

Predictors of Child Protective Service Contact between Birth and Age Five:  
An Examination of California's 2002 Birth Cohort

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## 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 contacts with child protective services (CPS) for 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 referred to CPS beyond infancy. Of the 530,843 children born in California in 2002, 14% (N=74,182) were found to have been referred for possible maltreatment before age 5. Eleven of the twelve variables examined presented as significant predictors of later CPS contact.

## 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 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 1,000) were subsequently deemed victims of maltreatment. Among maltreated children, the nation's youngest children were disproportionately represented: 33% of all victims in 2008 were under four years of age; the highest rate of maltreatment was observed during the first year of life (21.7 per 1,000).

The profound vulnerability of these youngest children cannot be understated. Not only are these children 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 (Felitti et al., 1998; Perry, 2001; Springer, Sheridan, Kuo, & Carnes, 2007), with outcomes often observed to be most severe and intractable for children with an onset of abuse or neglect occurring 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 present to child protective services suggest that a renewed focus on primary prevention through various early intervention activities prenatally and shortly after the birth of a child 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 can be employed to identify those children who may be at greatest risk of maltreatment.

### *1.1 Studies Linking Child Welfare Data and Birth Records*

Prior research has examined the relationship between birth indicator variables and a verified or substantiated case of infant maltreatment (Wu et al., 2003), rates of maltreatment among children who received home visiting services (Murphey & Braner, 2000), as well as an

infant's entry to foster care following a maltreatment substantiation (Needell & Barth, 1998). To the best of our knowledge, however, this is the first US-based study to extend this method of population-based data linkage and inquiry to all children referred to CPS after birth and before the age of five, regardless of report disposition. A relatively larger body of literature linking child welfare and birth records arises from European studies, where linkages between administrative data sources are more common (for examples of research involving children outside of the US, see: Murphy, Jenkins, Newcombe, & et.al., 1981; Sidebotham & Heron, 2006; Spencer, Wallace, Sundrum, Bacchus, & Logan, 2006). Additionally, ecological studies examining associations between child maltreatment risk and perinatal characteristics at the community level have also been conducted (Lee & Goerge, 1999; Zhou, Hallisey, & Freymann, 2006)

### *1.2 Research Objectives*

Of interest is the extent to which those birth variables that have been identified in prior research as predictive of infant maltreatment, have sustained value in foretelling which children will have any CPS contact by age five. The potential usefulness of using birth data to construct an epidemiologic risk-assessment tool was argued by Wu and colleagues who, through the use of just 3 birth variables, were able to identify 50% of all substantiated infant maltreatment cases from 13% of Florida's 1996 birth cohort (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 referred for maltreatment during early childhood and to 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-level child welfare records were extracted from the state's Child Welfare Services Case Management System (CWS/CMS) – the state's database for tracking children referred 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 State of California.

## *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 a child's fifth birthday.

## *2.3 Base Child Welfare and Vital Birth Record Datasets*

The records of all children who were born in 2002 and referred to child protective services for possible maltreatment in California before the age of 5 were downloaded from the Quarter 1, 2009 extract of CWS/CMS (n=91,520). While some unknown 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 it was a non-California birth 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 the child welfare records.

## *2.4 Record Linkages*

Records 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 close manual examination of a 1% random sample of comparison pairs falling within each 10-point weight strata, lower bound and upper bound cut-off scores were established. For those comparison pairs with a score in the established “gray area” between the lower bound cut-off and upper bound cut-off, a clerical review was completed to determine match-status. 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 generally 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 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 ( $\chi^2(3)=5.6e+03, p<.001$ ). 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 tracked as assessment only (9% vs. 27%), with no differences observed between matched and unmatched children who had unsubstantiated or inconclusive allegations. Racial differences also emerged ( $\chi^2(4)=205.9, p<.001$ ). 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 substantive differences between matched and unmatched children based on allegation type: roughly 47% were referred for neglect and 12% for physical abuse.

### *2.5 Dependent Variable*

The outcome of interest in this study was a referral to CPS after birth and before the age of five (captured as a dichotomous variable indicating whether or not any referral was received). We include both referrals that resulted in an investigation and disposition (i.e., unfounded, inconclusive, or substantiated) as well as those that were tracked as “assessment only” and received no investigation. Our decision to include all children who were reported, even if their case was not investigated, is based on other analyses of data from California indicating that over

40% of referred children ages 0-4 are re-referred within two years, regardless of whether or not the first allegation was substantiated, unfounded, inconclusive, or tracked as assessment only (Needell et al., 2010).

This decision also arises from a body of literature highlighting the fallibility of correctly ascertaining whether a child has been maltreated (Drake, 1996; Drake, Jonson-Reid, Way, & Chung, 2003; Giovannoni, 1989) and a lack of distinguishable differences in subsequent behavioral measures between children with a substantiated versus unsubstantiated allegation of maltreatment (Hussey et al., 2005; Leiter, Myers, & Zingraff, 1994). As such, we chose to view a referral to CPS as a measure of latent “familial disorganization” that may place a child at risk of harm from maltreatment (either current, or future) and treat the referral itself, rather than any classification of that referral, as providing practical and valuable descriptive 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 sociodemographic risk factors for contact with child protective services, as well as biomedical markers which emerged as significant in prior linkages between 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 was derived directly from the birth record (*male, female*).
2. Birth Weight: A binary variable indicating whether or not the child weighed less than 2500 grams at birth was constructed from a continuous measure of birth weight (*low (<2500g), normal (>=2500g)*).
3. Prenatal Care: A prenatal care variable was created based on the month in which care began, including a fourth category if there was no prenatal care (*first trimester, second trimester, third trimester, no care*).
4. Birth Abnormality: A binary variable capturing the presence of one or more birth abnormalities was constructed from a birth record variable that allows for up to 10 conditions to be recorded (*birth abnormality, none*).

5. Maternal Birth Place: A dichotomous variable indicating whether or not the mother was born in the United States was constructed based on the mother's reported county, state, or country of birth (*US-born, foreign-born*).
6. Maternal Race/Ethnicity: A mother's race/ethnicity was coded into five categories based on the first identified race and a Hispanic identifier variable (*non-hispanic white, non-hispanic black, hispanic, non-hispanic asian/pacific islander, non-hispanic native american*).
7. Maternal Age: Maternal age captured at the time of birth was coded into a variable with four levels (*< 20 years, 20-24 years, 25-29 years, 30+ years*).
8. Maternal Education: A four-level variable for maternal education was constructed based on reported years of school completed. Mothers who reported having completed eleven years of school or less were coded as *<12<sup>th</sup> grade*. Those with 12 completed years were coded as having a *12<sup>th</sup> grade*. Mothers who identified as having completed 13 to 15 years were coded as *some college*. Mothers with 16 years or more of completed education classified as *college or higher*.
9. Abortion History: Based on a maternal birth variable reporting the number of prior early-term and late-term abortions, a binary variable was created indicating if any prior pregnancies had been terminated by abortion (*one or more, none*).
10. Father Information: We were unable to include an indicator of mother's marital status since California Health and Safety Code Section 102425 now prohibits the release of this information 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 provides a lower-bound estimate of non-marital births and a seeming lack of substantial parental partner involvement (*missing, present*).
11. Total Children Born to Mother: The total number of children in the family, inclusive of the birth at hand, was captured at one of three levels (*one child, two children, three or more children*).
12. Medi-Cal Status: The expected source of payment for the birth 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*).

## 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 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). Results were compared with those obtained from logistic models. As expected, the same variable associations emerged, although the logistic models produced more extreme values.

In addition to multivariate models, the distribution of children who did and did not have CPS contact during the first five years of life was calculated for each level of the twelve independent variables examined in this analysis, along with unadjusted RR and 95% confidence intervals (95% CI). Predicted probabilities for CPS contact 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 with and without CPS contact across variable levels, as well as the unadjusted risk of a referral. Of the full 531,035 children born alive in the state in 2002, 13.9% (74,182) were referred for possible abuse or neglect before their fifth birthday, roughly consistent with earlier published prevalence estimates from California (Magruder & Shaw, 2008). This rate of contact should be considered a lower bound count of the true fraction of the cohort referred to CPS as we were unable to find matching birth records for

16% of the children identified in the state's administrative database as born in 2002. Although it is likely that many of these children were born out of state, 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.

Significant differences were observed in the unadjusted rates of CPS contact for all variables of interest except child gender. The percentage of children born with low birth weight among children who had CPS contact was 8.6% compared with only 6.1% among children who were not referred. Children with birth abnormalities and mothers with a prior history of one or more abortions were also slightly overrepresented among children referred for abuse or neglect. For children without CPS contact, 88% had prenatal care that began during the first trimester of the pregnancy; this was true of only 76% of children referred for maltreatment. Children referred to CPS were born to younger mothers, with almost 18% born to a teenage mother and 50% born to a mother younger than 25. Among children for whom no CPS-contact was recorded, only 8% were teen births and 30% were births to a mother less than 25 years old.

An almost exact 50/50 split of US-born and foreign-born mothers was observed for children not referred for maltreatment. Yet, only 30% of referred children had a foreign-born mother. Established 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 referred to CPS before the age of five. In contrast, the fraction of White and Hispanic children referred stood at 13% and 14%, respectively, and only 5% of all Asian/Pacific Islander children were referred. The distribution of maternal education was fairly balanced between the four variable levels among children who were not referred for abuse or neglect, but 78.5% of referred children had mothers who had completed no more than the 12<sup>th</sup> grade.

No paternity information was recorded on the birth record for 5.5% of children without CPS contact, but this was true for 17.6% of referred children. Larger 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 referred to CPS were covered by Medi-Cal at birth compared with only 39% of children who had no CPS contact.

In summary, the unadjusted risk ratios suggest that children referred to CPS before the age of five were significantly different from those who were not referred on all dimensions

except for gender. Crude risk ratios in excess of 2.0 were observed for children born to mothers who: 1) began receiving prenatal services late or not at all, 2) were younger, 3) had less education, 4) did not have paternity documentation, 5) were born in the US, 6) were Black or Native American, and 7) were poor as indicated by Medi-Cal coverage of the birth.

*[INSERT TABLE 1 HERE]*

### *3.2 Adjusted Risk Ratios*

Multivariate models are presented in Table 2 and reflect the relative risk of CPS contact observed for each independent birth record variable, after adjusting for all other birth variables. 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 Medi-Cal status and maternal race/ethnicity (LR  $\chi^2(4)=1282.6$ ,  $p<.001$ ), education (LR  $\chi^2(3)=1874.14$ ,  $p<.001$ ), birth place (LR  $\chi^2(1)=441.9$ ,  $p<.001$ ), and age (LR  $\chi^2(3)=1194.9$ ,  $p<.001$ ). 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 non Medi-Cal births.

Several strong associations between birth indicators and CPS contact were sustained in the multivariate models. Birth to a mother who had immigrated to the United States was strongly protective, particularly for children born on Medi-Cal, while being third or higher in the birth order more than doubled the risk of CPS contact. Children who joined just one sibling and therefore fell second in the birth order were 40% more likely to be referred for maltreatment than children in the cohort who were first born. Although we found that additional years of completed education was protective against a referral for maltreatment across stratifications by Medi-Cal coverage, associations between educational attainment and CPS contact were notably dampened for children born on Medi-Cal and amplified for children who are not.

After adjusting for all other variables, 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 referred 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 children 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 referred to CPS 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 a two-fold increase in the likelihood of a referral to CPS. Children referred to CPS 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 poverty status. Child sex continued to demonstrate no significant associations with likelihood of CPS contact.

*[INSERT TABLE 2 ABOUT HERE]*

### *3.3 Children Reported to CPS After Infancy*

The previous analyses used a dichotomous measure of whether or not a child was referred to CPS 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 CPS contact throughout the first five years of life. One could argue, however, that these findings continue to emerge, at least in part, because of high rates of CPS contacts during the first year of life. In this cohort, 35% of all children with CPS contact were initially reported before their first birthday (among these reported infants, 25% had been referred 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 referred 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 CPS contact, a complete lack 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 associations previously observed between birth indicator variables and subsequent maltreatment continue to emerge in a recent birth cohort, beyond infancy, and regardless of the report disposition. We also uncover some previously unreported associations, including that a maternal history of an abortion is a risk factor of a CPS contact and that Medi-Cal coverage at birth significantly interacts with a number of variables.

Overall, the strength of associations for biomedical and prenatal variables were somewhat attenuated relative to prior research and compared with sociodemographic risk factors. For example, an earlier study found that 25% of infants who entered foster care were classified as low birth weight (versus only 5.8% of other children) and this variable remained one of the strongest predictors of an infant's entry to care in the multivariate model (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 referred to CPS had been 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 than in our examination of children referred up until age five.

As mentioned earlier, we also ran all models restricted to only children who were first referred 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 CPS contact for children ages 1-4 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 referred to CPS early in life. Among children in this cohort who had not received any prenatal care, 49% were referred to CPS, and 72% of those children were referred during the first

three days of life. One possible interpretation is that the women who present without any prenatal care are a highly heterogeneous group, comprised of both mothers recently immigrated and who may not have 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 are disproportionately referred at birth, while children of the former are not initially referred and then benefit from the protective associations of their immigrant status over the next several years of the life.

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 CPS contact 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 unmeasured maternal characteristics and behaviors that are connected to a history of an unplanned and/or unwanted pregnancy, and child maltreatment.

Risk Ratios reported in Model 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, support recent research suggesting that standard measures of poverty may capture different dynamics based on one’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 referred to CPS 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 have CPS contact. (See Figure 1.)

*[INSERT FIGURE 1 HERE]*

Our observations of racial disparities in CPS contact among non Medi-Cal births 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 were 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 align with our finding of a heightened risk of CPS contact for White children born on Medi-Cal.

To attempt an explanation of this finding, we borrow a term used by Drake and colleagues – “differential assortment” – which they used to describe 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 (2009). Drake argued that if the antecedent reasons for poverty differ by race, than 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 fairly direct measure of maternal characteristics and behaviors that place a child at risk of maltreatment. Yet among Black mothers, Medi-Cal status may be confounded by systemic, non-maternal, barriers to economic achievement that are unrelated to child maltreatment.

Divergence in the magnitude of CPS contact risk across levels of maternal education and levels of maternal age may also be explained by “differential” sorting based on Medi-Cal status. With regards to race/ethnicity, we posited above that the average poor White mother possessed a greater number of latent risk factors for child maltreatment than did the average poor Black mother in our cohort. 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 reported 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 are still caught in the net of Medi-Cal coverage, the salience of age and education prove less critical. This pattern was also reported by Needell and Barth who found that the 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 (1998).

#### *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 services data. An examination of unmatched records suggests that these children were more likely to have been tracked as assessment only, and much less likely to have ever had a report substantiated. We cannot be certain how these children may have differed from our study population in other ways. Our study is limited to children born in California. 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 risk of CPS contact because of high rates of father variables that were not missing at random. A disproportionate share of children for whom no paternal information was entered were referred to CPS. As such, attempts to examine CPS associations based on paternal characteristics would have been unduly influenced by data collected for fathers who were either married to the child's mother, or were 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 of 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).

#### *4.2 Implications*

As Wulczyn (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" (2009, p. 41). 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 future CPS contact. Compared with the demographics of the birth cohort as a whole, these young children amount to a fairly homogenous 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 to CPS, and take steps to provide services and support to prevent all that occurs 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., if we were to utilize just a



handful of risk factors for CPS contact (*prenatal care that began after the first trimester, missing father information, <=12 years of education, 3+ children in the family, maternal age <=24 years, Medi-Cal Coverage of the birth for a US-born mother*) to classify as “high risk” any child born with three or more of these risk factors, we could identify 50% of children referred to CPS 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 and protective 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 referred to CPS 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 CPS contact 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. Figure 2 displays the predicted probability of CPS contact based on this unweighted risk factor count.

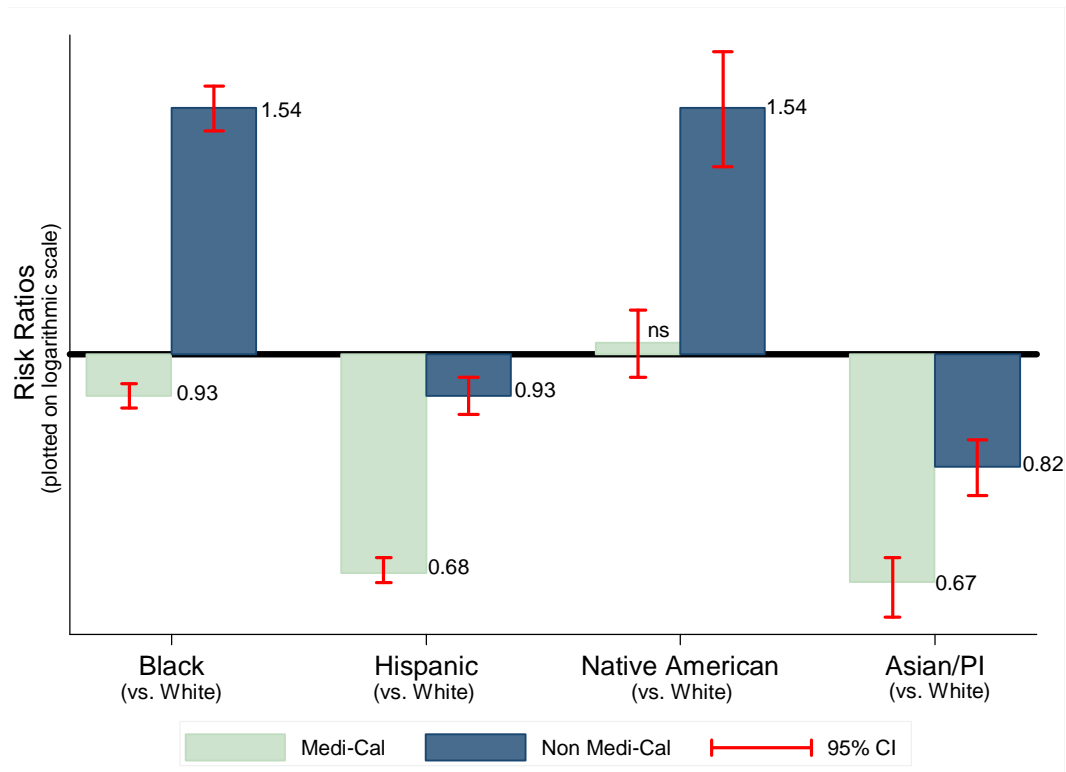
*[INSERT FIGURE 2 HERE.]*

These represent simple back of the envelope calculations. Obviously, more refined analyses could be developed 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 present prior to the birth of a child, and are 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 preventive and 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.

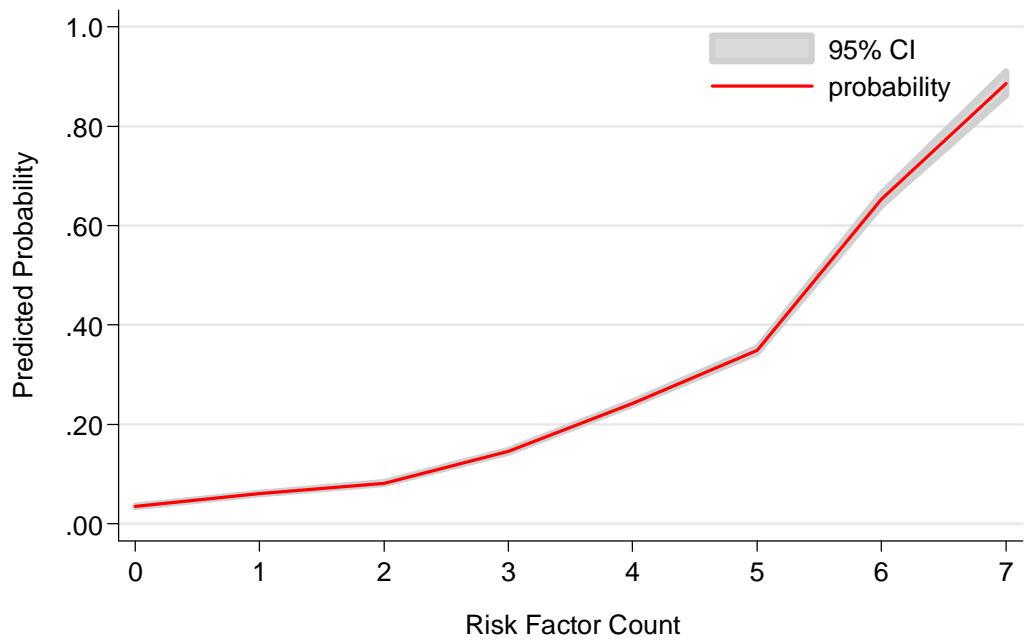
### *4.3 Future Directions for Research*

Using recently completed record linkages between child welfare data and vital birth records, this study examined maltreatment referrals from birth through age five for all children in California's 2002 birth cohort. Future directions for research using linked data such as these are numerous. This method of birth cohort inquiry can be extended by tracking CPS referrals as these children age. It can also be replicated using earlier and later birth cohorts from California (or other states), with models of CPS predictions tested. Examinations of risk and protective factors as they relate to decision points subsequent to a referral (e.g., investigation, victimization, entry to care) could serve to elucidate possible differences among children referred to CPS. Mixed-effects models could be specified to examine within and between-county differences in associations between birth indicator variables and childhood risk of CPS contact; 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.

**Figure 1. Risk of CPS Contact (and 95% CI) by Race and Medi-Cal Coverage at Birth, adjusted by other birth indicator variables**



**Figure 2. Predicted Probability of CPS Contact (and 95% CI) by Count of Risk Factors at Birth**



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.

**Table 1. Birth Cohort Characteristics: *Variable distributions, rates of contact, and unadjusted risk ratios***

	No CPS Contact n=456,650	CPS Contact n=74,182	Rates of CPS Contact	Crude Risk Ratios	
	%	%	per 1,000	RR	(95% CI)
<u>Sex</u>					
<i>boy</i>	51.1	51.1	139.8	1.00	ns
<i>girl</i>	48.9	48.9	139.7	--	--
<u>Birth Weight</u>					
<i>low (&lt;2500 g)</i>	6.1	8.6	186.9	1.37	(1.33, 1.40)
<i>normal (&gt;=2500 g)</i>	94.0	91.4	136.5	--	--
<u>Prenatal Care</u>					
<i>none</i>	0.3	1.8	488.5	3.92	(3.70, 4.13)
<i>third trimester</i>	1.8	3.9	253.9	2.04	(1.96, 2.11)
<i>second trimester</i>	9.9	17.6	222.8	1.79	(1.75, 1.82)
<i>first trimester</i>	88.0	76.7	122.7	--	--
<u>Birth Abnormality</u>					
<i>one or more abnormality</i>	6.0	7.7	172.7	1.26	(1.22, 1.29)
<i>none</i>	94.0	92.3	137.6	--	--
<u>Maternal Birth Place</u>					
<i>US-born</i>	50.9	70.1	182.8	2.03	(2.00, 2.06)
<i>foreign-born</i>	49.1	29.9	90.0	--	--
<u>Maternal Race/Ethnicity</u>					
<i>native american</i>	0.3	1.1	349.0	2.61	(2.43, 2.82)
<i>black</i>	4.9	12.9	300.0	2.25	(2.19, 2.30)
<i>hispanic</i>	50.1	51.5	143.1	1.07	(1.05, 1.09)
<i>asian/pi</i>	13.0	4.5	53.5	0.40	(0.38, 0.41)
<i>white</i>	31.7	30.1	133.5	--	--
<u>Maternal Age at Birth</u>					
<20 yrs	8.3	17.7	256.6	2.75	(2.69, 2.81)
20-24 yrs	21.9	31.5	189.5	2.03	(1.99, 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	--	--
<u>Maternal Education</u>					
<12th grade	26.7	41.6	200.7	4.40	(4.28, 4.53)
12th grade	27.3	36.9	179.3	3.93	(3.82, 4.04)
some college	20.0	16.0	114.3	2.51	(2.43, 2.59)
college+	26.0	5.6	33.7	--	--
<u>Abortion History</u>					
<i>one or more</i>	16.8	20.1	162.5	1.20	(1.18, 1.22)
<i>none</i>	83.2	79.9	135.0	--	--
<u>Father Information</u>					
<i>missing</i>	5.5	17.6	343.6	2.77	(2.73, 2.81)
<i>present</i>	94.5	82.4	124.0	--	--
<u>Total Children Born to Mother</u>					
<i>three children</i>	27.1	43.6	207.4	1.96	(1.93, 1.99)
<i>two children</i>	32.7	27.1	118.7	1.12	(1.10, 1.14)
<i>one child</i>	40.3	29.3	105.6	--	--
<u>Medi-Cal Coverage of Birth</u>					
<i>medi-cal</i>	39.3	65.0	211.7	2.48	(2.44, 2.51)
<i>other</i>	60.7	35.0	85.4	--	--

**Table 2. Adjusted Risk of CPS Contact: 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
<u>Sex</u>						
<i>boy vs. girl</i>	1.00	ns	1.00	ns	1.02	ns
<u>Birth Weight</u>						
<i>low vs. normal</i>	1.18	(1.15, 1.21)	1.15	(1.12, 1.19)	1.22	(1.17, 1.27)
<u>Prenatal Care</u>						
<i>second vs. first</i>	1.20	(1.18, 1.22)	1.11	(1.09, 1.13)	1.31	(1.27, 1.36)
<i>third vs. first</i>	1.29	(1.25, 1.33)	1.17	(1.13, 1.20)	1.46	(1.37, 1.56)
<i>none vs. first</i>	1.79	(1.72, 1.87)	1.49	(1.42, 1.57)	2.04	(1.89, 2.20)
<u>Birth Abnormality:</u>						
<i>one or more vs. none</i>	1.07	(1.04, 1.10)	1.08	(1.05, 1.11)	1.03	ns
<u>Paternity Information</u>						
<i>missing vs. present</i>	1.58	(1.56, 1.61)	1.45	(1.42, 1.47)	1.85	(1.79, 1.92)
<u>Maternal Education</u>						
<i>some college vs. college+</i>	1.77	(1.71, 1.82)	1.01	ns	1.86	(1.78, 1.93)
<i>12th grade vs. college+</i>	2.23	(2.16, 2.30)	1.16	(1.12, 1.21)	2.44	(2.34, 2.54)
<i>&lt;12th grade vs. college+</i>	2.63	(2.54, 2.71)	1.38	(1.33, 1.43)	3.23	(3.08, 3.39)
<u>Abortion History</u>						
<i>prior abortion vs. none</i>	1.13	(1.12, 1.15)	1.13	(1.11, 1.15)	1.13	(1.10, 1.16)
<u>Children Born Alive</u>						
<i>two children vs. one</i>	1.40	(1.38, 1.43)	1.42	(1.39, 1.45)	1.40	(1.36, 1.44)
<i>three+ children vs. one</i>	2.33	(2.29, 2.37)	2.19	(2.14, 2.24)	2.37	(2.29, 2.44)
<u>Maternal Birth Place</u>						
<i>us-born vs. foreign born</i>	2.13	(2.10, 2.17)	2.47	(2.42, 2.52)	1.63	(1.57, 1.68)
<u>Maternal Race/Ethnicity</u>						
<i>black vs. white</i>	1.19	(1.17, 1.22)	0.93	(0.91, 0.95)	1.54	(1.48, 1.60)
<i>hispanic vs. white</i>	0.80	(0.78, 0.81)	0.68	(0.67, 0.70)	0.93	(0.90, 0.96)
<i>native american vs. white</i>	1.27	(1.20, 1.34)	1.02	ns	1.54	(1.39, 1.70)
<i>asian/pi vs. white</i>	0.80	(0.77, 0.82)	0.67	(0.63, 0.70)	0.82	(0.78, 0.86)
<u>Maternal Age</u>						
<i>25-29 yrs vs. 30+ yrs</i>	1.17	(1.15, 1.19)	1.01	ns	1.28	(1.24, 1.32)
<i>20-24 yrs vs. 30+ yrs</i>	1.52	(1.48, 1.55)	1.18	(1.16, 1.21)	1.94	(1.88, 2.00)
<i>&lt;20 yrs vs. 30+ yrs</i>	2.09	(2.04, 2.14)	1.55	(1.51, 1.60)	2.95	(2.82, 3.10)
<u>Medi-Cal Coverage at Birth</u>						
<i>medi-cal vs. non-medi-cal</i>	1.76	(1.74, 1.79)	--	--	--	--

## REFERENCES

- Chen, E., Matthews, K. A., & Boyce, W. T. (2002). Socioeconomic differences in children's health: How and why do these relationships change with age? *Psychological Bulletin*, *128*(2), 295-329.
- Davies, H., Crombie, I. K., & Tavakoli, M. (1998). When can odds ratios mislead? *BMJ (British Medical Journal)*, *316*, 989-991.
- Drake, B. (1996). Unraveling "unsubstantiated". *Child Maltreatment*, *1*(3), 261-271.
- Drake, B., Jonson-Reid, M., Way, I., & Chung, S. (2003). Substantiation and recidivism. *Child Maltreatment*, *8*, 248-260.
- Drake, B., Lee, S. M., & Jonson-Reid, M. (2009). Race and child maltreatment: Are Blacks overrepresented? *Children and Youth Services Review*, *31*, 309-316.
- English, D., Graham, J. C., Litrownik, A., Everson, M., & Bangdiwala, S. (2005). Defining maltreatment chronicity: Are there differences in child outcomes? *Child Abuse & Neglect*, *29*, 575-595.
- English, D., Upadhyaya, M., Litrownik, A., Marshall, J., Runyan, D., Graham, J., & Dubowitz, H. (2005). Maltreatment's wake: The relationship of maltreatment dimensions to child outcomes. *Child Abuse & Neglect*, *29*(5), 597-619.
- Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., . . . Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. *American Journal of Preventive Medicine*, *14*(4), 245-258.
- Giovannoni, J. (1989). Substantiated and unsubstantiated reports of child maltreatment. *Children and Youth Services Review*, *11*(4), 299-318.
- Hussey, J. M., Marshall, J. M., English, D. J., Knight, E. D., Lau, A. S., Dubowitz, H., & Kotch, J. B. (2005). Defining maltreatment according to substantiation: Distinction without a difference? *Child Abuse & Neglect*, *29*, 479-492.
- Jonson-Reid, M., Drake, B., & Kohl, P. L. (2009). Is the overrepresentation of the poor in child welfare caseloads due to bias or need? *Children and Youth Services Review*, *31*(3), 422-427.



- Kotch, J., Browne, D., Dufort, V., Winsor, J., & Catellier, D. (1999). Predicting child maltreatment in the first 4 years of life from characteristics assessed in the neonatal period. *Child Abuse & Neglect*, 23(4), 305-319.
- Kotch, J., Lewis, T., Hussey, J., English, D., Thompson, R., Litrownik, A., . . . Dubowitz, H. (2008). Importance of early neglect for childhood aggression. *Pediatrics*, 121, 725-731.
- Lee, B. J., & Goerge, R. (1999). Poverty, early childbearing, and child maltreatment: A multinomial analysis. *Children and Youth Services Review*, 21(9/10), 755-780.
- Leiter, J., Myers, K. A., & Zingraff, M. T. (1994). Substantiated and unsubstantiated cases of child maltreatment: Do their consequences differ? . *Social Work research*, 18(2), 67-82.
- Lopez, A. (2003). Race and income in California: Census 2000 Profiles, No. 13 *CCSRE Race and Ethnicity in California: Demographics Report Series*. Stanford, CA: Stanford University.
- Magruder, J., & Shaw, T. V. (2008). Children ever in care: an examination of cumulative disproportionality. *Child Welfare*, 87(2), 169-188.
- McCullagh, P., & Nelder, J. A. (1989). *Generalized Linear Models* (2nd ed.). London: Chapman & Hall/CRC.
- Murphey, D. A., & Braner, M. (2000). Linking child maltreatment retrospectively to birth and home visit records: An initial examination. *Child Welfare*, 79(6), 711-728.
- Murphy, J. F., Jenkins, J., Newcombe, R. G., & et.al. (1981). Objective birth data and the prediction of child abuse. *Archives of Diseases in Childhood*, 56, 295-297.
- Needell, B., & Barth, R. P. (1998). Infants entering foster care compared to other infants using birth status indicators. *Child Abuse & Neglect*, 22(12), 1179-1187.
- Needell, B., Webster, D., Armijo, M., Lee, S., Dawson, W., Magruder, J., . . . Moore, M. (2010). Child Welfare Services Reports for California Retrieved May 15, 2010, from The University of California at Berkeley Center for Social Services Research website. URL: [http://cssr.berkeley.edu/ucb\\_childwelfare](http://cssr.berkeley.edu/ucb_childwelfare).
- Perry, B. D. (2001). The neurodevelopmental impact of violence in childhood. In D. Schetky & E. Benedek (Eds.), *Textbook of child and adolescent forensic psychiatry* (pp. 221-238). Washington, DC: American Psychiatric Press, Inc.
- Schnitzer, & Ewigman. (2005). Child deaths resulting from inflicted injuries: Household risk factors and perpetrator characteristics. *Pediatrics*, 116(5), 687-693.

- Sedlak, A., & Broadhurst, D. (2010). *The Fourth National Incidence Study of Child Abuse and Neglect (NIS-4): Report to Congress*. Washington, DC: U.S. Government Printing Office.
- Shaw, T. V., Putnam-Hornstein, E., Magruder, J., & Needell, B. (2008). Measuring racial disparity in child welfare. *Child Welfare*, 87(2), 23-36.
- Sidebotham, P., & Heron, J. (2006). Child maltreatment in the "children of the nineties": A cohort study of risk factors. *Child Abuse & Neglect*, 30, 497-522.
- Spencer, N., Wallace, A., Sundrum, R., Bacchus, C., & Logan, S. (2006). Child abuse registration, fetal growth, and preterm birth: A population based study. *J Epidemiol Community Health*, 60, 337-340.
- Springer, K. W., Sheridan, J., Kuo, D., & Carnes, M. (2007). Long-term physical and mental health consequences of childhood physical abuse: Results from a large population-based sample of men and women. *Child Abuse & Neglect*, 31, 517-530.
- U.S. Department of Health and Human Services. (2010). Child Maltreatment 2008, from <http://www.acf.hhs.gov/programs/cb/pubs/cm08/cm08.pdf>
- UCLA Academic Technology Services: Statistical Consulting Group. Stata FAQ: How can I estimate relative risk using glm for common outcomes in cohort studies? Retrieved April 4, 2010, from <http://www.ats.ucla.edu/stat/stata/ado/analysis/>.
- Wu, S. S., Ma, C.-X., Carter, R. L., Ariet, M., Feaver, E. A., & Roth, M. B. R. J. (2003). Risk factors for infant maltreatment: A population-based study. *Child Abuse & Neglect*, 28, 1253-1264.
- Wulczyn, F. (2009). Epidemiological perspectives on maltreatment prevention. *The Future of Children*, 39(2), 39-66.
- Wulczyn, F., Barth, R., Yuan, Y.-Y., Harden, B. J., & Landsverk, J. (2005). *Beyond Common Sense: Child Welfare, Child Well-being, and the Evidence for Policy Reform*. New Brunswick, NJ: AldineTransaction.
- Wulczyn, F., & Lery, B. (2008). *Social context and racial disparities in foster care admission*. Chapin Hall Center for Children, University of Chicago.
- Zhang, J., & Yu, K. F. (1998). What's the relative risk? A method of correcting the odds ratio in cohort studies of common outcomes. *JAMA*, 280(19), 1690-1699.

- Zhou, Y., Hallisey, E. J., & Freymann, G. R. (2006). Identifying perinatal risk factors for infant maltreatment: An ecological approach. *International Journal of Health Geographics*, 53(5).
- Zou, G. (2004). A modified poisson regression approach to prospective studies with binary data. *American Journal of Epidemiology*, 159(7), 702-706.