose to view a report of maltreatment to CPS as a measure of latent familial dysfunction that may place a child at risk of harm (either current, or future) and treat the report itself, rather than any classification of that report, as valuable information for the development of risk assessment tools and targeted interventions.

2.6. Explanatory variables

Twelve variables captured in the birth record were selected for analysis. Chosen variables consisted of previously identified socio-demographic risk factors for contact with child protective services, as well as pregnancy markers which emerged as significant in prior examinations of birth records and child welfare records (Murphey & Braner, 2000; Murphy et al., 1981; Needell & Barth, 1998; Spencer et al., 2006; Wu et al., 2003).

Variables included:

1. Sex: Child's sex as recorded on the birth record (*male, female*).
2. Birth Weight: A binary variable indicating whether or not the child weighed less than 2500 g at birth (*low (<2500 g), normal*).
3. Prenatal Care: A prenatal care variable was created based on the month in which care began (*1st trimester, 2nd trimester, 3rd trimester, no care*).
4. Birth Abnormality: A binary variable capturing the presence of one or more birth abnormalities (*abnormality, none*).
5. Maternal Birth Place: A binary variable indicating whether or not the mother was born in the United States (*US-born, foreign-born*).
6. Maternal Race/Ethnicity: Maternal race/ethnicity was coded based on primary race and a Hispanic indicator variable (*non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Asian/Pacific Islander, non-Hispanic Native American*).

7. Maternal Age: Maternal age at the time of birth was coded into a four-level variable (*<20 years, 20–24 years, 25–29 years, 30+ years*).
8. Maternal Education: A four-category variable for maternal education was constructed based on reported years of school completed (*<high school, high school, some college, college +*).
9. Abortion History: A binary variable was created indicating whether the mother reported that any prior pregnancies had been terminated (*prior abortion, none*).
10. Paternity: We were unable to include an indicator of mother's marital status since California Health and Safety Code Section 102425 prohibits the release of this information in confidential birth record files maintained by the California Department of Public Health. Since this same Health and Safety Code specifies that “If the parents are not married to each other, the father's name shall not be listed on the birth certificate unless the father and the mother sign a voluntary declaration of paternity at the hospital before the birth certificate is prepared”, the absence of any paternal information in the record provided a lower-bound estimate of non-marital births and a seeming lack of substantial parental partner involvement (*missing, established*). Paternity as established on the birth record has been utilized in prior examinations of infant mortality (Gaudino, Jenkins, & Rochat, 1999; Parrish & Gessner, 2010).
11. Children Born: The total number of children born to the mother, inclusive of the subject child's birth, was coded as a three-level variable (*1 child, 2 children, 3+ children*).
12. Birth Payment Method: The birth payment source was used to create a rough proxy for family socioeconomic status based on a dichotomous coding of Medi-Cal coverage, California's state Medicaid program (*Medi-Cal, other*). Those births coded as “medically indigent” (0.02%) were also coded as Medi-Cal.

2.7. Statistical analysis

Although logistic regression remains a commonly employed technique for analyzing group differences when the dependent variable is dichotomous and there exist multiple confounders, logistic models yield odds ratios (ORs) which can be difficult to interpret (Davies, Crombie, & Tavakoli, 1998) and exaggerate risk associations when the incidence of the outcome of interest is not a rare event ($>10\%$) (Zhang & Yu, 1998). Because the overall incidence of CPS contact in this birth cohort was 13.9%, and notably higher across some variable levels, risk ratios (RRs) were estimated to generate results that were both intuitively interpreted and statistically conservative.

The relative risk of a referral to CPS before the age of five was computed using Generalized Linear Models (McCullagh & Nelder, 1989). Since our models suffered from (not uncommon) convergence problems when run based on a log-binomial distribution, we used the “modified Poisson regression” technique proposed as an alternative method for use with prospective cohort studies in which the outcome of interest is binary (Zou, 2004). This technique specifies a Poisson distribution and log link, using a robust standard error adjustment (sandwich estimator) in order to correct for estimated confidence intervals that would otherwise be too wide (UCLA Academic Technology Services: Statistical Consulting Group, 2010). Results were compared with those obtained from logistic regression models. As expected, the same variable associations emerged, although the logistic models produced more extreme point estimates.

In addition to multivariate models, the distribution of children who were and were not reported for maltreatment during the first five years of life was calculated for each level of the twelve independent variables, along with crude RR and 95% confidence intervals (95% CI). Predicted probabilities for a report of maltreatment before the age of five were computed based on the count of risk factors present at birth. All statistical analyses were conducted using StataSE (v.11, StataCorp).

3. Results

3.1. Descriptive statistics

Table 1 presents the distribution of children who were and were not reported for maltreatment across variable levels, as well as the unadjusted risk of a referral. Of the full 531,035 children born alive in California in 2002, 13.9% (74,182) were reported for possible abuse or neglect before their fifth birthday, roughly consistent with earlier published maltreatment prevalence estimates from California (Magruder & Shaw, 2008). This rate of children who were reported should be considered a lower bound estimate of the true fraction of the cohort reported for maltreatment as we were unable to find matching birth records for 16% of children identified in the state's administrative database as born in 2002. Although some of these children were born outside of California, certainly some represent missed linkages. Additionally, some children in this birth cohort may have moved out-of-state and subsequently had contact with another state's CPS agency.

Table 1
Birth cohort characteristics: variable distributions, rates of children reported for maltreatment, crude risk ratios and 95% confidence intervals.

| | No CPS report n = 456,650 | CPS report n = 74,182 | Rates of children reported | Crude risk ratios | |
|-------------------------|------------------------------|--------------------------|----------------------------------|----------------------|--------------|
| | % | % | Per 1000 | RR | (95% CI) |
| Sex | | | | | |
| Male | 51.1 | 51.1 | 139.8 | 1.00 | ns |
| Female | 48.9 | 48.9 | 139.7 | – | – |
| Birth weight | | | | | |
| Low (<2500 g) | 6.1 | 8.6 | 186.9 | 1.37 | (1.33, 1.40) |
| Normal | 94.0 | 91.4 | 136.5 | – | – |
| Prenatal care | | | | | |
| None | 0.3 | 1.8 | 488.5 | 3.98 | (3.82, 4.14) |
| 3rd trimester | 1.8 | 3.9 | 253.9 | 2.07 | (2.00, 2.14) |
| 2nd trimester | 9.9 | 17.6 | 222.8 | 1.82 | (1.78, 1.85) |
| 1st trimester | 88.0 | 76.7 | 122.7 | – | – |
| Birth abnormality | | | | | |
| Abnormality | 6.0 | 7.7 | 172.7 | 1.26 | (1.22, 1.29) |
| None | 94.0 | 92.3 | 137.6 | – | – |
| Maternal birth place | | | | | |
| US-born | 50.9 | 70.1 | 182.8 | 2.03 | (2.00, 2.06) |
| Foreign-born | 49.1 | 29.9 | 90.0 | – | – |
| Maternal race/ethnicity | | | | | |
| Native American | 0.3 | 1.1 | 349.0 | 2.61 | (2.43, 2.82) |
| Black | 4.9 | 12.9 | 300.0 | 2.25 | (2.19, 2.30) |
| Hispanic | 50.1 | 51.5 | 143.1 | 1.07 | (1.05, 1.09) |
| Asian/PI | 13.0 | 4.5 | 53.5 | 0.40 | (0.38, 0.41) |
| White | 31.7 | 30.1 | 133.5 | – | – |
| Maternal age at birth | | | | | |
| <20 yrs | 8.3 | 17.7 | 256.6 | 2.75 | (2.70, 2.81) |
| 20–24 yrs | 21.9 | 31.5 | 189.5 | 2.03 | (2.00, 2.07) |
| 25–29 yrs | 26.4 | 23.3 | 125.6 | 1.35 | (1.32, 1.37) |
| 30+ yrs | 43.4 | 27.5 | 93.2 | – | – |
| Maternal education | | | | | |
| <High school | 26.7 | 41.6 | 200.7 | 5.95 | (5.76, 6.14) |
| High school | 27.3 | 36.9 | 179.3 | 5.31 | (5.15, 5.49) |
| Some college | 20.0 | 16.0 | 114.3 | 3.39 | (3.27, 3.51) |
| College+ | 26.0 | 5.6 | 33.7 | – | – |
| Abortion history | | | | | |
| Prior abortion | 16.8 | 20.1 | 162.5 | 1.20 | (1.18, 1.22) |
| None | 83.2 | 79.9 | 135.0 | – | – |
| Paternity | | | | | |
| Missing | 7.1 | 22.8 | 343.6 | 2.88 | (2.84, 2.92) |
| Established | 92.9 | 77.2 | 124.3 | – | – |
| Children born | | | | | |
| 3+ children | 27.1 | 43.6 | 207.4 | 1.96 | (1.93, 1.99) |
| 2 children | 32.7 | 27.1 | 118.7 | 1.12 | (1.10, 1.14) |
| 1 child | 40.3 | 29.3 | 105.6 | – | – |
| Birth Payment Method | | | | | |
| Medi-Cal | 39.3 | 65.0 | 211.7 | 2.48 | (2.44, 2.51) |
| Other | 60.7 | 35.0 | 85.4 | – | – |

Significant differences were observed in the unadjusted rates of reported maltreatment for all variables of interest except child gender. Among children who were reported, 8.6% were born low birth weight, compared with only 6.1% of children who were not reported. Children with birth abnormalities and mothers with a prior history of one or more pregnancy terminations were also overrepresented among children referred for abuse or neglect. Among children not reported for maltreatment, 88% had prenatal care that began during the first trimester of the pregnancy; this was true of only 76% of children with alleged maltreatment. Children reported for maltreatment were born to younger mothers, with almost 18% born to a teenage mother and 50% born to a mother younger than 25.

An almost exact 50/50 split of US-born and foreign-born mothers was observed for children not reported for maltreatment. Yet, 70% of children reported for maltreatment had a mother who had been born in the US. Pronounced racial disparities in rates of contact with child welfare agencies emerged in the unadjusted analyses: 30% of all Black children and 34% of all Native American children in the birth cohort were reported for maltreatment before the age of five. In contrast, the fraction of White and Hispanic children referred stood at 13% and 14%, respectively. Only 5% of Asian/Pacific Islander children had been reported. The distribution of maternal education was fairly balanced across the four variable levels among children who were not reported for abuse or neglect, but 78.5% of children reported for maltreatment had mothers who had completed no more than the 12th grade.

Paternity had not been established on the birth records of 7.1% of children who were not reported, but this was true of 22.8% of children reported for maltreatment. Family size was inversely distributed across children with and without CPS contact: 43% of referred children were third or higher in birth order; 40% of children without any referrals were only children. Finally, almost 2/3 of children reported for maltreatment were covered by Medi-Cal at birth compared with only 39% of children who were not reported.

The crude risk ratios suggest that the characteristics of children reported for maltreatment before the age of five were significantly different from those who were not reported on all dimensions except gender. Crude risk ratios in excess of 2.0 were observed for children in which: 1) prenatal services began in the third trimester or not at all, 2) the mother was under the age of 25 at the time of birth, 3) the mother had less than a college education, 4) paternity was not established, 5) the mother was born in the US, 6) the mother was Black or Native American, and 7) the family was Medi-Cal eligible at the time of birth.

3.2. Adjusted risk ratios

Multivariate models are presented in Table 2. Risk ratios reflect the relative risk of being reported for maltreatment after adjusting for other factors. Although multivariate models largely confirmed bivariate findings, the associations between several birth variables and CPS contact were found to vary by Medi-Cal coverage at birth. Interactions for all combinations of variables were independently tested. Significant interactions were observed between birth payment method and maternal race/ethnicity ($LR \chi^2(4) = 1282.6, p < 0.001$), education ($LR \chi^2(3) = 1874.14, p < 0.001$), birth place ($LR \chi^2(1) = 441.9, p < 0.001$), and age ($LR \chi^2(3) = 1194.9, p < 0.001$). As such, the decision was made to run models stratified by a child's Medi-Cal coverage status: Model 1 reports adjusted risk ratios for the full birth cohort and includes Medi-Cal status as one of the independent variables; Model 2 reports adjusted risk ratios among only those children whose births were covered by Medi-Cal; and Model 3 reports adjusted risk ratios only among children who were not covered by Medi-Cal.

Several strong associations between birth indicators and a child's risk of being reported for maltreatment were sustained in the multivariate models. Birth to a mother who had immigrated to the

Table 2
Adjusted risk of CPS report: risk ratios and 95% confidence intervals.

| Variables | Model 1 | | Model 2 | | Model 3 | |
|---------------------------|-------------------|--------------|------------------------|--------------|----------------------------|--------------|
| | Full birth cohort | | Medi-Cal (n = 226,903) | | Non Medi-Cal (n = 302,250) | |
| | RR | 95% CI | RR | 95% CI | RR | 95% CI |
| Sex | | | | | | |
| Male vs. female | 1.00 | ns | 1.00 | ns | 1.02 | ns |
| Birth weight | | | | | | |
| Low vs. normal | 1.18 | (1.15, 1.21) | 1.15 | (1.12, 1.19) | 1.22 | (1.17, 1.27) |
| Prenatal care | | | | | | |
| 2nd vs. 1st | 1.20 | (1.18, 1.22) | 1.11 | (1.09, 1.13) | 1.31 | (1.27, 1.36) |
| 3rd vs. 1st | 1.29 | (1.25, 1.33) | 1.17 | (1.13, 1.20) | 1.42 | (1.34, 1.52) |
| No care vs. 1st | 1.79 | (1.72, 1.87) | 1.49 | (1.42, 1.57) | 1.99 | (1.85, 2.14) |
| Birth abnormality | | | | | | |
| Abnormality vs. none | 1.07 | (1.04, 1.10) | 1.08 | (1.05, 1.11) | 1.03 | ns |
| Maternal birth place | | | | | | |
| US-born vs. foreign born | 2.13 | (2.10, 2.17) | 2.47 | (2.42, 2.52) | 1.63 | (1.57, 1.68) |
| Maternal race/ethnicity | | | | | | |
| Black vs. White | 1.19 | (1.17, 1.22) | 0.93 | (0.91, 0.95) | 1.54 | (1.48, 1.60) |
| Hispanic vs. White | 0.80 | (0.78, 0.81) | 0.68 | (0.67, 0.70) | 0.93 | (0.90, 0.96) |
| Native American vs. White | 1.27 | (1.20, 1.34) | 1.02 | ns | 1.54 | (1.39, 1.70) |
| Asian/PI vs. White | 0.80 | (0.77, 0.82) | 0.67 | (0.63, 0.70) | 0.82 | (0.78, 0.86) |
| Maternal age at birth | | | | | | |
| 25–29 yrs vs. 30+ yrs | 1.17 | (1.15, 1.19) | 1.01 | ns | 1.28 | (1.24, 1.32) |
| 20–24 yrs vs. 30+ yrs | 1.52 | (1.48, 1.55) | 1.18 | (1.16, 1.21) | 1.94 | (1.88, 2.00) |
| <20 yrs vs. 30+ yrs | 2.09 | (2.04, 2.14) | 1.55 | (1.51, 1.60) | 2.89 | (2.76, 3.04) |
| Maternal education | | | | | | |
| Some college vs. college+ | 2.31 | (2.22, 2.39) | 1.34 | (1.26, 1.44) | 2.09 | (2.00, 2.18) |
| High school vs. college+ | 2.95 | (2.84, 3.06) | 1.54 | (1.44, 1.64) | 2.74 | (2.62, 2.86) |
| <High school vs. college+ | 3.54 | (3.41, 3.68) | 1.83 | (1.71, 1.95) | 3.63 | (3.45, 3.82) |
| Abortion history | | | | | | |
| Prior abortion vs. none | 1.13 | (1.12, 1.15) | 1.13 | (1.11, 1.15) | 1.13 | (1.10, 1.16) |
| Paternity | | | | | | |
| Missing vs. established | 1.56 | (1.53, 1.59) | 1.45 | (1.42, 1.47) | 1.85 | (1.79, 1.91) |
| Children born | | | | | | |
| Two children vs. one | 1.40 | (1.38, 1.43) | 1.42 | (1.39, 1.45) | 1.40 | (1.36, 1.44) |
| Three children vs. one | 2.33 | (2.29, 2.37) | 2.19 | (2.14, 2.24) | 2.37 | (2.29, 2.44) |
| Birth payment method | | | | | | |
| Medi-Cal vs. other | 1.69 | (1.66, 1.72) | – | – | – | – |

United States was very protective, particularly for children covered by Medi-Cal, while falling third or higher in the birth order more than doubled a child's risk of being reported. Although we found that additional years of completed education were protective against a report of maltreatment across stratifications by Medi-Cal coverage, associations between educational attainment and maltreatment were notably dampened for children born on Medi-Cal.

After adjusting for other risk factors, both Black and Native American children were still significantly more likely than White children to have been reported to CPS by age 5, and a child whose birth was covered by Medi-Cal was significantly more likely to have been reported than a child who was not. But among children covered by Medi-Cal, Black children were actually *less likely* than White children to have been referred and no significant differences were observed between Native American and White children.

Risk of a referral for maltreatment increased with late commencement of prenatal care, although the association was weaker among children born on Medi-Cal. Children covered at birth by Medi-Cal who received no prenatal care were roughly 1.5 times as likely to be reported for maltreatment than were those whose care began in the first trimester. Among children not covered by Medi-Cal, a lack of prenatal care was associated with twice the risk of being reported. Children reported for maltreatment were slightly more likely to have been born with one or more birth abnormalities if also born on Medi-Cal, but there was no association observed among children who were not covered by Medi-Cal at birth. In our bivariate analyses, findings suggested that a maternal history of one or more abortions was a significant predictor of later CPS contact. This finding was sustained in our multivariate models and did not vary by Medi-Cal status. Child sex continued to demonstrate no significant associations with maltreatment reporting risk.

3.3. Children reported to CPS after infancy

This study used a dichotomous measure of whether or not a child was reported for maltreatment at any point after birth and before their fifth birthday. Results highlight the consistency with which indicators measured at the birth of a child continue to predict maltreatment reports during the first five years of life. One could argue, however, that these findings are driven by high rates of maltreatment reports during the first year of life. In this cohort, 35% of all children reported for maltreatment were first reported before their first birthday (among these reported infants, 25% had been reported within three days of birth; 33% by the conclusion of the neonatal period). In order to determine whether our findings were sensitive to the inclusion of these youngest children, we also ran all models restricted to children reported for the first time after their first birthday. The results of these analyses (not shown) were largely consistent in both magnitude and direction with the associations already reported, with just three exceptions. Low birth weight and the presence of a birth abnormality no longer presented as significant risk factors. In addition, while late prenatal care (beginning in the second or third trimester) continued to be a significant predictor of a maltreatment report, a complete absence of prenatal care was no longer significant.

4. Discussion

Prior research established that data universally collected at the time of birth and recorded in the birth record could be used to identify those infants most at risk of maltreatment. In this study, we find that many of the birth indicator variables previously observed to predict a

report of maltreatment continue to emerge for a recent cohort of children born in California, beyond infancy and through the age of five, and inclusive of reports that are screened out or unfounded.

Overall, the strength of association for biomedical, pregnancy-related variables was somewhat attenuated compared to prior research and relative to sociodemographic risk factors. For example, an earlier study found that 25% of infants who entered foster care were classified as low birth weight (vs. only 5.8% of other children) and this variable remained one of the strongest predictors of an infant's entry to foster care in multivariate models (Needell & Barth, 1998). Although low birth weight also proved a significant risk factor in our unadjusted and adjusted analyses, only 8.6% of all children who were reported for maltreatment were born low birth weight and it was a very modest predictor in our multivariate models. Similarly, the presence of a birth abnormality proved a much stronger forecaster in Needell and Barth's examination of infants entering care than in our examination of all children reported through the age of five.

As mentioned earlier, we also ran all models restricted to only children who were first reported for maltreatment after infancy. Our finding that low birth weight and the presence of a birth abnormality were no longer significant is consistent with overall weaker associations discussed above. Yet our finding that a complete lack of prenatal care was no longer associated with a report of maltreatment for children one to four years of age was unexpected. Upon closer examination of the data, we found that the absence of a continued association was driven by the exceptionally high rates at which this group was reported at birth. Among children in this cohort who had not received any prenatal care, 49% were reported to CPS, and 72% of reported children were referred to CPS during the first three days of life. One possible interpretation is that the women who present without any prenatal care in California reflect two distinct groups, comprised of both mothers recently immigrated and who may not have had access to prenatal care, as well as mothers who may be struggling with severe substance abuse or mental health problems. The children of the latter group may be disproportionately reported at birth, while children of the former are not initially reported and may then enjoy the protective benefits incurred from their status as children of immigrants (i.e., the "Hispanic Paradox") (Franzini, Ribble, & Keddie, 2001).

An increased risk of CPS contact based on a prior pregnancy termination was observed for this birth cohort. Although one could argue a lower risk of reported maltreatment for children born following a pregnancy termination, since one could impute that this child was "wanted" by a mother who does not hold personal beliefs that prevented her from terminating earlier pregnancies, our findings do not support this claim. We believe that the observed relationship reflects unobserved maternal characteristics and behaviors that may be associated with both a history of an unplanned and/or unwanted pregnancy, as well as child maltreatment. It should be noted that this variable, in particular, is likely vulnerable to measurement error arising from selective maternal disclosures of abortion history. Still, even if this variable is merely a proxy for some other maternal characteristic that we were unable to include in our models, it does predict a report to CPS.

The unadjusted risk ratios reported in Table 1 are largely consistent with published accounts of racially disparate patterns of CPS contact (Shaw, Putnam-Hornstein, Magruder, & Needell, 2008) and high rates of a referrals among poor children (Jonson-Reid, Drake, & Kohl, 2009). Our finding of significant poverty by race/ethnicity interaction effects, which we addressed by running separate models based on Medi-Cal coverage at birth, supports recent research suggesting that measures of poverty may capture different dynamics based on an individual's race (Drake, Lee, & Jonson-Reid, 2009; Wulczyn & Lery, 2008). We find that, after adjusting for other factors, the children of poor White mothers are slightly more likely than the children of poor Black mothers to be reported for maltreatment, and

no more or less likely than the children of poor Native American mothers. Yet, among non-poor (non Medi-Cal) mothers, both Black and Native American children are significantly more likely than their non-poor White counterparts to be reported (Fig. 1).

The continued emergence of racial disparities in reports of maltreatment among non Medi-Cal births, even after adjusting for other risk factors, may be attributed to unmeasured gradations in income, which are strongly associated with child maltreatment (Sedlak & Broadhurst, 2010). On average, non Medi-Cal White families are likely wealthier than non Medi-Cal Black families. Yet, because Black families are significantly poorer than White families in California (Lopez, 2003), this logic fails to explain our finding of a heightened risk of maltreatment reports for White children born on Medi-Cal.

To explain this finding, we borrow a term used by Drake and colleagues—"differential assortment" (2009). This term describes a process through which historic and present day structural barriers to economic success result in the differential sorting of Whites and Blacks by poverty status. Drake argues that if the antecedent reasons for poverty differ by race, then it stands to reason that a measure of impoverishment may proxy different latent risk factors for child maltreatment. Among White mothers, Medi-Cal may be a more direct measure of maternal characteristics and behaviors that place a child at risk of maltreatment. Yet among Black mothers, Medi-Cal status may be more likely to be confounded by systemic, non-maternal barriers to economic achievement that are unrelated to child maltreatment.

Divergence in the magnitude of maltreatment reporting risk across levels of maternal education and maternal age may also be explained by "differential" sorting according to Medi-Cal status. Earlier, we posited that the average poor White mother in our data possessed a greater number of latent risk factors associated with child maltreatment than did the average poor Black mother. It also seems reasonable to assume that the presence of more highly educated mothers on Medi-Cal, as well as older mothers, may reflect more entrenched, yet unmeasured, maternal factors associated with child maltreatment.

Among non Medi-Cal births, increased education can be assumed to translate into income gradations protective against child maltreatment. Similarly, later maternal age may be associated with higher levels of personal and material resources that promote parenting behaviors protective against child maltreatment. Yet among mothers who have the benefits of either one or both of these factors, but who still find themselves meeting the eligibility requirements for Medi-Cal coverage, the salience of age and education are reduced. This pattern was also reported by Needell and Barth (1998) who found that the

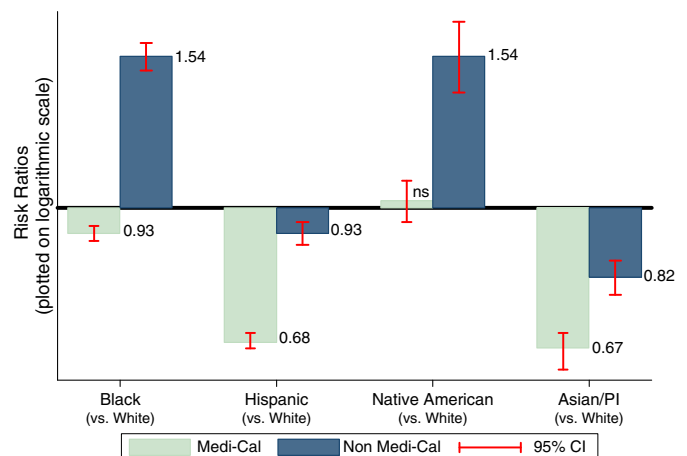


Fig. 1. Relative risk of being reported for maltreatment (and 95% CI) by race and Medi-Cal coverage at birth, adjusted by other birth indicator variables.

association between maternal age and an infant's entry to foster care was modified by Medi-Cal status—increased age was protective for children born to non-poor mothers, but a risk factor for children born to poor mothers.

4.1. Limitations

Several limitations bear further comment. As noted at the outset, we were unable to locate birth records for 16% of the children identified in the child welfare data. An examination of unmatched records suggests that these children were more likely to have been screened out without an investigation and were less likely to have had a report substantiated. We cannot be certain how these children may have differed in other ways. Our study is limited to children born in California in 2002. Associations that emerged in this study may not hold true in other geographies or for other populations. We were prevented from examining paternal variables associated with a report of maltreatment due to high rates of paternal demographic variables that were not missing at random. A disproportionate share of children for whom paternity was not established was subsequently reported for maltreatment. As such, attempts to examine paternal characteristics as predictors of a maltreatment report would have been unduly influenced by data collected for fathers who were either married to the child's mother, or were present at the child's birth and willing to sign a paternity declaration.

Finally, a more refined measure of socioeconomic status or income would have been highly desirable. Medi-Cal coverage is a crude proxy for poverty, especially in light of research suggesting child health and well-being gradations associated with even subtle shifts in socioeconomic status (Chen, Matthews, & Boyce, 2002). In addition, uptake of Medi-Cal and other public insurance programs is far from universal among those who meet income thresholds. We did, however, review the alternative birth payment coverage methods among those who were coded as non Medi-Cal. This group was highly homogeneous in the sense that almost all were covered by private insurance or an HMO. Further, California allows the retroactive enrollment of Medi-Cal eligible, nonparticipating mothers to cover the cost of labor and delivery, reducing concerns of selective entry into this program.

4.2. Implications

As Wulczyn (2009, p. 41) (and others) have correctly pointed out, "The notion that a single set of investments in prevention programs will have direct and unambiguous benefits...reaches well past what the available data tell us". Yet, our analysis highlights that objective data collected at birth can be used to identify those children in a given birth cohort who are at greatest risk of being reported for maltreatment during the first five years of life. Compared with the demographics of the birth cohort as a whole, these young children amount to a fairly homogeneous group, defined by the presence of multiple risk factors. Although it is unlikely a "one-size fits all" intervention will ever be developed, that does not mean we cannot make an informed assessment of the probability that a given child will be referred for maltreatment, and take steps to provide services and support to prevent all that occur downstream from a first report of maltreatment.

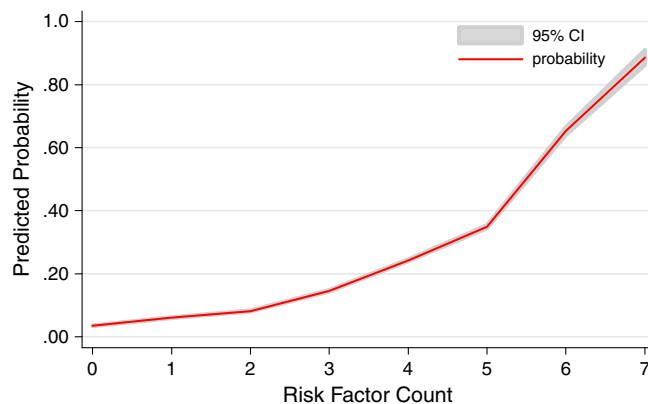
So how might these data be used? Following the premise of an epidemiologic risk assessment tool for infant maltreatment as proposed by Wu et al. (2003), if we were to classify as "high risk" any child born with three or more of just a handful of risk factors (*prenatal care that began after the first trimester, missing paternity, <=high school education, 3+ children in the family, maternal age <=24 years, Medi-Cal coverage of the birth for a US-born mother*), we could identify 50% of children reported for maltreatment before the age of five from just 15% of the total birth cohort.

For descriptive purposes, we also estimated predicted probabilities based on various combinations of risk factors. We first considered a child falling in the high-risk level of every theoretically "modifiable" variable in this analysis (thus, we excluded only maternal race, maternal birth place, and child sex, all of which we set to the group mean based on other risk factor specifications). We estimated a child fitting this profile to have a 0.89 (95% CI: 0.86, 0.91) predicted probability of being reported for maltreatment before their fifth birthday. At the other extreme, the predicted probability of a child falling in the low-risk level for each of these same variables was estimated to be just 0.03 (95% CI: 0.03, 0.04). We also plotted the predicted probability of a maltreatment report based on the count of modifiable risk factors present, sorted by the rate at which a given risk factor was present in the overall cohort. Fig. 2 displays the predicted probability that a child is reported to CPS based on this unweighted risk factor count.

These represent simple back of the envelope calculations. Obviously, more refined analyses could be conducted that better account for interactions observed among risk factors. A risk assessment tool that could be used on the day of birth to identify those children at greatest risk of maltreatment holds great value. Since many of the strongest risk factors are present prior to the birth of a child, and are objectively observable maternal and family characteristics, prenatal risk assessments could be used to identify children at risk of maltreatment while still in the womb. Needless to say, a standardized assessment tool that relies on a demographic profile can never replace more comprehensive assessments of an individual family's strengths and risks. But against an invariable backdrop of limited resources, the ability to provide prevention-oriented intervention services to a highly targeted swath of at-risk families has the potential for cost-savings to be realized, while also improving child well-being.

4.3. Future directions for research

Future directions for research using linked data are numerous. This method of birth cohort inquiry can be extended by tracking maltreatment reports as these children age. It can also be replicated using earlier and later birth cohorts from California (or other states), with prediction models tested. Examinations of risk and protective factors as they relate to decision points subsequent to a report (e.g., investigation, victimization, and entry to care) could serve to elucidate possible differences among children reported for maltreatment. Hierarchical models could be specified to examine within and



1. Included risk factors are those considered "modifiable", at least in theory.
2. Risk factors are unweighted and ordered based upon their frequency within the cohort (from most to least common).
3. Non-modifiable variables not included are set at the group mean, given other risk factors.

Fig. 2. Predicted probability of being reported for maltreatment (and 95% CI) by count of risk factors at birth.

between-county differences in associations between birth indicator variables and childhood risk of maltreatment; survival analysis could be used to explore patterns and timing of first and repeat referrals as a means of further organizing demographic profiles of at-risk children. Finally, the success of targeted interventions could be tested at a population-level by tracking service recipients over time in the context of the full birth cohort.

4.4. Summary

Using administrative child protective service data linked to statewide vital birth records, this study provides a population-based examination of child and family characteristics predictive of a maltreatment report. This study demonstrates that it is possible to use objective, universally collected data on the day of birth to prospectively identify those children at greatest risk of maltreatment during the first five years of life, providing opportunities to target high-risk subsets of children for intervention services upstream of a first contact with child protective services.

Research support

Support for this research was received from the Harry Frank Guggenheim Foundation, the Fahs-Beck Foundation, and the Center for Child and Youth Policy. Ongoing support for the California Performance Indicator's Project is provided by the California Department of Social Services and the Stuart Foundation.

Financial disclosure/conflict of interest

None.

Acknowledgments

The authors would like to acknowledge and thank colleagues at both the California Department of Social Services and the Center for Social Services Research for their assistance in preparing data files underlying this analysis. The authors would also like to thank Wendy Wiegmann for her assistance in editing this article.

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