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Understanding Child Maltreatment Report Risks as a Function of Age, Socioeconomic Status, Race, and Neighborhood

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by

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Acknowledgments

The current study's data were obtained from a larger longitudinal study which linked data from various Missouri administrative systems and Census data. The parent study is permitted to use these data with human subjects' approval by all service system agencies and the Washington University Hilltop Institutional Review Board. All personal identifiers (e.g., names) were already removed prior to accessing the data for the present study.

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Dedicated to my family.

Abstract of the Dissertation

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Professor Brett Drake, Chair

Objectives: This study seeks to improve our understanding of risk and protective factors for child maltreatment both over time and within an ecological context. First, this study examines longitudinal patterns of child maltreatment reports (CMR) with child age from 1 to 17 years based on various risk and protective factors (Aim 1). This study also examines neighborhood contextual effects on CMR (Aim 2).

Methods: This study used secondary data from a larger longitudinal study which had followed up two samples from the 1991-1994 St. Louis birth cohorts. The CAN sample included all children aged 3 or under with a first-time CMR in 1993-1994 (n = 2,111). The AFDC sample included randomly selected children aged 3 or under receiving AFDC in 1993-1994 with no current or prior CMR (n = 1,923). For Aim 1, this study followed up children from 1995 through 2009 in the secondary data and estimated the CMR likelihood at each age from 1 to 17 years. For Aim 2, only age-year observations on welfare (AFDC/TANF) were selected to trace changes of residential neighborhoods through welfare records. This study does not specifically focus on either onset or first-time recurrence of CMR. Rather, this study estimates the likelihood of any CMR at a given age regardless onset, first-time recurring, or any subsequent recurring of CMR.

This study used multilevel logistic growth curve models to estimate the CMR likelihood as a function of various risk and protective factors. Variables were measured by the secondary data which had traced children in various Missouri administrative datasets and Census data.

Results: This study found that 60% to 67% of the variance of the CMR likelihood was between age-year observations and 33% to 40% was between children. Less than 1% of the variance was found between neighborhoods. Analyses for Aim 1 found important observation-level (i.e., time-varying) and child-level predictors. Every one-year increase in child age decreased the CMR likelihood by 13% in the CAN sample (OR = 0.87, 95% CI = 0.86-0.88). While the main term of child age was not significant in the AFDC sample (0.99, 0.96-1.02), child age was associated with CMR through interacting with current welfare (AFDC/TANF) receipt. Current welfare receipt increased the CMR likelihood by 2.32 times in the CAN sample (2.32, 1.98-2.71). This relationship varied by child age in the AFDC sample: current welfare receipt increased the CMR likelihood by 3.62 times at age 1 and by 1.18 times (18%) at age 17. Prior welfare receipt (% of months on AFDC/TANF; 1 unit = 10-percentage point) increased the CMR likelihood by 8% for the CAN sample (1.08, 1.05-1.11) and by 12% for the AFDC sample (1.12, 1.08-1.17) only while not receiving welfare currently. When receiving welfare currently, prior welfare receipt was not significant for both CAN sample (1.00, 0.97-1.03) and AFDC sample (0.97, 0.93-1.02). Compared to Whites, the CMR likelihood for Blacks was 16% lower in the CAN sample (0.84, 0.74-0.95) and 35% lower in the AFDC sample (0.65, 0.53-0.80). Many other predictors including prior CMR, CPS in-home services, child mental health, child injury, child special education, parent criminal issue, parent low education, and maternal foster care placement were associated with CMR in both samples. Child behavioral and health problems were significant only for the CAN sample. Multivariate analyses for Aim 2 revealed that no neighborhood characteristics were significant in the CAN sample, while some were significant in the AFDC sample. Each 10-percentage-point increase in neighborhood poverty rate increased the CMR likelihood by 31% (1.31, 1.05-1.64) for Whites. This relationship was not significant for Blacks (1.01, 0.92-1.10). Neighborhood child/adult ratio (1 unit = 0.1) decreased the CMR likelihood by 10% (0.90, 0.82-0.99). The CMR likelihood for children moving out of St. Louis (i.e., making a long-distance move) was 63% higher than for those staying in St. Louis (1.63, 1.07-2.48).

Conclusions: Results suggest that CMR risks largely varied by time. Current welfare (AFDC/TANF) receipt remained a strong predictor of CMR risks. The strong observed interactions of current welfare receipt with child age and prior welfare receipt suggest the importance of longitudinal approaches in understanding their relationships to CMR. CMR risks were much higher at younger ages. Once risk factors were controlled for, Blacks showed no higher CMR risk than Whites. In fact, Blacks showed a lower risk. Although some neighborhood characteristics were significant, their effect sizes were mostly small in contribution to the overall risk and were less observable among families at a higher risk of future CMR. Implications include the importance of considering longitudinal changes among risk and protective factors over time, the centrality of current family economic conditions (if current AFDC/TANF receipt proxies this) in CMR, the importance of early intervention, and necessity of addressing these critical issues in policy and practice. To lower racial disparity in CMR, addressing differential exposure to risk factors, especially low SES, may be more promising than racial bias interventions. Additionally, this study highlights the utility of cross-sector data in improving our ability to better understand and predict child maltreatment.

Chapter 1: Background and Significance

1.1 Introduction

Child abuse and neglect, often referred to as "child maltreatment," has long been considered a pressing social problem and is increasingly being framed as an important public health issue (Centers for Disease Control and Prevention, 2014; National Research Council, 2014; World Health Organization and International Society for Prevention of Child Abuse and Neglect, 2006). Each year in the US, about 4.5% of children are reported to state child protective services (CPS) (U.S. Department of Health and Human Services, 2018). A recent lifetime prevalence study estimates that 37.4% of US children are reported to CPS at least once for maltreatment concerns during childhood (Kim, Wildeman, Jonson-Reid, & Drake, 2017). The estimates of lifetime prevalence for substantiated reports and foster care placement are much lower, with 12.5% of US children ever having a substantiated report (Wildeman et al., 2014) and 5.9% experiencing foster care placement (Wildeman & Emanuel, 2014). Child maltreatment has been linked to a long list of negative outcomes, such as poor physical and mental health, low educational performance, issues with intellectual and cognitive development, increased behavioral problems, and even shortened life expectancy (Anda et al., 2006; Currie & Tekin, 2012; Felitti et al., 1998; Hildyard & Wolfe, 2002; Jonson-Reid, Chance, & Drake, 2007; Jonson-Reid, Drake, Kim, Porterfield, & Han, 2004; Lansford et al., 2002, 2007; Putnam-Hornstein, 2011; Putnam-Hornstein, Cleves, Licht, & Needell, 2013; Widom, 1989). A recent study estimates that the monetary cost for each year's cohort of new CPS reports is as high as $585 billion (Fang, Brown, Florence, & Mercy, 2012).

Prevention efforts offer promise in reducing the burden of child maltreatment for individual families and for society as a whole. Effective prevention efforts depend upon our ability to identify risk and protective factors and to understand how these factors contribute to child maltreatment. Several serious gaps in our knowledge are limiting our ability to move forward. First, while low socioeconomic status (SES) is a long-proposed (Pelton, 1978) and well established (Drake & Jonson-Reid, 2014; Pelton, 2015) risk factor for child maltreatment, we have a limited understanding of the relationship between low SES and child maltreatment over time. Recently, there has been an increased interest in longitudinal approaches to examine the relationship between SES and child maltreatment (Brown, Cohen, Johnson, & Salzinger, 1998; Irwin, 2009; Kotch, Browne, Dufort, Winsor, & Catellier, 1999; Putnam-Hornstein & Needell, 2011; Slack, Holl, McDaniel, Yoo, & Bolger, 2004). These efforts have both advanced science and yielded policy-relevant information. It may be time, however, to take a more nuanced and comprehensive approach to understanding SES and child maltreatment. Prior studies have generally limited their observations to the first maltreatment event and ignored subsequent events. Similarly, many studies use only baseline SES information to estimate future maltreatment risks and consider neither a change of SES nor the cumulative history of SES over time. A further limitation is that most studies follow children during early childhood only, disregarding middle childhood and adolescence. Recently, a few studies have started filling in knowledge gaps regarding these limitations (e.g., Jonson-Reid, Emery, Drake, & Stahlschmidt, 2010; Jonson-Reid, Kohl, & Drake, 2012).

Another gap has to do with neighborhood contextual effects on child maltreatment. The importance of neighborhood ecology in understanding child maltreatment has long been proposed (Garbarino, 1977), and some research using methodologically sophisticated approaches (i.e., multilevel modeling) to examine neighborhood contextual effects emerged after 1999 (Coulton, Korbin, & Su, 1999; Freisthler & Maguire-Jack, 2015; Freisthler & Wolf, 2016; Irwin, 2009; Kim & Drake, 2017; Kim, 2004; Merritt, 2009; Molnar, Buka, Brennan, Holton, & Earls, 2003). These studies, however, tested neighborhood contextual effects in a cross-sectional manner or used baseline information of neighborhood context while disregarding any change of residential neighborhoods over time.

The current study seeks to better understand the risk of child maltreatment reports in longitudinal and multilevel contexts. Regarding longitudinal contexts, the basic research question could be stated as "what factors predict child maltreatment reports for children at specific ages". The current study takes a longitudinal perspective in estimating the likelihood of having at least one maltreatment report at each age (in years) from 1 to 17 as a function of various risk/protective factors. With regards to multilevel contexts, this study examines whether aspects of the neighborhood context have unique effects on child maltreatment reporting. To examine influences of "current" neighborhood contexts, this study includes sub-analyses which traced changes in residential neighborhoods over time.

1.2 Official Child Maltreatment and Substantiation

Child maltreatment laws and child protective services (CPS) agencies exist in all 50 US states, the District of Columbia, and the U.S. Territories (U.S. Department of Health and Human Services, 2018). Certain professionals and institutions (e.g., social workers, school personnel, medical personnel, mental health professions, child care providers, medical personnel, and law enforcement) are mandated by these laws to report suspected child maltreatment to CPS (Child Welfare Information Gateway, 2016b). CPS receives child maltreatment reports not only from these professionals (mostly mandated reporters), but also from non-professionals (mostly nonmandated reporters), such as friends, relatives, and neighbors. In each year, about 65% of reports are from professionals, while about 35% of reports are from non-professionals or other unclassified reporters (U.S. Department of Health and Human Services, 2018).

In the child welfare literature, federal and state publications, “reports” usually refer to “reported and screened-in cases” and the term “referral” is used for all reported cases including both screened-in and screened-out cases. In some states, such as California, screened-out cases are well documented individually (see Putnam-Hornstein & Needell, 2011). In most states, however, screened-out cases are usually documented in a summarized manner such as a state total (see Missouri DSS, 2011). Because of the scant literature on screened-out cases, it is difficult to discuss any possible impact of screening on sensitivity and specificity in measuring child maltreatment.

Definitions of child maltreatment vary among states. Federal legislation (The Child Abuse Prevention and Treatment Act), however, provides states minimum standards for defining child maltreatment. The federal law defines child maltreatment as (Child Welfare Information Gateway, 2016a):

> *Any recent act or failure to act on the part of a parent or caretaker which results in death, serious physical or emotional harm, sexual abuse or exploitation; or an act or failure to act, which presents an imminent risk of serious harm.*

A disposition of a reported maltreatment case can be concluded as *substantiated* or *unsubstantiated*. Technically, *substantiated* includes substantiated and indicated conclusions. In 2016, among reported children for maltreatment concerns, 16.5% were substantiated and 0.7% were indicated (U.S. Department of Health and Human Services, 2018). Altogether, 17.2% of reported children were *substantiated* (here and after, *substantiated* indicates substantiated and indicated conclusions).

Legal substantiation of a child maltreatment report refers to a decision that CPS finds sufficient evidence of child maltreatment from an investigation of a report under state laws, and that the event meets necessary criteria and levels of harm. Otherwise, a report is unsubstantiated. While the CPS investigation process and legal substantiation might be expected to increase specificity, many researchers claim that legal substantiation is actually unreliable (Cross & Casanueva, 2009; Drake, 1996; Drake, Jonson-Reid, Way, & Chung, 2003; Hussey et al., 2005; Kohl, Jonson-Reid, & Drake, 2009). If the CPS agency's ability to find evidence is related to the level of actual maltreatment risk or the severity of maltreatment, substantiated reports would be worse than unsubstantiated reports in most respects. Although Chiu, Ryan, and Herz (2011) found that the risk of juvenile arrest was higher for youth involved in a substantiated report than youth involved in an unsubstantiated report, many other studies have found that substantiation status was practically irrelevant as a predictor of later negative outcomes (Drake et al., 2003; Hussey et al., 2005; Jonson-Reid et al., 2004; Kohl et al., 2009; Leiter, Myers, & Zingraff, 1994). These studies found that substantiated children and unsubstantiated children were virtually indistinguishable across a wide range of future risks including negative school outcomes, delinquency, behavioral problems, mental health problems, developmental problems, and recidivism of child maltreatment.

Many, if not most, unsubstantiated cases involve high-risk situations (Drake, 1996). Prior findings suggest that excluding unsubstantiated reports may not improve specificity. Rather, evidence suggests that omitting unsubstantiated reports greatly diminishes sensitivity. Many current studies therefore use “any report” to measure child maltreatment rather than limiting the definition to a “substantiated report” (Cancian, Yang, & Slack, 2013; Irwin, 2009; Putnam-Hornstein, 2011; Slack et al., 2004). In line with this trend, the current study examines all reports including both substantiated and unsubstantiated reports.

1.3 Prevalence of Child Maltreatment

Child maltreatment in the United States is common. For each of the most recent five years (2012-2016), over 3 million US children were reported for concerns of child maltreatment to state child protective services (CPS) agencies. This is equivalent to about 4.5% of US children each year (U.S. Department of Health and Human Services, 2018). Among the reported children, about one-fifth were categorized as substantiated by CPS (U.S. Department of Health and Human Services, 2018). The fourth National Incidence Study of Child Abuse and Neglect (NIS-4) also found that about 4% of US children were *endangered* annually by child maltreatment and that 1.7% of US children were *harmed* by child maltreatment per year (Sedlak, Mettenburg, et al., 2010).

The cumulative prevalence of child maltreatment is much higher. Sabol, Coulton, and Polousky (2004) found that over 30% of children in Cuyahoga county were reported to CPS at least once due to alleged child maltreatment and 19.5% of children were found to be substantiated for maltreatment during the first ten years of their lives. Wildeman et al. (2014) estimated that 13% of US children were found to be a *victim* (i.e., substantiated) of child maltreatment upon an investigation/assessment by CPS agencies at least once during childhood. Some retrospective studies also have estimated the lifetime prevalence of child maltreatment. The three National Surveys of Children’s Exposure to Violence provided estimates of the lifetime prevalence for any maltreatment among respondents aged 14-17 in 2008 (32.1%), 2011 (41.2%), and 2013-2014 (38.1%) (Finkelhor, Turner, Shattuck, & Hamby, 2013, 2015;

Finkelhor, Turner, Ormrod, & Hamby, 2009). Another national survey (National Longitudinal Study of Adolescent Health) asked young adults about a lifetime maltreatment prevalence and found a prevalence of 41.5% for supervision neglect, 11.8% for physical neglect, 28.4% for physical assault, and 4.5% for sexual abuse (Hussey, Chang, & Kotch, 2006). A recent study estimating the cumulative prevalence of child maltreatment reports found a lifetime rate very similar to that reported by retrospective survey studies (Kim et al., 2017). This study found a lifetime prevalence of 37.4% for the risk of having an official maltreatment report at least once during childhood.

At the bivariate level, the prevalence of child maltreatment is much higher among younger children, families of lower SES, Blacks (than Whites), and lower SES neighborhoods. National data indicated that compared to children aged 17 years, children aged less than 1 year had a 3.5-fold higher risk of first-time maltreatment reports (Kim et al., 2017) and a 6.9-fold higher risk of substantiated reports (U.S. Department of Health and Human Services, 2018). Regarding family SES, the 2005-2006 National Incidence Studies of Child Abuse and Neglect (NIS-4) found that children in the low-SES category (i.e., annual income < $15,000, parent education < high school, or any income-based welfare receipt) had about 6 times higher risk of child maltreatment by the endangerment standard than those not in the low-SES category (Sedlak, Mettenburg, et al., 2010). Several regional studies also found similar trends in official maltreatment reports. In Cuyahoga County Ohio, children receiving TANF or Medicaid showed a 6.1-fold greater risk of maltreatment reporting by age 5 years than those receiving neither (Irwin, 2009). A California study found that newborns on Medicaid were at 2.5 times greater risk of maltreatment reporting by age 4 years than newborns not on Medicaid (Putnam-Hornstein & Needell, 2011). With regard to racial disparity in child maltreatment, national data indicated that compared to Whites, Blacks had about 1.7 times higher risk of surveyed maltreatment by NIS-4 (Sedlak, Mettenburg, et al., 2010) and of substantiated maltreatment by CPS (U.S. Department of Health and Human Services, 2018). Local studies identified a somewhat higher Black-White disparity in maltreatment reports. Compared to Whites, the risk of maltreatment reporting was 2.8 times higher for Blacks in a Cuyahoga County (Ohio) study (Irwin, 2009) and 2.3 times higher for Blacks in a California study (Putnam-Hornstein & Needell, 2011). Prior studies also have identified that maltreatment rates are far higher in high-poverty neighborhoods. For example, a Missouri study found that the maltreatment report rates among neighborhoods with a poverty rate larger than 40% were about 5 time greater than the rates among neighborhoods with a poverty rate between 0% and 5% (Drake, Lee, & Jonson-Reid, 2009). This trend has been consistently found in other neighborhood studies (Coulton, Crampton, Irwin, Spilsbury, & Korbin, 2007; Freisthler, Merritt, & LaScala, 2006).

1.4 Consequences of Child Maltreatment

Child maltreatment is associated with serious negative consequences across myriad domains. These outcomes include increased risk of adverse neurological development related to chronic and severe stress over time (McCrory, De Brito, & Viding, 2011; Tarullo & Gunnar, 2006), physical health problems (Anda et al., 2006; Felitti et al., 1998; Lanier, Jonson-Reid, Stahlschmidt, Drake, & Constantino, 2010), increases in risky sexual/reproductive behaviors (Anda et al., 2006; Garwood, Gerassi, Jonson-Reid, Plax, & Drake, 2015; Gerassi, Jonson-Reid, & Drake, 2016), poor mental health (Anda et al., 2006; Jonson-Reid, Presnall, et al., 2010; Lansford et al., 2002) impaired intellectual and cognitive development (Hildyard & Wolfe, 2002; Jonson-Reid et al., 2004; Lansford et al., 2002), and elevated violent and criminal behaviors (Bright & Jonson-Reid, 2010; Currie & Tekin, 2012; Jonson-Reid, Drake, & Kohl, 2009; Jonson-

Reid et al., 2012; Lansford et al., 2007; Widom, 1989). Some studies have found even more tragic consequences of child maltreatment, such as a higher risk of death in childhood (Jonson-Reid et al., 2007; Putnam-Hornstein, 2011; Putnam-Hornstein, Cleves, et al., 2013) lasting into adulthood (Anda et al., 2006; Felitti et al., 1998; Jonson-Reid, Drake, & Kohl, 2016).

As expected from the high prevalence and the various negative consequences of child maltreatment, the social costs for maltreatment are heavy. According to surveys by Urban Institute and Child Trends, the total governmental expenditures on public child welfare activities were over 25 billion dollars (in 2012 US dollars) annually for the last decade (DeVooght, Fletcher, & Cooper, 2014). Over 45% of these expenditures were covered by the federal government, about 40% by the state governments, and over 10% by the local governments (DeVooght et al., 2014). On top of these direct child welfare costs by governments, there are other indirect costs related to health care, productivity losses, criminal justice involvement, and special education services. Fang, Brown, Florence, and Mercy (2012) estimated more comprehensive costs of child maltreatment including these direct and indirect costs. For newly substantiated children (i.e., children found to be a victim of child maltreatment by CPS) in 2008, the estimated total lifetime cost of child maltreatment in the US was about $124 billion (in 2010 US dollars) (Fang et al., 2012). The cost was even higher for all newly investigated allegations of child maltreatment in 2008, rising to approximately $585 billion (in 2010 US dollars) (Fang et al., 2012). It is interesting to note that although total costs are very high, the amount spent by CPS on investigation and intervention (excluding foster care services) may be as low as 2 to 3 billion dollars per year (Drake & Jonson-Reid, 2007).

Given the serious negative consequences and high social costs of child maltreatment, it is important to improve our understanding of factors which are influential at the population level.

For this reason, the present study mainly focuses on child age, family SES, race, and neighborhood context, as these have been identified as influential factors differentiating the prevalence of child maltreatment at the population level. The current study seeks to better understand how these factors are related to the risk of child maltreatment in longitudinal and multilevel contexts while controlling for other risk and protective factors. The current study examines the risk of child maltreatment reports including both substantiated and unsubstantiated reports. This is because prior findings suggest that limiting measurement to substantiated reports carries a high cost relative to sensitivity, while adding little to specificity.

The current study uses secondary data from a larger longitudinal study based in St. Louis (Jonson-Reid et al., 2009). This study followed two samples. One sample (the "CAN" sample) includes children with a maltreatment report in early childhood. The other sample (the "AFDC" sample) consists of children on welfare (AFDC) with no maltreatment report in early childhood at the time of sampling. This study does not particularly focus on first-time reports (i.e., the onset of reporting) or first-time re-reports (i.e., the onset of recurring). Rather, this study estimates the likelihood of any report at a given age regardless of whether a report is the first event ever, the first recurring event, or any subsequent event beyond onset of reporting or recurring. It is worth noting, however, that estimates are restricted to recurring reports for the CAN sample as all sampled children have a report at the baseline, while estimates include both onset and recurring of reports for the AFDC sample since their children have no maltreatment report at the time of sampling. The current study does not limit the meaning of "reports" to first-time ever reports. Rather, "reports" are used to indicate any reports including first-time ever, first-time recurring, and any subsequent recurring reports. When this issue is handled differently, it is always explicitly described as such in the text.

Chapter 2: Theoretical Framework/Literature Review

Following the publication of the " Battered Child Syndrome" in the Journal of the American Medical Association (Kempe, Silverman, Steele, Droegemueller, & Silver, 1962), child maltreatment research included mainly psychopathological or psychodynamic perspectives which viewed child maltreatment largely as a form of mental illness within the perpetrator (Garbarino, 1977; Pelton, 1978; Polansky, Borgman, & De Saix, 1972). This tendency to emphasize psychological causes masked attention to the relationships between ecological factors and child maltreatment, especially between socioeconomic status (SES) and child maltreatment (Drake & Zuravin, 1998; Pelton, 1978, 2015). In recent years, the fascination with psychological explanations for child maltreatment has begun to diminish. Researchers have turned to ecological models embracing various contextual factors (Belsky, 1980; National Research Council, 1994, 2014).

In line with this trend, child welfare research has provided attention to factors which can change the risk of child maltreatment at the population level, such as child age (Irwin, 2009; Kim et al., 2017; Wildeman et al., 2014; Wulczyn, Barth, Yuan, Harden, & Landsverk, 2005), family SES (Drake & Jonson-Reid, 2014; Drake & Zuravin, 1998; Pelton, 1978, 1994, 2015), race (Drake et al., 2011, 2009; Mersky & Janczewski, 2018; Putnam-Hornstein, Needell, King, & Johnson-Motoyama, 2013; Slopen et al., 2016), and neighborhood contexts (Coulton et al., 2007; Freisthler et al., 2006; Maguire-Jack, 2014). Given mounting empirical evidence and theory suggesting a strong relationship between SES and child maltreatment (Drake & Jonson-Reid, 2014; Drake & Zuravin, 1998; Pelton, 1978, 1994, 2015), it is important to attend empirically to the role of SES and other influential factors (i.e., child age, race, and neighborhood contexts). At the bivariate level, there is a strong association of maltreatment reporting with certain racial and ethnic categories (Sedlak, Mettenburg, et al., 2010; U.S. Department of Health and Human Services, 2018). Race and SES, however, are closely related in the US given the tremendous socio-economic stratification in our society. The current section reviews two popular and competing rationales for the racial/ethnic differences in reporting (i.e., systematic racial bias versus differential exposure to risk factors) (Drake et al., 2011). Similarly, the relationship between the higher incidence of reporting for younger children (U.S. Department of Health and Human Services, 2018) may be confounded by SES as both maltreatment and low SES risks are not randomly distributed across child age. Younger children are more vulnerable to maltreatment as well as low SES and the risks of both total maltreatment and low SES decline as child age increases (U.S. Census Bureau, n.d.-a; U.S. Department of Health and Human Services, 2018). Third, there is substantial interest in neighborhood contextual effects on maltreatment independent of family-level characteristics but again there is an extremely high correlation between individual and neighborhood SES.

Ecological framework. Ecological models provide an overarching framework to conceptualize how mutually embedded hierarchical systems (i.e., individuals nested in families, nested in neighborhoods, and in turn nested in larger social and cultural systems) and their interactions contribute to child maltreatment (National Research Council, 2014). The current study adopts this framework to understand the contributions of SES and relevant factors to child maltreatment reports. The ecological framework is particularly useful to understand that there are complex interactions among various risk/protective factors. For example, family SES is not a factor isolated from other factors. Rather, it should be understood within its interplay with other individual/family characteristics (e.g., race, age) and neighborhood context.

This section starts by clarifying the relationship of child maltreatment reporting to family SES in terms of theory and empirical findings. This section also reviews theory and empirical findings for other important factors which are closely related to family SES as well as maltreatment (i.e., child age, race, and neighborhood context). Finally, theory and empirical studies are reviewed related to interaction effects among these key factors.

2.1 Family Socioeconomic Status

2.1.1 Theories of Family SES and Child Maltreatment

Although the ecological framework serves as a grand theoretical model, it provides little insight into specific reasons why family SES may lead to child maltreatment. Fortunately, several mid-range theoretical explanations are available for the linkage between family SES and child maltreatment, particularly neglect. There is a dearth of studies on sexual abuse and emotional abuse in this area. However, there is empirical evidence of a positive association between family SES and sexual abuse, whereas the strength of the association is smaller than those for neglect and physical abuse (Drake & Pandey, 1996).

Theories of child neglect, physical abuse, and family SES. Poor parents may simply have insufficient material resources to meet the basic needs of their children (Berger, 2004; Pelton, 1978, 1994). That is, even if poor parents and non-poor parents possess the same level of caregiving and financial management skills, poor parents have less room to weather financial downturns or crises. Pelton has pointed out that “the less money one has, the better manager of money one has to be.” (1978, p. 35). Legally, failure to provide due to poverty is not generally considered as neglect—for example, Washington and Wisconsin indicate this in their statutory definitions of child maltreatment (Child Welfare Information Gateway, 2016a). Yet, financial difficulties may greatly limit resources and options of poor parents to provide an adequate care to their children and consequently may increase a risk of neglect. Shah, Mullainathan, and Shafir (2012) found that scarcity (of material resources) has an exogenous negative effect on individual's financial management abilities. This implies that poor parents not only have less room to fail in financial management, but they also are more likely to be a worse financial manager due to the lack of resources.

Additionally, parenting is harder when you are poor. Families living in lower SES encounter more health and safety hazards stemming from inadequate housing and neighborhood conditions and consequently must be more diligent to protect their children from such hazards (Pelton, 1978, 1994, 2015). Thus, when the level of adequate supervision skills may be the same between poor and non-poor parents, low-SES families have to be more vigilant to avoid the increased risks.

Berger (2004) described a possible third explanation for the relationship between family SES and neglect related to the investment behaviors of parents in their children. Poor parents may under-invest in their children because the expected future returns to them from investments in their children may be less. Parents may try to increase their own utilities by using limited resources on themselves rather than on their children, particularly when there are fewer expected returns from spending resources on their children. In other words, parents are believed to invest less or more in their children by weighing benefits from investments in themselves and in their children. With fewer expected returns from their children, parents may be less likely to use limited resources on their children. This lack of investment may increase the risk that parental inaction turns to neglect.

Family SES has also been used as an explanation for physical abuse. Weinberg (2001) suggests that poor parents have fewer resources to manage their children's behaviors. In particular, they may lack pecuniary incentives, which make them use more nonpecuniary means such as corporal punishment. These methods may increase the risk of becoming abusive. A meta-analysis found that parent use of corporal punishment had a moderate to large effect on physical abuse (Stith et al., 2009). Zolotor and colleagues found that both frequency and severity of corporal punishment were associated with physical abuse, suggesting a dose-response relationship (Zolotor, Theodore, Chang, Berkoff, & Runyan, 2008). Crouch and Behl (2001) found that parenting stress was related to physical abuse among parents with high belief in the value of corporal punishment, but not among those with low belief in such value. It may be true that stress and the tendency to use corporal punishment interact, that is, that use of corporal punishment while stressed may be more likely to lead to physical abuse. Low SES may contribute to both these factors.

While some of the prior explanations suggest an implicit role of parental stress, stress theory also suggests direct means by which parenting actions are impacted. Under a high level of stress provoked by low SES, parents may temporarily withdraw from a caretaking role due to depression (Garbarino, 1977; Pelton, 2015). As a result, highly stressed low-SES parents may be more likely to neglect their children. A parent highly stressed by low SES may also react poorly to even trivial irritations by children. The resulting anger may escalate into physical violence (Pelton, 1978, 2015).

Various other explanations propose that "sometimes preexisting issues place a parent at risk of both poverty and abusing or neglecting their children" (Jonson-Reid & Drake, 2018, p. 55). For example, parental traits such as the inability to delay gratification or to manage anger could plausibly be associated with increased risk for both poverty and violence. Severe parental substance abuse is another obvious potential spurious factor. A parent who is severely functionally impaired by alcohol or other substances is unlikely to make either a good employee or a good parent.

2.1.2 Empirical Evidence of Family SES and Child Maltreatment

Although few studies specifically test the above theory, the strong relationship between family SES and child maltreatment has long been proposed and is now well established (Drake & Jonson-Reid, 2014; Drake & Zuravin, 1998; Pelton, 1978, 1994, 2015). Some recently emerging studies attempt to move our understanding of this beyond what can be gained through correlational evidence (Cancian et al., 2013; Slack, Berger, & Noyes, 2017). This section provides a review of empirical evidence on this relationship, starting with bivariate evidence.

Bivariate Evidence

Strong bivariate associations between family SES and child maltreatment are found from both the National Incidence Studies of Child Abuse and Neglect (NIS) and official maltreatment records. The 1993 NIS (NIS-3) found that a lower socioeconomic status was strongly associated with increased likelihood of being maltreated according to their endangerment standard. Child maltreatment rates were 9.59% for children with annual family incomes below $15,000, 3.31% for those with incomes between $15,000 and $29,000, and 0.38% for those with incomes at or above $30,000 (Sedlak, Hantman, & Schultz, 1997). That is, children belonging to the lowest family income category were about 25 times more likely to categorized as maltreated than those in the highest income category and about 9 times more likely than those in the second highest income category. The NIS-4 conducted in 2005-2006, measured family SES somewhat differently. In this study, the annual child maltreatment rate was 5.51% for children in the lower socio-economic status (i.e., having any of the following conditions: annual income below $15,000, parental education level below high school graduation or equivalent, or any income-based welfare receipt) and 0.95% for children not in the lower socio-economic status group (Sedlak, Mettenburg, et al., 2010). Measured this way, children living in lower socio-economic status families were about 6 times more likely to be classified as maltreated under the endangerment standard when compared to other children.

Some studies have linked official child welfare data to poverty-related welfare data, such as Temporary Assistance for Needy Families (TANF) and Medicaid, and provided CPS involvement rates by the welfare receipt status. Irwin (2009) followed up a 1998-2001 birth cohort in Cuyahoga County, Ohio (N = 65,181) from birth through their sixth birthday. The study found 42.88% of children receiving both TANF and Medicaid had at least one maltreatment report by age 5 years, which was about 7 times greater than the report rate for children receiving no welfare assistance (6.04%). The report rate for children receiving only Medicaid (28.82%) was about 5 times greater than the rate for those with no welfare receipt. Another study followed up a 2002 California birth cohort (N = 531,035) from the birth to the fifth birthday (Putnam-Hornstein & Needell, 2011). This study used the official CPS referral as the child maltreatment outcome (i.e., both screened-in and screened-out referrals) and reported the referral rates by the Medicaid receipt status at birth. The study found that the CPS referral rates were 21.17% for children on Medicaid at birth, which was 2.5 times larger than the referral rate of 8.54% for children not on Medicaid at birth.

Multivariate Evidence in General Populations

Several studies have tested the association between family SES and child maltreatment in a sample representing a general population (i.e., including both poor and non-poor subjects) while controlling for other important risk/protective factors. These studies found a strong and consistent association. Putnam-Hornstein and Needell (2011) followed up the entire 2002 California birth cohort (N = 531,035 children) for 5 years. The study found that during the first 5 years of life, children on Medicaid at birth were 1.7 times more likely to have a CPS referral (i.e., including both screened-in and out referrals) than children not on Medicaid at birth. Brown et al. (1998) also found that low income and AFDC receipt were strongly associated with child maltreatment among the randomly selected young adults in two upstate New York counties (N = 644). To operationalize maltreatment, the study used substantiated CPS reports spanning childhood as well as retrospective self-reports. Individuals with any CPS victim record or any self-reported maltreatment were considered to have a history of maltreatment. The study found that individuals with low family income at some time during childhood were 3 times more likely to have official or self-report child maltreatment experiences than others. Also, it was found that individuals with a history of AFDC receipt during the childhood had 5 times higher chance of child maltreatment experience than others. Other studies using survey data had similar findings. Maguire-Jack and Klein (2015) used data from eight cities of LA County, California in 2009 (N = 438) and found that the number of socioeconomic disadvantages (i.e., poverty, less than high school education, and unemployment) was significantly associated with neglect scores based on the Multidimensional Neglect Behavior Scale. Berger (2004) used the National Longitudinal Survey of Youth and created child maltreatment markers based on medical check-up, cognitive stimulation, emotional support, and spanking data. This study identified that a lower income increased the overall risk of child maltreatment. Another study examined material hardship while using the Fragile Families and Child Well-being Study data (including oversampled unwed mothers) (Warren & Font, 2015). This study found that the effect of housing instability was mediated by maternal stress for abuse but less so for neglect. The indirect effects through maternal stress, however, were much smaller than the direct effects for both neglect and abuse.

Multivariate Evidence in Low-SES Populations

Many studies have tested the association between family SES and child maltreatment among low-SES samples using multivariate modeling. The findings of these studies were weaker and less consistent than the findings for a general population. This inconsistency might be because while the studies using general population samples used only one or two SES indicators, the studies limited to low-income populations included multiple similar SES indicators in the same model. Given the expected narrow SES spectrum within a low-SES population, it might be difficult to obtain stable results for a specific indicator (e.g., income) when other similar indicators (e.g., employment, welfare receipt, and reduction of welfare benefits) are entered in the same model. However, if the relationship between family SES and child maltreatment is stable even in a low-SES population, one of the similar indicators should be significant. Indeed, all reviewed studies, except one (Dworsky, Courtney, & Zinn, 2007), found significant findings for at least one SES indicator. Here, only statistically significant findings are discussed.

CPS involvement (i.e., reports or substantiated reports) was significantly associated with AFDC/TANF recipient history (Cancian et al., 2013; Needell, Cuccaro-Alamin, Brookhart, & Seon, 1999; Ovwigho, Leavitt, & Born, 2003), earnings (i.e., income from employment) (Beimers & Coulton, 2011), any income (from any source) (Beimers & Coulton, 2011; McDaniel & Slack, 2005; Ovwigho et al., 2003; Shook, 1999), any welfare receipt (TANF/AFDC, Medicaid, and/or Food Stamps) (Beimers & Coulton, 2011; Epstein, 2001; Kotch et al., 1999; McDaniel & Slack, 2005; Ovwigho et al., 2003), employment status (Courtney, Dworsky, Piliavin, & Zinn, 2005; Slack et al., 2003), and sanction or reduction in welfare benefits

(Beimers & Coulton, 2011; Slack, Lee, & Berger, 2007). Specifically, neglect was found to be significantly associated with financial problems, earning history, TANF sanction or reduction, employment status, and welfare receipt status (Epstein, 2001; Slack et al., 2004, 2007). Physical abuse showed a significant association with father's financial support and TANF reduction (Epstein, 2001; Slack et al., 2007).

Findings of Prior Multilevel Studies

Family-level SES was found to be significant after controlling for neighborhood-level characteristics in most prior multilevel studies. Coulton et al. (1999) and Merritt (2009) found that family income, which was centered to each neighborhood's mean income (i.e., group-mean centering; this will be further discussed later), was significantly associated with self-reported neglect and physical abuse among the sampled households (N=400) from Cleveland City, Ohio. Molnar et al. (2003) found that family socioeconomic status and employment were significantly associated with self-reported parent-to-child physical aggression among the sampled children (N=4,252) in Chicago City, Illinois. Using data from young adults from the National Longitudinal Study of Adolescent Health, Kim (2004) found that employment status was marginally associated with self-reported maltreatment. With the full Cuyahoga County birth cohort in Ohio, Irwin (2009) found that welfare receipt status was significantly associated with official maltreatment reports, official neglect reports, and substantiated reports. Kim and Drake (2017), using data previously linked (Jonson-Reid et al., 2009), found that a family's longer duration in poverty-related welfare programs was significantly associated with an increased number of maltreatment reports in high-risk samples from St. Louis, Missouri.

Evidence Beyond Correlation

A recent experimental study found that a randomly assigned increase of income was related to a significant decrease of the future risk of reported maltreatment (Cancian et al., 2013). In the study, the 13,062 unmarried female TANF entrant parents in Wisconsin were randomly assigned to an experimental group or control group which had been established for the purposes of evaluating a new state policy relating to welfare payments. While the control group received 41% of their child support benefits, the experimental group received 100% of the benefits. As a result, the experimental group received about $100 more income than the control group. Despite the moderately small amount of money involved, the study found a significant and meaningful effect on the future risk of child maltreatment reports. The experimental group was about 10% less likely to have a CPS report than the control group.

Recently, more studies have come forward with evidence bearing on the relationship between economic factors and child maltreatment (Slack et al., 2017). Rostad and colleagues examined the influence of concrete support—discretionary funding by a home visiting worker to address urgent basic needs of families (e.g., food, clothes, and utilities)—on CPS in-home services and maltreatment re-reporting (Rostad, Rogers, & Chaffin, 2017). This study found that concrete support was related to greater service engagement, satisfaction, and achievement and lower risk of re-reporting. Some other studies looked at policy-level indicators. Raissian and Bullinger (2017) found that higher state minimum wage levels decreased maltreatment report rates, especially for neglect report rates. McLaughlin (2017) found that an increase in the gasoline price, which might decrease disposable income of families, predicted slightly higher maltreatment report rates.

Unlike Cancian et al. (2013), the latter three studies do not provide rigorously controlled experimental evidence. Nevertheless, their findings may be more scientifically supportive of a causal link between economic factors and child maltreatment than existing correlational findings for several reasons. The first reason is that those program- and policy-level changes may be less likely to be related to any spurious factors predisposing families to both poverty and maltreating behaviors. Another reason can be found in the novel and creative techniques used in these studies. Rostad and colleagues (2017) developed quasi-experimental samples by propensity stratification. Raissian and Bullinger (2017) used a fixed-effect approach to handle unobserved between-state heterogeneity. Their findings therefore may be interpreted as demonstrating effects secondary to exogenous increases in a family's income.

Prior findings in this area consistently support a strong relationship between family SES and child maltreatment and could be interpreted (with caution) to suggest that this relationship may be causal. There are, however, considerable gaps in our knowledge. First, there is limited understanding of longitudinal patterns of family SES and child maltreatment due to the frequent use of cross-sectional data (Coulton et al., 1999; Freisthler & Maguire-Jack, 2015; Freisthler & Wolf, 2016; Kim, 2004; Maguire-Jack & Klein, 2015; Merritt, 2009; Molnar et al., 2003) or disregard of longitudinal changes in family SES (Epstein, 2001; Irwin, 2009; Kotch et al., 1999; McDaniel & Slack, 2005; Putnam-Hornstein & Needell, 2011). Second, while a number of studies investigated such longitudinal patterns, these were generally time-limited (5 years or less) (Beimers & Coulton, 2011; Courtney et al., 2005; Needell et al., 1999; Ovwigho et al., 2003; Shook, 1999; Slack et al., 2007). This short timeframe also limits our understanding of any interaction between current SES and cumulative history of SES. Last, most prior multilevel studies in this area were cross-sectional in their analyses (Coulton et al., 1999; Freisthler &

Maguire-Jack, 2015; Freisthler & Wolf, 2016; Kim & Drake, 2017; Kim, 2004; Merritt, 2009; Molnar et al., 2003). The present study takes longitudinal patterns into account by investigating child maltreatment reports at each child age from 1 to 17 years while considering changes in both current family SES and cumulative history of family SES over this period.

2.1.3 Potential Biases in the SES-Maltreatment Relationship

There are several challenges which have been made to the validity of the data relating family SES to child maltreatment. Among potential biases in this relationship, visibility bias and class bias have received substantial attention. The presence and strength of these possible biases have been part of the accepted conventional wisdom for decades. However, new and rapidly accumulating evidence suggests that none of these potential forms of bias are likely to have large effects or practical impacts on findings linking family SES and maltreatment.

The link between family SES and child maltreatment as evidenced in CPS involvement has been often challenged as merely a function of (allegedly) different levels of public scrutiny between the poor and the non-poor, which is often referred to *visibility bias* (Drake et al., 2009; Pelton, 1978). That is, poor families may encounter welfare services more often than non-poor families and accordingly may be more visible to professional reporters. However, as Pelton (1978, 1994) suggested, visibility bias cannot explain why poorer families have both more CPS involvement in general and also more severe maltreatment cases, such as total fatalities, accident related fatalities, preventable fatalities and maltreatment-related fatalities. More direct tests of visibility bias are available (Drake et al., 2009; Kim, Drake, & Jonson-Reid, 2018). Both nationwide and statewide data have found no evidence of higher proportions of child maltreatment reports from professional reporters in high poverty areas, in fact, the reverse is generally true.

Chaffin and Bard (2006) investigated the effect of surveillance bias on child maltreatment reports. They did this by tracking report rates during known periods of service provision in two samples, one secondary analysis of a home-visiting study and a second sample that looked at in-home child welfare services compared to other families not receiving such services (Chaffin & Bard, 2006). The study found a statistically significant effect of surveillance bias. However, the effect sizes were very small (leading to a 5% to 6% increase in the likelihood of being reported among service participants compared to non-participants) during the entire study period including both active service and inactive follow-up periods (2.6 years). During active service involvement, there was a larger (but very time-limited) effect (12% to 25% increase in the likelihood) that disappeared once cases were closed (Chaffin & Bard, 2006). Such small effects cannot explain much higher maltreatment report rates among poorer families (Drake, Jonson-Reid, & Kim, 2017).

It has also been suggested that lower SES families are more likely to be reported to CPS, or to be differently treated by CPS due to "class bias." The idea here is that low-SES families are simply seen more negatively because of their low SES, making them more likely to be reported. If there is a substantial class bias, that is, if many low-SES children are reported unnecessarily while not truly at risk, then reported low-SES children should do better on measures of recidivism or other outcomes of maltreatment than reported high-SES children (Jonson-Reid et al., 2009). However, Jonson-Reid and colleagues (2009) showed that the low-SES children reported to CPS did worse, not better, than high-SES children on a wide range of future risks, including CPS recidivism, health, mental health, and behavioral outcomes. This is precisely the opposite of what a class bias perspective would suggest.

2.2 Race

The representation of Black children in the CPS is far higher than that of White children. For example, in 2016, the substantiated maltreatment report rate was 1.39% for Black children compared to only 0.81% of White children, a ratio of almost 2:1 (U.S. Department of Health and Human Services, 2018). The early National Incidence Studies for Child Abuse and Neglect (i.e., NIS-2 and NIS-3) found an almost identical racial disparity, but extremely large confidence intervals caused this finding to be statistically nonsignificant (Drake & Jonson-Reid, 2011). NIS-3 reported the lack of a significant finding but not that the (nonsignificant) estimate of racial differences in rates of actual abuse was large. They concluded that "different races receive differential attention somewhere during the process of referral, investigation and service allocation" (Sedlak & Broadhurst, 1996, p. 4-28). This finding was promulgated through a range of other sources, often in the gray literature (Hill, 2004, 2006; Morton, 1999) and became generally accepted wisdom claiming that racial disproportionality is a function of an unfair racial bias either at the reporting or the early CPS screening level.

The evidence base with regard to this racial disparity has changed radically in the past few years. NIS-4, in particular, found no evidence for differential maltreatment reporting or CPS system behavior of Blacks (Sedlak, Mettenburg, et al., 2010). The NIS-4 estimates for differences in the rates of the surveyed harm and endangerment of maltreatment between Blacks and Whites were practically the same as the observed racial disparity in the CPS system. More importantly, a recent study revealed that the findings on the race between NIS-4 and the earlier studies (NIS-2 and NIS-3) were essentially the same, but the interpretations were contradictory because the findings of NIS-2 and NIS-3 were non-significant due to the lack of statistical power and extremely large confidence intervals (Drake & Jonson-Reid, 2011). This earlier misinterpretation, however, led to a concerted effort among many child maltreatment experts to identify racial bias within the CPS system as a reason for the racial disparity rather than explore other explanations such as differential exposures to risk like low SES (Harris & Hackett, 2008; Hill, 2006; James, Green, Rodriguez, & Fong, 2008; Johnson, Antle, & Barbee, 2009; O. A. Miller & Ward, 2008; Morton, 1999; Wells, Merritt, & Briggs, 2009).

More recently increasing evidence has mounted for a competing perspective suggesting that racial disparity is mainly due to differential exposure to risk factors, especially low SES (Bartholet, 2009; Drake et al., 2011, 2009; Font, Berger, & Slack, 2012). This "risk" perspective has strong empirical support as virtually all recent child welfare studies in this area have found that Black/White racial disparity in CPS is reduced, eliminated or often even reversed when socio-economic conditions are controlled for. The maltreatment reporting risk of low-SES Blacks (receiving AFDC/TANF) was practically same to that of similar low-SES Whites with no statistically meaningful difference (Courtney et al., 2005; Slack et al., 2004) or even slightly lower at a statistically significant level (Cancian et al., 2013; Dworsky et al., 2007; Kim & Drake, 2017; Needell et al., 1999; Putnam-Hornstein, Needell, King, & Johnson-Motoyama, 2013; Slack et al., 2003, 2007). General population data, where Blacks were disproportionally more likely to be poor and to have a maltreatment report than Whites, also showed that the vast majority of Black/White racial disparity in CPS disappeared after socio-economic conditions were taken into account (Irwin, 2009; Putnam-Hornstein & Needell, 2011). It is worth noting, however, that little attention has been given to other racial and ethnic groups that may be under or over-represented compared to their proportion in the population.

Research on the Black-White disparity in child maltreatment has evolved substantially in recent years. The prior focus was mainly on explaining the presumed overrepresentation of

Blacks compared to Whites, evaluating if this presumed overrepresentation was better explained by the “bias” or “risk” perspectives. More recently, the assertion that Blacks are overrepresented compared to Whites has come into question, with several recent studies suggesting that Black children might actually be underrepresented after poverty and other factors are controlled (Drake et al., 2009; Maloney, Jiang, Putnam-Hornstein, Dalton, & Vaithianathan, 2017; Mersky & Janczewski, 2018; Putnam-Hornstein, Needell, et al., 2013; Slopen et al., 2016). Further empirical and theoretical work is needed to confirm and explain this possible emerging finding.

2.3 Child Age

National data show that younger children are at a higher risk of both maltreatment reports and substantiated reports. In 2016, the national maltreatment reporting data indicated the rate of substantiated reports was highest for children aged less than 1 year at 2.48%. This rate decreased to 1.19% at age 1 year and then gradually declined to 1.12% by age 2 years, 1.06% by age 3 years, and a low of 0.36% by age 17 years (U.S. Department of Health and Human Services, 2018). Sabol and colleagues (2004) found similar trends in age-specific risks of having a first-time maltreatment report (i.e., screened-in report or substantiated report) while tracing a birth cohort of Cuyahoga County from birth to age 10 years. That study found that the age-specific risk for maltreatment reports was 8.2% for infants but dropped to 2.0% by age 10 years. It was also found that the age-specific risk for substantiated reports dropped from 5.0% to 2.5% between age 0 and 1 year and showed a steady decrease to 1.2% by age 10 years. Using NCANDS data, a recent study observed a similar trend in age-specific risks of having a first-time maltreatment report (Kim et al., 2017). The study found that the age-specific risk was the highest as of 5.3% at age less than 1 year, decreased to 3.2% at age 1 year, and gradually declined to 1.5% at age 18.

Prior studies have examined the relationship between child age and child maltreatment in a multivariate setting. More studies found that younger children were at a higher risk of maltreatment reports (Cancian et al., 2013; Needell et al., 1999; Slack et al., 2003) and substantiated reports (Beimers & Coulton, 2011; Ovwigho et al., 2003), while fewer found no significant association between child age and maltreatment reports (Dworsky et al., 2007; McDaniel & Slack, 2005). These studies mostly examined the age-maltreatment relationship in a cross-sectional manner. An exception was Irwin (2009) which found that younger children had a higher risk of maltreatment reporting in a longitudinal context. This study followed up children for a relatively short period (i.e., 6 years from birth to age 5) without considering changes in family SES over time. It may be a time to examine the age-maltreatment relationship in a longer-term design while considering longitudinal changes of other important factors, especially family SES.

2.4 Neighborhood Contextual Effects

2.4.1 Theories for Neighborhood Effects

Coulton et al. (2007) suggested that there have been two different traditions explaining the effects of neighborhood-level characteristics on individual-level child maltreatment outcomes. Sociologists led the first tradition, which emphasized the sociological processes within neighborhoods, including social disorganization and collective efficacy (Sampson & Groves, 1989; Sampson, Morenoff, & Earls, 1999; Sampson, Raudenbush, & Earls, 1997). The second tradition was led by psychologists, who focused on child and family development and expanded such development to the interactions of children and families with their environments including neighborhoods (Belsky, 1980; Cicchetti & Lynch, 1993; Garbarino, 1977). Some researchers (e.g., Drake & Jonson-Reid, 2014; Freisthler, 2004) suggested a third possible approach, which was based on “a more purely economic perspective emphasizing resource availability (services, quality education, good day care, employment opportunities, etc….)” (Drake & Jonson-Reid, 2014, p. 136). This section discusses these three approaches explaining neighborhood-level pathways.

Sociological Approach: Social Disorganization and Collective Efficacy

The sociological approach used two key concepts to explain how the neighborhood processes influence the lives of children. The first concept is *social disorganization*, which is defined as “the inability of a community structure to realize the common values of its residents and maintain effective social controls” (Sampson & Groves, 1989, p. 777). This concept is empirically measured by (1) informal social networks (e.g., friendship ties), (2) formal social networks (e.g., participation in organizational activities such as committee, club, and other organizational activities), and (3) collective supervision for local problems (e.g., control of community children) (Sampson & Groves, 1989). The second concept is *collective efficacy*, which refers to “social cohesion among neighbors combined with their willingness to intervene on behalf of the common good.” (Sampson et al., 1997, p. 918). Collective efficacy is measured by (1) informal social control of local children and (2) social cohesion/trust including a willingness to help neighbors, a cohesion of social network, neighborhood trust, and shared neighborhood values (Sampson et al., 1997).

Conceptually, social disorganization appears to be related to but perhaps broader than collective efficacy. Social disorganization focuses on general community mechanisms that enable or disable collective engagement while collective efficacy emphasizes community capacity and willingness, which is represented by the combination of community cohesion and community willingness, for collective engagement. In terms of empirical measurement, social disorganization and collective efficacy can be similar. Both concepts include social capital, which refers to “a resource that is realized through relationships” (Sampson et al., 1999, p. 634). In addition to social capital, both concepts measure the process converting social capital to collective engagement (e.g., measures of collective supervision or informal social control).

Social disorganization and collective efficacy were adopted mainly to explain the neighborhood processes for local crime and delinquency (Sampson & Groves, 1989; Sampson et al., 1997). Sampson and colleagues (1999) expanded this theoretical framework and explained how neighborhood social organization produces collective efficacy for children and eventually influences children’s lives across more domains. Sampson et al. (1999) suggest three aspects of neighborhood social organization influence children’s lives: (1) intergenerational closure; (2) reciprocated exchange; and (3) shared expectations for informal social control and mutual social support of children. Intergenerational closure, referring to local social ties which exist when parents know the parents of their children’s friends, may promote social support for children, information exchange between parents, and an establishment of norms for child-rearing (Sampson et al., 1999). Reciprocal exchange is defined as an interfamilial exchange of resources for childrearing, such as information, advice, and material goods (Sampson et al., 1999). Shared expectations refer to the expected capacity and willingness of collective engagement, and may channel the gains from social capital (i.e., gains from intergenerational closure and reciprocal exchange) to collective engagement for childrearing (Sampson et al., 1999). Neighborhoods characterized by higher level of intergenerational closure, reciprocal exchange, and shared expectations, therefore, may have positive impacts on childrearing and eventually may reduce the risk of child maltreatment.

The sociological approach also explains how neighborhood structures (e.g., impoverishment) influence neighborhood processes (e.g., social disorganization and collective efficacy). Sampson et al. (1999) suggested six neighborhood structures which might influence the above mentioned three aspects of neighborhood social organization (i.e., intergenerational closure, reciprocated exchange, and shared expectations). The first one is residential stability measured by residential mobility and homeownership. High residential mobility may hurt social ties because the establishment of social ties takes time. Also, a low level of homeownership may hinder collective engagement due to lack of a shared financial interest to improve neighborhood life. Second, a concentrated disadvantage may impede collective social control by isolating people from adequate resources. It may also reduce shared expectations for collective engagement since people in impoverished areas encounter high levels of distrust, fear of strangers, uncertainty, and economic dependency. Third, high immigrant concentration may obstruct collective engagement due to linguistic and cultural segregation. Fourth, concentrated affluence may work in the opposite way of concentrated disadvantage. Fifth, the density of adults relative to children may affect collective engagement due to insufficient numbers of adults being available to help with childrearing. Last, high population density may limit social ties due to a high level of anonymity. Among these six neighborhood structures, Sampson et al. (1999) found empirical supports for (1) the associations of concentrated affluence, population density, and residential stability with intergenerational closure and reciprocal exchange and (2) the association of concentrated disadvantage with the shared expectations for the informal social control of children.

Social-Psychological Approach: Ecological Model

There are several different ecological models of child maltreatment, including the human ecology model (Garbarino, 1977), the ecological model (Belsky, 1980), and the ecological/transactional model (Cicchetti & Lynch, 1993). The ecological model was exclusively dedicated to explaining the etiology of child maltreatment (Belsky, 1980). Although the ecological/transactional model also provides some explanation for causes of child maltreatment, the model appears to be more focused on consequences of child maltreatment for children's development (Cicchetti & Lynch, 1993). The most noticeable difference between the human ecology model and the previous two models is the amount of the interest in ontogenic development (i.e., the level including factors within an individual, such as a parent's developmental history of child maltreatment and a parent's experience in child care). While the ecological model and the ecological/transactional model include a substantial interest in ontogenic development for causes of child maltreatment (Belsky, 1980; Cicchetti & Lynch, 1993), the human ecological model shows little interest in ontogenic development (Garbarino, 1977).

Among these models, there is little difference in explaining how neighborhood characteristics influence the risk of child maltreatment. Belsky (1980) includes four levels in his ecological model: (1) ontogenic development (i.e., individual level); (2) microsystem (i.e., family level); (3) exosystem (i.e., community level); and (4) macrosystem (i.e., cultural values and belief system). The ecological/transactional model also adopts this four-levels framework (Cicchetti & Lynch, 1993). The human ecology model does not particularly adopt this framework, indeed the model focuses on exosystem and macrosystem in explaining the necessary conditions of child maltreatment (Garbarino, 1977). The processes in the exosystem appear to be most relevant to the neighborhood pathways leading to child maltreatment.

Both the ecological model and ecological/transactional model emphasize social isolation from formal and informal support systems as important (Belsky, 1980; Cicchetti & Lynch, 1993). Concentrated poverty and unemployment, especially in inner-city neighborhoods, may increase stress on families (Cicchetti & Lynch, 1993). Adequate social supports can be stress buffers, whereas socially isolated families lack social supports and thus may be vulnerable to an increased risk of child maltreatment at stressful times (Belsky, 1980, 1993; Cicchetti & Lynch, 1993). It is also possible that socially isolated families are less likely to exchange information and advice about childrearing reducing the opportunity to develop prosocial and more effective child-rearing norms (Belsky, 1980; Cicchetti & Lynch, 1993).

While recognizing that neighborhood socioeconomic conditions are important in explaining higher or lower risk of child maltreatment, the human ecology model further develops the role of social isolation through the concept of social impoverishment (Garbarino & Sherman, 1980). Socially rich neighborhoods include families who can afford to exchange resources with neighbors because their resources exceed their needs. On the other hand, socially impoverished neighborhoods contain families who have insufficient resources to meet their needs and therefore lack resources to share with neighbors. Garbarino and Sherman (1980) found that when neighborhoods were economically similar (e.g., at similar poverty levels), socially impoverished neighborhoods showed a higher risk of child maltreatment than socially rich ones. Garbarino and Kostelny (1992) also found that under similar economic conditions, neighborhoods at a higher risk of child maltreatment showed a higher level of social disorganization and a lower level of social coherence than those at a lower risk of child maltreatment.

The similarity between the psychological approach and the sociological approach is that both approaches consider social ties as an important process explaining child maltreatment. However, these two approaches differ in how social ties work. In the sociological approach, the function of social ties is embedded in the neighborhood processes such as social disorganization and collective efficacy and in turn, the approach explains how these processes affect children's lives. Additionally, the sociological approach explains how neighborhood structures shape neighborhood processes. While the sociological approach does not particularly deny the direct effects of neighborhood structures on children's lives, it mainly focuses on the indirect effects of neighborhood structures mediated by neighborhood processes. On the other hand, in the psychological approach, social ties more directly influence families by buffering environmental stressors associated with neighborhood structures. Social ties function as a moderator for the effect of neighborhood structures rather than a mediator.

Economic Approach: Resource Availability

Instead of considering neighborhood impoverishment as a structural factor influencing child maltreatment through neighborhood processes (the sociological approach) or as a source of environmental stressors leading to child maltreatment through influencing stress and social support (the psychological approach), it is possible to examine the effect of neighborhood impoverishment on child maltreatment as a mechanism that reduces available material resources to residents (e.g., Drake & Jonson-Reid, 2014; Freisthler, 2004; Jonson-Reid, Drake, & Zhou, 2013). From this perspective, neighborhood impoverishment may influence child maltreatment through individual-level socio-economic conditions, like inability afford child care.

A political perspective provides possible explanations for reasons why there is low provision of public goods and services (e.g., low-quality public schools) in impoverished neighborhoods, particularly in the US setting. If a society has a high level of decommodification[1] of social goods and services, local communities will have a similar level of social infrastructure[2] regardless their political or economic power. However, in the opposite case, the political power of local communities is crucial in shaping their social infrastructure. As it is expected that societies with a low level of decommodification would have low social consensus to provide goods and services through public sectors, the level of social infrastructure of local communities in such societies may vary according to the political power of local communities. Shihadeh and Flynn (1996) and Wallace (1990, 1991) found that political leaders tend to provide less social goods and services to worse-off communities than to better-off communities. Also, Alba and Logan (1993) and Bullard (1994) found that the deprived communities have less political power than affluent communities and that the lower political power results in underinvestment, a low level of social infrastructure, and a lower quality of life. According to this perspective, the US, which is characterized by weak labor market policies and a low level of decommodification (Esping-Andersen, 1990, 1999), should have a systematic underinvestment in social infrastructure in impoverished neighborhoods. In turn, low levels of social infrastructure may lead to low material resource availability among residents.

2.4.2 Empirical Evidence for Neighborhood Effects

Many aggregate level studies (i.e., studies relying only on geographic areas as the unit of analysis) have found a strong association between neighborhood poverty rates and neighborhood child maltreatment rates (Coulton et al., 2007; Drake & Pandey, 1996; Freisthler et al., 2006).

[1] Decommodification refers to social goods and services such as education, health, housing, and welfare being provided by the public sector rather than private market sectors (Esping-Andersen, 1990).
[2] Social infrastructure refers to public provision of education, health services, transportation, food, housing, social insurance, and public assistance (Kaplan, Pamuk, Lynch, Cohen, & Balfour, 1996; Lynch et al., 1998; Lynch & Kaplan, 1997; Smith, 1996).

The limitation of such aggregate level findings is, however, that it is unknown whether the aggregate level association represents the contribution of family characteristics (e.g., poverty status of a family) or of neighborhood context (e.g., living in a deprived neighborhood). In this section, a few key methodological considerations are reviewed prior to discussion of multilevel studies attempting to understand neighborhood contextual effects independent of individual-level characteristics.

Group-Mean Centering versus Grand-Mean Centering

In multilevel studies, individual-level predictors can be centered to each neighborhood's mean (i.e., group-mean centering) or to the entire sample's mean (i.e., grand-mean centering). Prior multilevel studies of child maltreatment used different centering methods including no use of centering (Coulton et al., 1999; Freisthler & Maguire-Jack, 2015; Freisthler & Wolf, 2016; Irwin, 2009; Kim & Drake, 2017; Kim, 2004; Merritt, 2009; Molnar et al., 2003). To better understand these studies, it is important to know how the choice of centering influences the estimation of neighborhood-level effects.

The choice between group-mean centering and grand-mean centering is theory driven rather than data driven. This is because the overall model fit differs little by this choice, while this choice can substantially change estimates of individual-level and neighborhood-level effects (Enders & Tofighi, 2007; Kreft, de Leeuw, & Aiken, 1995). If one uses group-mean centering, for example, the family-level difference in SES between poor and rich neighborhoods would be largely allocated to neighborhood-level SES. Using group-mean centering may therefore increase the *estimates* of neighborhood-level effects, while decreasing the *estimates* of family-level effects, as Enders and Tofighi (2007, Table 3, p. 132) demonstrate.

It is suggested that one should avoid using group-mean centering when there is no clear theoretical reason to do so—e.g., the frog-pond effect (Snijders & Bosker, 2012). It appears that there is neither theory nor reference for why a relative position (e.g., of SES) within a neighborhood is more important than a position within a larger society in terms of child maltreatment. As Enders and Tofighi (2007) point out, group-mean centering is not adequate for assessing unique neighborhood effects because neighborhood-level effects are estimated while not accounting for individual-level effects. Some prior multilevel studies used group-mean centering (Coulton et al., 1999; Merritt, 2009). It would be wise to interpret findings of these studies while considering possible theoretical reasons and methodological issues of group-mean centering.

Child Maltreatment Risks by Ecological Levels

Multilevel modeling can estimate the proportion of the variance in an outcome variable placed at each ecological level (e.g., family and neighborhood) without taking predictors into account. Prior multilevel studies have found that 7% or less of the variance in the risk of child maltreatment was between neighborhoods, while over 93% of the variance was between children or families (Coulton et al., 1999; Irwin, 2009; Kim & Drake, 2017; Kim, 2004; Merritt, 2009; Molnar et al., 2003). These results suggested that the risk of child maltreatment largely varied between children or families, while the risk varied little between neighborhoods.

Since prior studies were mostly cross-sectional in their analyses, they did not estimate the proportion of variance accountable by time (e.g., between ages). By conducting longitudinal analyses, the current study will provide a better understanding of whether the risk of child maltreatment largely varies by time or is held constant over time within a family.

Study Sites and Outcomes of Interest of Prior Multilevel Studies

There are currently eight multilevel studies available which bear on this topic. Six studies used self-reported maltreatment as an outcome. Coulton et al. (1999) and Merritt (2009) used parent-reported neglect and physical abuse scores from the child abuse potential inventory (CAPI) administered among randomly sampled 400 households in Cleveland City, Ohio. Molnar et al. (2003) used parent-reported parent-to-child physical aggression scores from the conflict tactics scale (CTS) based on randomly sampled 4,252 children in Chicago City, Illinois. Kim (2004) measured parent-reported maltreatment (yes/no) based on questions asking parents' maltreatment behaviors to their children (i.e., neglect, physical abuse, and CPS experience) by using 1,532 young adults having at least one child from the National Longitudinal Study of Adolescent Health. Freisthler and colleagues used parent-reported numbers of parents' physical abuse acts measured by CTS based on 3,023 parents from 50 mid-size cities in California (Freisthler & Maguire-Jack, 2015; Freisthler & Wolf, 2016). Two studies used official maltreatment reports as an outcome. Irwin (2009) estimated three different official report outcomes (i.e., first-time screened-in report, first-time screened-in neglect report, and first-time substantiated report during the first 6 years of childhood) from the 1998-2001 full birth cohort of Cuyahoga County, Ohio (N = 65,181). Kim and Drake (2017) used the number (i.e., frequency) of screened-in maltreatment reports from birth to age 15 years by following up high-risk St. Louis children (i.e., 3,343 children with a screened-in report during early childhood and 2,805 children with an AFDC case but no maltreatment report during early childhood).

Neighborhood Findings

In this section, prior multilevel findings on neighborhood contextual effects are reviewed, starting with neighborhood impoverishment.

Impoverishment. Irwin (2009) found that neighborhood impoverishment (a factor of % poor, % unemployed, % Black, % female-headed families, and % vacant housing units) had a significant positive association with the likelihood of having an official maltreatment report. The effect size of neighborhood impoverishment was, however, notably smaller than those from socioeconomic measures at the family level. For example, while there was 1.26-fold increase in the likelihood of maltreatment reporting with one standard deviation (σ) increase in neighborhood impoverishment (i.e., 34% of the sample between "0" and "+1σ" and 13.5% between "+1σ" to "+2σ"), children receiving TANF (i.e., 22% of the sample) showed a 3.23 times greater likelihood of maltreatment reporting than those not receiving TANF (Irwin, 2009). Kim and Drake (2017) found no statistically significant association between baseline neighborhood poverty and the frequency of screened-in reports while family's longer duration in low-income status was strongly associated with a higher frequency of reports. Coulton et al. (1999) and Merritt (2009) found that higher levels of neighborhood impoverishment (a factor of % female-headed families, % poor, % unemployed, % vacant housing units, population loss, and % Black) was significantly associated with higher physical abuse and neglect scores of CAPI. As aforementioned, however, these findings should be interpreted with caution because they might be confounded by family income due to group-mean centering. Other studies found no significant association of self-reported maltreatment (i.e., parents' physical abuse acts by CTS, parent's maltreatment behaviors, and parent-to-child physical aggression scores of CTS) with neighborhood impoverishment or similar measures (Freisthler & Maguire-Jack, 2015; Freisthler & Wolf, 2016; Kim, 2004; Molnar et al., 2003).

Childcare burden. Prior studies found no significant association of neighborhood childcare burden (e.g., a factor of ratio of adults to children and ratio of adult males to adult females) with official maltreatment reports (Irwin, 2009) and with the frequency of parents' physical abuse acts by CTS (Freisthler & Wolf, 2016). Although Coulton et al. (1999) and Merritt (2009) found a significant positive association of neighborhood childcare burden with physical abuse scores and neglect scores of CAPI, these neighborhood effects might be overestimated by using group-mean centering for family-level social support and marital status.

Residential stability. Freisthler and Maguire-Jack (2015) and Freisthler and Wolf (2016) found that a higher level of neighborhood stability (e.g., a factor of % of longtime residents and % of recent movers) was significantly associated with a lower CTS score of physical abuse and/or neglect while controlling proper family-level confounders such as participation in neighborhood activities, the number of years living in the neighborhood, social support, and social network. Irwin (2009) also found a significant association between a higher level of residential instability and a lower likelihood of maltreatment reporting. Unfortunately, this estimate might not reflect a unique neighborhood effect as this study did not control for appropriate family-level confounders (e.g., family-level transience or social support) (Maguire-Jack, 2014). Other studies regarding self-reported maltreatment (i.e., CTS parent-to-child physical aggression scores, parents' maltreatment behaviors, and CAPI physical abuse and/or neglect scores) showed no significant finding for neighborhood stability while controlling for family-level social support and/or transience (Coulton et al., 1999; Kim, 2004; Merritt, 2009; Molnar et al., 2003).

Ethnic Heterogeneity. A higher level of neighborhood immigrant concentration (e.g., a factor of % Hispanic and % foreign-born residents) was significantly associated with a lower frequency of parents' physical abuse acts measured by the CTS (Freisthler & Maguire-Jack, 2015) and with a lower parent-to-child physical aggression score measured by the CTS (Molnar et al., 2003). Consistently, a higher level of naturalized Asian/Pacific Islanders in a neighborhood (a factor of % naturalized and % Asian/Pacific Islander) was significantly associated with more parents' physical abuse acts reported with the CTS (Freisthler & Maguire-Jack, 2015). These findings go against sociological theoretical expectations which posit that immigrant concentration may obstruct collective engagement due to linguistic and cultural segregation. Rather, these findings are consistent with an individual-level effect, the so-called "healthy immigrant effect" or decay of such an effect due to acculturation found both in the medical and the child welfare literature (Drake & Jonson-Reid, 2014; Putnam-Hornstein, Needell, et al., 2013). Kim (2004) found no significant association between neighborhood ethnic heterogeneity and parents' maltreatment behaviors.

Alcohol outlet density. Freisthler and colleagues found no significant association between alcohol outlet density and parents' physical abuse acts measured by the CTS (Freisthler & Maguire-Jack, 2015; Freisthler & Wolf, 2016). They concluded that "it appears that alcohol outlets may work through drinking behaviors or drinking locations and not through neighborhood structure." (Freisthler & Maguire-Jack, 2015, p. 274).

Neighborhood process. While some studies found factors measuring neighborhood processes were significantly related to self-reported maltreatment (Freisthler & Maguire-Jack, 2015; Kim, 2004), others found no similar significant relationships (Coulton et al., 1999; Merritt, 2009). Freisthler and Maguire-Jack (2015) found significant associations between a higher frequency of a parent's physical abuse acts and both a higher level of neighborhood social disorder (measured by resident-perceived problems for heavy traffic, violent crimes, gangs, drug activities in their neighborhoods) and a lower level of neighborhood collective efficacy (measured by resident-perceived child-centered informal social control and reciprocated exchange). Kim (2004) found that a higher level of neighborhood violent crime (a factor of violent crime rates and juvenile violent crime arrest rates) was significantly associated with a higher likelihood of a parent's maltreatment behavior. On the other hand, Coulton et al. (1999) and Merritt (2009) found no factors representing neighborhood processes (i.e., the level of neighborhood satisfaction, the level of local facility availability, the level of perceived neighborhood disorder, and the level of neighborhood child-centered control) to be statistically significant. Kim (2004) also found no significant associations between maltreatment and neighborhood-level perceived network, happiness, safety, and resource.

In summary, the findings of prior multilevel studies were somewhat inconsistent in supporting substantial unique influences of neighborhood context on child maltreatment. Prior multilevel studies often found theory-generated neighborhood-level characteristics to be statistically non-significant, to be significant in a direction opposite to what theory would predict, or to be practically much less important than family-level characteristics. Significant findings on certain neighborhood characteristics in some studies were not without concerns in terms of methodological issues (e.g., using group-mean centering, having no proper family-level control) and/or inconsistency with other studies (i.e., similar characteristics were not significant in others). It may be that underlying relationships among variables are complex, perhaps manifesting in interaction or synergistic effects. We need more multilevel research to fully understand neighborhood contextual effects on child maltreatment.

2.5 Other Risk/Protective Factors

Based on an ecological perspective, the current study explores various other risk/protective factors for child maltreatment. Although these factors are outside the main interests of the current study, understanding these factors has its own theoretical and practical importance and is also important to isolate the net effects of key risk/protective factors.

The current study's estimates are not limited to onset of reporting or recurrence. Instead, the likelihood of any report (i.e., any of first-time reports, first-time re-reports, and any subsequent reports) at a given age was estimated based on various risk and protective factors. For this reason, this section's review includes factors related to onset of reporting, as well as factors related to re-reporting. All these factors may be of concern for the AFDC sample since children in this sample can have first-time reports, first-time re-reports, or subsequent re-reports during follow-up. On the other hand, factors predicting recurrence may be more relevant to the CAN sample as all children in this sample had a report at the baseline and can have only re-reports during follow-up.

While some studies specifically examined the risk of "first-time" maltreatment or the risk of "recurring" maltreatment, others did not distinguish "first-time" and "recurring" events and estimated the risk of "any" (first or recurring) maltreatment. This section reviews prior studies while considering this difference in their outcome of interest.

2.5.1 Child Characteristics

As Jonson-Reid, Emery, Drake, and Stahlschmidt (2010) point out, child's characteristics may have an active role in altering the likelihood of recurrent maltreatment. Prior studies have also examined various characteristics which might link to child maltreatment risk.

Child Sex

Irwin (2009) found that boys were significantly more likely to have a first-time maltreatment report than girls. Yet, the difference in the likelihood was less than 5% and not practically meaningful. Many other studies found that child's sex had no significant association with the risk of first-time reports (Putnam-Hornstein & Needell, 2011), first-time substantiated reports (Irwin, 2009), recurring reports (Drake, Jonson-Reid, & Sapokaite, 2006; Jonson-Reid, Emery, et al., 2010), any (first or recurring) reports (Dworsky et al., 2007; McDaniel & Slack, 2005; Needell et al., 1999), and any (first or recurring) substantiated reports (Ovwigho et al., 2003). Research suggests that child's sex may be related to certain types of maltreatment. Both NIS-3 (conducted in 1993) and NIS-4 (conducted in 2005-2006) found that girls were significantly more likely to be harmed or endangered for sexual abuse than boys, while there was no significant difference in neglect, physical abuse, and emotional abuse between girls and boys (Sedlak, Mettenburg, et al., 2010; Sedlak & Broadhurst, 1996).

Child Mental Health/Behavioral Problem

Child mental health or behavioral problems may increase the burden of parenting and therefore the risk of child maltreatment. Empirical findings, however, have been somewhat inconsistent and the measurement of "mental health" and "behavioral problems" varies. Brown and colleagues (1998) found that early anxious and withdrawn child behaviors were associated with greater risk of child neglect (i.e., having any of substantiated neglect report or retrospective self-reported neglect during childhood) but not with other maltreatment types. Jaffee and colleagues (2004) found that controlling for genetic and other factors, children's antisocial behavior was associated with self-reported corporal punishment but not self-reported physical abuse. Dworsky et al. (2007) also found no significant association between child behavioral problems and maltreatment reporting (including both first-time and recurring reports). Regarding recurrent maltreatment, Hamilton and Browne (1999) found that children with behavioral problems were significantly more likely to have a re-report. Drake et al. (2006) found that children with a Medicaid record of mental health or substance abuse treatments were at a higher risk of having a re-report. Jonson-Reid et al. (2010) examined the risk of a recurrence of a report in four sequential stages from the first re-report to the fourth re-report and found that child's emergency room care for mental health significantly *increased* the risks of the first, second, and fourth re-reports. The study found, however, a record of mental health treatment significantly *lowered* the risks of a re-report in all stages from the first to the fourth.

Child Educational Needs

The burden of parenting can be higher for children with higher educational needs. For example, children with a learning disability were found to be significantly more likely to have a recurrence of a maltreatment report (Hamilton & Browne, 1999). Child's special education eligibility status can also be an indicator for child's educational needs. A population-based study based in Omaha, Nebraska found that children receiving special education services were over three times more likely to have a substantiated report than those with no disability related to special education needs (Sullivan & Knutson, 2000). Yet, findings for recurrent maltreatment are somewhat inconsistent. Child's special education eligibility status showed a significant association with an increased risk of maltreatment re-reporting when the eligibility status was related to emotional disturbance (Drake et al., 2006). In the same study, the eligibility status based on any other disability had no significant association with a recurrence of a report. Another study even found that the eligibility status significantly lowered the risks of the first, second, and fourth re-reports (Jonson-Reid, Emery, et al., 2010).

Child Injury

Injuries can be a sign of both reported and unreported child maltreatment (Spivey, Schnitzer, Kruse, Slusher, & Jaffe, 2009). Spivey and colleagues (2009) found that more injury-related emergency room visits were significantly associated with a higher likelihood of having a maltreatment report. A different study found that children with hospital treatment for injury had a significantly higher risk of recurrence for the first and second re-reports, but not for the third and fourth re-reports (Jonson-Reid, Emery, et al., 2010). Findings of several case-control studies were inconsistent. A study based in Western Australia found that increased rates of hospitalizations for injuries were related to much higher risk of reported and substantiated maltreatment (O'Donnell et al., 2010). Yet, other two studies did not find higher rates of injuries among maltreated children compared to controls. Friedlaender and colleagues (2005) found that among children on Medicaid, those with a first-time maltreatment report leading to foster care placement showed no higher rate of injury diagnoses than matched control subjects. Another study found that children with a substantiated report (including both first-time and recurring substantiations) showed no higher rates of emergency room visits for injuries than controls (Guenther, Knight, Olson, Dean, & Keenan, 2009).

Child Birth Outcomes

Although we have not yet developed a clear understanding of the relationship between birth outcomes and child maltreatment (e.g., this relationship could be because children with negative birth outcomes are more difficult to care for or because birth outcomes are a proxy for dysfunction that is present before birth), many studies have found that poor birth outcomes are significantly associated with a high risk of child maltreatment. Beimers and Coulton (2011) found no significant association between low birth weight (< 2,500g) and any (first or recurring) substantiated maltreatment among female-headed households exiting TANF. Others found that children born with low birth weight were significantly more likely to have first-time reports (Irwin, 2009; Putnam-Hornstein & Needell, 2011), first-time substantiated reports (Irwin, 2009; Wu et al., 2004), and any (first and recurring) reports (Needell et al., 1999). Birth abnormality was also found to have a significant association with the future risk of first-time maltreatment reporting (Putnam-Hornstein & Needell, 2011). With regard to recurrent maltreatment, known medical condition (including very low birth weight, congenital conditions, etc.) was significantly associated with the first and second re-reports, but not with the third and fourth re-reports (Jonson-Reid, Emery, et al., 2010).

2.5.2 Parent Characteristics

Parent characteristics may be related to child maltreatment risk. Prior studies have examined various characteristics of parents, such as age, education, developmental problems, mental health, alcohol and substance abuse problems, and criminal behaviors.

Parent Age

Many studies have tested the association of child maltreatment risk with parent age. Findings are inconsistent. Some studies found that older parents had a *lower* risk of having first-time maltreatment reports (Irwin, 2009), any (first or recurring) reports (Courtney et al., 2005; Needell et al., 1999), and any (first or recurring) substantiations (Beimers & Coulton, 2011; Ovwigho et al., 2003). Other studies, however, found that older parents had a *higher* risk of any (first or recurring) reports (Cancian et al., 2013) and re-reports (Jonson-Reid, Emery, et al., 2010). There are also studies observing no significant association of parent's age with any (first or recurring) reports (Dworsky et al., 2007; McDaniel & Slack, 2005) and with first-time substantiated reports (Irwin, 2009).

Parent Education

Prior studies have sometimes observed a significant effect of parental education level and maltreatment, but not always. In some studies, it was found that parents with a lower level of education had a significantly higher risk of first-time maltreatment reports (Irwin, 2009; Kotch et al., 1999; Putnam-Hornstein & Needell, 2011), first-time substantiated reports (Irwin, 2009), maltreatment re-reports (Drake et al., 2006; Jonson-Reid, Emery, et al., 2010), any (first or recurring) reports (Cancian et al., 2013), and any (first or recurring) substantiated reports (Beimers & Coulton, 2011). Other studies found no significant association with any (first or recurring) maltreatment reports (Courtney et al., 2005; Dworsky et al., 2007; McDaniel & Slack, 2005) or with any (first or recurring) substantiated reports (Slack et al., 2007).

Parent Criminal Behavior

Hines, Lemon, Wyatt, and Merdinger (2004) suggest that there is a positive association between parental incarceration and CPS involvement based on their review of the literature. Yet, the findings for parent's arrest history varied. Kim and Drake (2017) found that children whose parents had an arrest history had a significantly higher number of maltreatment reports during childhood than others. Yet, McDaniel and Slack (2005) found no significant association between parental arrests and any (first or recurring) reports.

Parent Cognitive Delay

Prior findings on parental learning disabilities are also mixed. Some studies have found that parents with a learning disability were significantly more likely to have a (first or recurring) maltreatment report (McDaniel & Slack, 2005) and a (first or recurring) substantiated report (Slack et al., 2007). Another study found no significant association between parent's learning disability and any (first or recurring) maltreatment reports (Slack et al., 2003). A secondary analysis of the Canadian Incidence Study of Child Abuse and Neglect (CIS-2003) found that the prevalence of parental cognitive impairment among first-time or recurring investigated cases (i.e., 10.1%) was substantially higher than that of a general population (i.e., 1% to 3%) (McConnell, Feldman, Aunos, & Prasad, 2011).

Parent Mental Health

Prior studies have provided contradictory findings regarding parent's mental health. Drake et al. (2006) found that parents with a history of mental health and/or substance abuse treatment (not by type of diagnosis) were significantly more likely to be involved in recurrent maltreatment. Jonson-Reid et al. (2010) also found parents having a mental health treatment prior to the first-time report had a significantly higher risk of recurrence. That study, however, found that parents having mental health treatment subsequent to the first report had a significantly lower risk of re-reports. Other studies found no significant association between parent's mental health and any (first or recurring) maltreatment reports (McDaniel & Slack, 2005; Slack et al., 2003). Kohl, Jonson-Reid, and Drake (2011) found that children of mothers with diagnoses of mood or anxiety disorders were more likely to be re-reported.

Parent Alcohol and Drug Abuse

Some prior studies found a significant association between parent's alcohol/drug abuse and child maltreatment risk, but others have not. Six studies reported that parents with alcohol and/or drug abuse problems were significantly more likely to have a first-time maltreatment report (Irwin, 2009; Kotch et al., 1999), a first-time substantiated report (Irwin, 2009), a recurring report (Drake et al., 2006; Hamilton & Browne, 1999), and any (first or recurring) report (Courtney et al., 2005). Other studies found no significant association between parental alcohol/drug abuse and maltreatment reports (Dworsky et al., 2007; McDaniel & Slack, 2005; Slack et al., 2003) or substantiated reports (Slack et al., 2007).

The current study did not include parent cognitive delay, parent mental health, and parent alcohol and drug abuse in analyses due to the lack of adequate data to measure them.

Parent Childhood History of Maltreatment

Some studies have looked at the parent's own childhood history of CPS contact as a risk for intergenerational maltreatment. Putnam-Hornstein and colleagues (2015) found that among first-time adolescent mothers, those with a childhood history of maltreatment reporting were at higher risk of first-time maltreatment reporting on their children. Widom, Czaja, and DuMont (2015) also found that parents who experienced child maltreatment as a child were more likely to have a maltreatment report regarding their children. Jonson-Reid et al. (2010) found that mothers with a foster care placement history as a child had a significantly increased risk of the third re-report, but had no significantly higher risk for the first, second, and fourth re-reports. Another study found that parents with a self-reported childhood history of maltreatment were significantly *less* likely to have a maltreatment report for maltreating their own children (McDaniel & Slack, 2005).

2.5.3 Prior CPS System Contact

A prior CPS contact has been consistently found to be a strong predictor of future contacts with CPS. A number of previous studies compared the risk of recurring reports among families with prior reports and the risk of onset of reporting among those with no prior report. These studies have consistently found that the former risk was markedly higher than the latter one for both reports (Courtney et al., 2005; Dworsky et al., 2007; McDaniel & Slack, 2005; Slack et al., 2003) and substantiated reports (Ovwigho et al., 2003; Slack et al., 2007).

2.5.4 CPS Service Use

CPS services, such as Family Centered Services (FCS), Intensive In-home Services (IIS), and foster care services, are designed to lessen the future risk of child maltreatment among reported families. Use of these CPS services, therefore, may reduce the risk of maltreatment recurrence if these services work properly (Jonson-Reid, Emery, et al., 2010). It is also possible that use of these services is statistically and spuriously associated with an increase in the future maltreatment risk because the services may be offered to families with high-risk (Jonson-Reid, Emery, et al., 2010). Either of these ideas have been identified in prior findings by intensity of services and adequate (or inadequate) controls of risk levels while examining CPS service use.

Some studies examined the relationship between FCS (i.e., low-intensive CPS services) and maltreatment recurrence. They found that FCS was mostly related to reduced risk of recurrence. A study based in Baltimore found that families' attendance at services as noted in their service plans after substantiated reports were at lower rates of substantiated re-reports (DePanfilis & Zuravin, 2002). A different study using Missouri statewide data found that among children with first-time reported sexual abuse, reported neglect, or substantiated physical abuse, FCS was associated with decreased risk of both re-reports and substantiated re-reports (Drake et al., 2003). Drake and colleagues found that children receiving FCS after first-time unsubstantiated reporting showed lower rates of re-reporting (Drake et al., 2006). Another study identified that FCS was related to decreased risk of first re-reporting and also subsequent re-reporting from second through fourth re-reports (Jonson-Reid, Emery, et al., 2010). These studies, especially the latter two studies, had adequate controls for risk levels including SES.

The latter three studies also looked at IIS (i.e., high intensity services to address imminent risk of foster care placement). Findings were somewhat inconsistent and at times presented higher risk of recurrence among IIS participants. Drake and colleagues (2003) found that IIS was associated with higher risk of recurrence for children with first-time reports for sexual abuse and physical abuse. In the same study, however, IIS was related to lower risk of recurrence among children with first-time neglect reports. Drake and colleagues (2006) identified that IIS predicted higher risk of re-reporting for children with first-time unsubstantiated reports, while those receiving IIS after first-time substantiated reports had lower rates of re-reporting. Jonson-Reid, Emery, et al. (2010) found that IIS was associated with lower risk of all first through fourth re-reports.

Other studies in this area examined CPS services while making no distinction between FCS and IIS and having no adequate SES control compared to above studies. These studies mostly found that CPS services were related to increased risk of recurrence. Fluke and colleagues found that CPS services were related to higher risk of recurrence among children with prior unsubstantiated reports, although CPS services predicted lower risk of recurrent for those with prior substantiated reports (Fluke, Shusterman, Hollinshead, & Yuan, 2008). Others found that CPS services were associated with higher rates of recurrence (Connell, Bergeron, Katz, Saunders, & Tebes, 2007; Lipien & Forthofer, 2004; Zhang, Fuller, & Nieto, 2013).

Prior findings from studies appropriately controlling for risk suggest that low-intensity CPS services, such as FCS, may be associated with lower rates of recurrence. Conversely, high-intensiveness CPS services (i.e., IIS) or CPS services without proper controls for risk levels are found to be associated with a higher risk of recurrence.

2.6 Interactions among Risk/Protective Factors

As discussed above, the current study mainly focuses on influential factors at the population level (i.e., child age, family SES, race, and neighborhood contexts). The current study's focus on interaction effects also emphasizes these factors.

An ecological perspective suggests that there will be interaction effects among risk and protective factors relative to child maltreatment. It is reasonable to assume that race-specific protective factors for child maltreatment might ease the effects of unfavorable conditions of families and neighborhoods on the risk of child maltreatment. Evidence supports some of these ideas. It has been found that within lower economic status populations, Blacks tend to have a slightly to moderately lower risk of child maltreatment than Whites (Cancian et al., 2013; Drake et al., 2009; Dworsky et al., 2007; Kim & Drake, 2017; Needell et al., 1999; Putnam-Hornstein, Needell, et al., 2013; Slack et al., 2003, 2007). This suggests that the relationship between family SES and child maltreatment may be less pronounced among Blacks. A similar trend was also found for neighborhood SES. A prior study found that the relationship between neighborhood disadvantage and child maltreatment was more evident among Whites (Irwin, 2009).

Possible interactions child age with race and SES are also supported by prior work. Regarding child age and race, the Black-White disparity in the risk of child maltreatment was larger at younger ages without controlling for possible confounders (Crampton & Coulton, 2008; Sabol et al., 2004; Wulczyn et al., 2005). When other factors were controlled for, however, such an interaction was not observed (Irwin, 2009). With regard to child age and SES, a study found that the relationship between county-level poverty and substantiated maltreatment reports was stronger at younger ages (Wulczyn et al., 2005). At an individual level, the difference in the risk of maltreatment reports between welfare recipients and non-recipients was found to be larger at younger ages (Irwin, 2009).

In this chapter, the current study mainly reviewed theory and empirical findings and influential factors relative to the population-level prevalence of child maltreatment at the bivariate level (i.e., child age, family SES, race, and neighborhood contexts). While prior work in this area has markedly advanced our understanding of these factors, there are still considerable gaps in our knowledge. With regard to the relationship between family SES and child maltreatment, our understanding of this relationship is generally limited to a short-term period (i.e., 5 years or less). More importantly, we lack an understanding of the risk of maltreatment reporting while considering changes of both current and cumulative historical conditions of family SES over time. This further limits our knowledge of the relationship between child age and maltreatment reports in a longer-term setting and in consideration of changes of key relevant factors including family SES over time. Regarding race, it is necessary to seek to replicate emerging evidence indicating lower risk of child maltreatment among Blacks than among Whites while controlling for SES. The current study examines this trend in a more rigorous setting while considering changes of key risk and protective factors, especially changes of both current and cumulative history of family SES, over time. It is also unknown whether this trend is more pronounced at younger ages or is maintained from early childhood through middle childhood and adolescence.

Regarding neighborhood contexts, despite strong theory-supported neighborhood contextual effects, prior multilevel findings were somewhat inconsistent. This suggests that we need to accumulate more evidence in this area to better understand any unique impacts of neighborhood contexts independent from individual conditions, especially family SES. It is also important to consider changes of residential neighborhoods over time in a longitudinal setting as children, especially disadvantaged ones, move frequently. There is only one prior study which examined the relationships between neighborhood contexts and maltreatment "reports" (Irwin, 2009). Although this study adopted a longitudinal setting, this study limited both measures of family SES and neighborhood contexts at the baseline and disregarded their changes over time. To better understand the unique influences of "current" neighborhood contexts on child maltreatment reports, it is necessary to examine this relationship while considering both changes of family SES and neighborhood contexts over time.

Chapter 3: Research Aims and Questions

To help address the identified knowledge gaps from the review of prior studies in Chapter 2, the present study has two specific aims. The first aim is to address the gaps in our knowledge of longitudinal patterns of child maltreatment reports. The second aim is to alleviate the gaps in our understanding of neighborhood contextual effects.

3.1 Aim 1

The first aim of the current study is *to examine longitudinal patterns of child maltreatment reports based upon child age from 1 to 17 years while considering various risk and protective factors*. Work stemming from this aim should help provide a better understanding of the relationships between child age, welfare (AFDC/TANF) receipt, and race and child maltreatment reports in a long-term context from early childhood to middle childhood and adolescence. The current study uses secondary data from a parent study which has traced four different birth cohorts (1991-1994) for 13 to 14 years (Jonson-Reid et al., 2009), allowing coverage of almost the entire period of childhood from age 1 to 17 years. The current study adopts longitudinal analyses to estimate the likelihood of maltreatment reporting at a given age while considering various time-varying variables (e.g., welfare receipt), time-fixed variables (e.g., race), and baseline neighborhood contexts. To take advantage of longitudinal data and to fill in knowledge gaps by doing so, the current study considers longitudinal changes of both current and cumulative history of welfare receipt and their interactions with child age. For this purpose, the current study also examines the relationship between race and child maltreatment while considering the interaction between race and child age. The longitudinal data from the parent study also allows the current study to consider changes of other risk and protective factors.

It is important to understand that the current study examines the likelihood of having "any" maltreatment report at a given age regardless whether a report is the first-time ever report, the first-time re-report, or any subsequent re-report. This allows the current study to follow up children even after having a report. The parent study has followed up two separate samples: children having reported maltreatment in early childhood (the CAN sample) and children receiving welfare (AFDC) with no reported maltreatment in early childhood (the AFDC sample). Accordingly, estimates for the CAN sample are limited to the likelihood of having a re-report, while estimates for the AFDC sample relate mainly to the likelihood of having a first-time report during the early stage of follow-up and to the likelihood of having a re-report at the later stage of follow-up.

As the first aim focuses on understanding the risk of maltreatment reporting in a longitudinal setting, the examination of neighborhood contextual influences is limited to baseline data due to the intrinsic limitation of the main administrative datasets used (i.e., AFDC/TANF data and child welfare data). The subjects' residential addresses can be followed up only for those who are caught by the administrative datasets. That is, addresses can be updated only for families who continue receiving AFDC/TANF after the baseline or for families who have a new maltreatment report after the baseline. To avoid selection bias in tracing addresses while maximizing both numbers of children and of age-year observations per child in the data, this examination is therefore restricted to baseline neighborhood characteristics. The first aim has the following specific research questions:

Question 1. *Does the risk of maltreatment reporting vary by child age?* Prior bivariate findings suggest that the risk decreases with the increase of child age. The current study examines this relationship while controlling for other risk and protective factors of child maltreatment in a long-term context from age 1 to 17 years.

Question 2. *Does the risk of maltreatment reporting vary by welfare receipt?* Theory and prior empirical findings strongly suggest that the risk would be higher for children receiving welfare (AFDC/TANF). To pursue more nuanced and situational understanding of welfare receipt, the measures of welfare receipt were separated to the current welfare receipt and the cumulative history of prior welfare receipt. For the same purpose, the current study examined whether the impact of prior welfare receipt varied by current welfare receipt and whether the impact of current welfare receipt varies by child age.

Question 3. *Does the risk of maltreatment reporting vary by child race?* Prior findings suggest the risk would be lower for Blacks than Whites after controlling for SES. It is expected that this study will also find this, given the nature of this study's samples as predominantly lower SES and further controls of both current and cumulative history of welfare receipt. To better understand the impact of child race, the current study examined whether the risk differs through the interaction between child race and child age and/or through the interaction between child race and welfare receipt.

Question 4. *Does the risk of maltreatment reporting vary by baseline neighborhood characteristics?* As abovementioned, baseline neighborhood characteristics are used for Aim 1. In some models, neighborhood characteristics are measured as factors (i.e., impoverishment, instability, and care burden) to be consistent with prior multilevel studies. In "separate" models, neighborhood characteristics are also measured as variables (i.e., poverty rate, mobility rate, and child/adult ratio) to pursue intuitive and practical interpretations.

Question 5. *Does the risk of maltreatment reporting vary by other risk and protective factors?* The current study further examined the impacts of other risk and protective factors, including TANF lifetime limit, prior CPS report, CPS in-home service, child injury, child mental health, child mental delay, child chronic health problem, child delinquency, child special education, parent conviction of crime, parent arrest, birth weight, birth year, child sex, Medicaid receipt at the subject child's birth, maternal education at the subject child's birth, maternal foster care placement during her youth, and the baseline AFDC receipt. To take the time proximity of an issue into account, child injury, child mental health, child delinquency, parent conviction, and parent arrest were measured separately for the current status of an issue and the prior history of an issue (e.g., child current mental health and child prior mental health).

3.2 Aim 2

The second aim is to *examine neighborhood contextual effects on child maltreatment reports*. For this aim, a subset of the original sample is used by selecting age-year observations with an active welfare (AFDC/TANF) case. This is to update any change of residential neighborhoods based on welfare records without the abovementioned selection bias. Although the examination of neighborhood contextual effects is limited to age-year observations on welfare, this allows the current study to consider changes of residential neighborhoods over time and to correctly measure "current" neighborhood contexts by considering such changes. This limitation also "fixes" current family SES to a low level, allowing the current study to examine the relationship between "current" neighborhood contexts and child maltreatment reports, independent from current family SES. For this purpose, cumulative history of welfare receipt is further controlled statistically. To my knowledge, no prior study has considered both changes of residential neighborhoods and family SES over time. The second aim has the following specific research questions:

Question 6. *Does the risk of maltreatment reporting vary by neighborhood characteristics?* For the Aim 2, changes of residential neighborhoods are considered while measuring neighborhood characteristics. For the same purpose as stated above, neighborhood characteristics are measured as factors and variables, and they are used in separate models. As prior studies suggest that the experience of neighborhood SES may be different by child race, the interaction between neighborhood SES (impoverishment and poverty rate) and child race is examined.

Question 7. *Does the risk of maltreatment reporting vary by other risk and protective factors?* The other risk and protective factors listed in Question 5 are also examined for Aim 2. The Aim-2 analyses examine two additional variables (i.e., family residential moves and residing out of St. Louis), which are drawn by longitudinally tracing family residential addresses.

Chapter 4: Methods

The current study used secondary administrative data which had been previously linked by a larger longitudinal study based in St. Louis City and County (Jonson-Reid et al., 2009). The current study adopted multilevel logistic growth curve models (Luke, 2008) to estimate the likelihood of having a maltreatment report at each age in years as a function of various risk/protective factors. The first set of analyses (for Aim 1) estimated this likelihood while using "baseline" information for neighborhood characteristics and ignoring longitudinal changes of residential neighborhoods after the baseline. This was to avoid the previously discussed risk of selection bias on tracing neighborhood changes with this dataset, while maximizing both the number of children to be included in the analyses and the number of years observing each child. The second set of analyses (for Aim 2) used a subset of samples for Aim 1 by limiting age-year observations to those with an active AFDC/TANF case. This was to tract changes of residential neighborhoods based on AFDC/TANF records, while addressing the selection bias problem. Integrating changes of residential neighborhoods allowed the second set of analyses to examine of influences of "current" neighborhood contexts.

This study estimated the likelihood of having any maltreatment report (i.e., the first report, the first re-report, or any subsequent re-report) at a given age. This allowed the current study to follow up children even after the first event and continued looking at the likelihood of having a report at each of next ages. This was a notable strength of the current study as it provided empirically sound models explaining longitudinal patterns of child maltreatment reports throughout children's lives.

4.1 Sampling and Follow-up

The parent study (Jonson-Reid et al., 2009) originally linked administrative data by accessing various Missouri statewide databases, including child maltreatment and income maintenance records. The sampling design of the parent study allowed the current study to construct two separate samples: (1) the *CAN (child abuse and neglect) sample* including children aged 3 or under with a maltreatment report and (2) the *AFDC sample* including children aged 3 or under with a AFDC case but without a known maltreatment report as of the time the sample was selected. The data, therefore, provided different opportunities in exploring the research questions by longitudinally following two different samples which represented two different populations: (1) children who experienced reported maltreatment in early childhood and (2) children who experienced welfare (AFDC) but no reported maltreatment in early childhood. This was an apparent strength for generalizability, as this was conceptually akin to replicating a single study on different populations. This also allowed the current study to explore how risk/protective factors work differently or consistently in different populations.

It is important to understand that the CAN sample is at risk of only recurring reports as all children in the sample have already experienced onset of reporting at the time of sampling—more precisely only those who had already been reported were selected in the sample. On the other hand, the AFDC sample is at risk of the onset of reporting near the baseline during follow-up. Later, some of them may encounter risk of recurrence as they would experience reported maltreatment during follow-up. Methodologically, the current study controlled for the number of prior reports from birth to one year prior to the current age to understand the current stage of report at the current age (i.e., onset of reporting, onset of re-reporting, or subsequent re-reporting).

CAN sample (*children aged 3 or under with a maltreatment report)*. Drawing upon the full Missouri statewide CPS records, the parent study selected all children who were (1) born from 1982 through 1994, (2) with a first-time screened-in report for alleged neglect, physical abuse, or sexual abuse during the sampling period in 1993-1994, (3) not dead before +7 days from the first report and (3) residing in St. Louis City or County at the time of sampling. When two or more children were in a family, the parent study randomly selected one child per family. This made the child level equivalent to the family level in the current study. Among these originally selected children, the current study selected those born in 1991-1994 (i.e., aged 3 or under at the time of sampling). This was to fully capture children's cumulative history of important risk/protective factors (e.g., welfare receipt) since their birth, given the data coverage back to 1991 for those factors. These children were included in the CAN sample.

AFDC sample (*children aged 3 or under receiving AFDC with no known maltreatment report*). From full Missouri statewide AFDC records, the parent study selected all families who (1) had an active AFDC case during the sampling period in 1993-1994 but (2) had no maltreatment report at the time of sampling. The parent study randomly selected one child per family. Then, the parent study randomly selected a subset of these children while matching to the *CAN sample* children who were receiving AFDC at the time of sample. They were matched on age and residential region (St. Louis City/County). The CAN sample children with no AFDC receipt at the time of sampling were not used for this match. For the same reason as above, the current study selected those born in 1991-1994 and included them in the AFDC sample.

It is important to note that the current study does not intend to use the AFDC sample as a quasi-experimental comparison group of the CAN sample or vice and versa. The current study examines its research questions twice in two separate samples representing two different populations, which is similar to, as abovementioned, replicating a single study on different populations.

4.1.1 Samples for Aim 1

Aim 1: To examine longitudinal patterns of child maltreatment reports with child age from 1 to 17 years while considering various risk and protective factors.

For Aim 1, the current study used the full CAN and AFDC samples. The current study followed up children after the sampling period (i.e., from 1995). Children were therefore followed up *from*: (1) age 4 for those born in 1991; (2) age 3 for those born in 1992; (3) age 2 for those born in 1993; and (4) age 1 for those born in 1994.

Then, the current study followed up children to age 17 or to the end of the data coverage (i.e., March 2009). That is, children were followed up *to*: (1) age 17 for those born from January 1991 to March 1991; (2) age 16 for those born from April 1991 to March 1992; (3) age 15 for those born from April 1992 to March 1993; (4) age 14 for those born from April 1993 to March 1994; and (5) age 13 for those born from April 1994 to December 1994.

The initial sample sizes were 32,348 (age-year) observations for the CAN sample and 25,596 observations for the AFDC sample. For the data integrity, the current study stopped following up after the subject child's: (1) death (0.66% of CAN-sample and 0.41% of AFDC-sample observations), (2) out-of-home placement (21.25% of CAN-sample and 3.7% of AFDC-sample observations), and (3) childbirth (0.009% of CAN-sample and 0.004% of AFDC-sample observations). The final sample sizes were 25,258 observations of 2,111 children nested in 235 baseline neighborhoods (i.e., tracts) for the CAN sample and 24,552 observations of 1,923 children nested in 210 baseline neighborhoods.

The innate limitation of the administrative datasets used by the current study was that the subjects' residential addresses could be traced only for those visible to Missouri's AFDC/TANF system or child welfare system. The use of information about changes in residential neighborhoods, therefore, could lead to a very serious selection bias because families without CPS or AFDC/TANF involvement became "invisible" in the address data. To prevent this selection bias while maximizing statistical power for Aim 1, the current study limited the measures of neighborhood characteristics to the baseline for this aim. The data for Aim 1, therefore, had limited information regarding the longitudinal patterns of neighborhood context, whereas the data provided ample information about the longitudinal patterns of child maltreatment reports and relevant risk/protective factors.

4.1.2 Samples for Aim 2

Aim 2: To examine neighborhood contextual effects on child maltreatment reports.

Aim 2 was intended to provide data to help the current study conduct more rigorous tests of "current" neighborhood contextual effects by considering changes of residential neighborhoods over time. For this purpose, the current study used a subset of the above CAN and AFDC samples to reduce concerns about the above selection bias in tracing changes of residential addresses. The current study selected all "age-year observations" with an active AFDC/TANF case during the follow-up period. After this selection, the address update was free from the selection bias as all children were having an active AFDC/TANF case at any given (selected) age and their residential neighborhoods at any given age were updated based on these AFDC/TANF case records.

By selecting age-year observations on welfare (AFDC/TANF), current family SES was fixed at a low level. Although generalizability was limited to age-year observations on welfare, this allowed the current study to examine the relationship between “current” neighborhood contexts and maltreatment reports while controlling for changes of current welfare receipt. A child might leave welfare at a certain age and never return to welfare after that age. Age-year observations of this child beyond that point were excluded and not considered for analyses. Some children might occasionally receive welfare during follow-up, while other children might be continuously on welfare over time. By selecting age-year observations on welfare, both groups of children would have a low level of current family SES at a given age. The difference in cumulative history of welfare receipt by a given age between these groups of children was considered in estimating the likelihood of maltreatment reporting at a given age.

After selecting age-year observations with an active AFDC/TANF case, there were 8,814 observations for the CAN sample and 7,393 observations for the AFDC sample. Some observations were excluded for data integrity. First, the current study excluded observations after a change of the subject child’s AFDC/TANF payee (10.62% of observations for the CAN sample and 6.97% for the AFDC sample). A child’s payee can be changed without a change of the child’s caregiver if the caregiver becomes ineligible to be a payee (e.g., failing a drug test). When this is the case, the child’s residential address would be updated to the payee’s address in AFDC/TANF records. Unfortunately, it was unclear in the study data whether a change of a payee indicated a change of a caregiver. Second, observations with last known residential areas out of Missouri were excluded (0.01% for the CAN sample and 0.06% for the AFDC sample). Finally, observations with an unknown residential neighborhood due to missing address information were excluded (1.09% for the CAN sample and none for the AFDC sample). The final sample sizes were 7,881 observations in 1,530 children and 385 neighborhoods for the CAN sample and 6,907 observations in 1,436 children and 328 neighborhoods for the AFDC sample. Addresses were geocoded in the parent study and a census tract number provided for linkage to census information.

4.2 Data Structure

The current study constructed longitudinal data with a three-level structure: the observation level (level 1), the child level (level 2), and the neighborhood level (level 3). In the data for Aim 1, levels were nested in a sequence. Age-year observations were nested in children and then children were nested in baseline neighborhoods. On the other hand, the data for Aim 2 had a cross-classified structure. A child's residential neighborhood was traced and subject to change over time in the data for Aim 2. Accordingly, observations of a child could be nested in multiple neighborhoods upon changes of the child's residential neighborhoods. The child and neighborhood levels were crossed rather than nested to one another in the data for Aim 2.

4.3 Variables and Data Sources

The parent study used a combination of common identifiers across certain systems (e.g., AFDC and child maltreatment) and matching using personal identifiers for others. All personal identifiers were removed prior to the present study once data linkage ended. The parent study included data from 16 different agencies as well as the linkage to census information. Some of these agencies limit eligibility for services by income (e.g., data from MoHealth, Medicaid) and were not included in the present study due to the inclusion of CAN cases that were not also receiving AFDC at baseline.

This section describes how variables were measured and which administrative data sources were used for measurement. Based on known risk and protective factors for child maltreatment in prior studies, the current study examined various predictor variables regarding their associations with the outcome variable (i.e., maltreatment reporting). The current study established temporal precedence between predictor and outcome variables because of the presence of dates of service system contacts in the data. It should be noted, however, that because these are data from services the date may or may not reflect the actual onset of a given problem. Table 1 lists the variables used for analyses.

It was worth noting that most administrative records were statewide. Families moving out of St. Louis but within Missouri, therefore, were still traced in these records. Unfortunately, for Missouri regions other than St. Louis, records for special education and juvenile court were less comprehensive. For families moving out of Missouri, no records exist. This is of lessor concern in the present study, however, because more disadvantaged families tend to make shorter distance moves although they make more moves (Coulton, Theodos, & Turner, 2012). In the current study's data for Aim 2 which traced residential neighborhoods, 92.9% of the CAN sample and 94.6% of the AFDC sample remained in St. Louis during the study period.

4.3.1 Outcome Variables: Child Maltreatment Report

The current study's outcome of interest was official child maltreatment reports. Reported but screened out children were not included in the state system and thus were not included in the current study's data. While excluding screened-out reports, the current study purposively included unsubstantiated reports as previously discussed (see Chapter 1). The current study used a binary measure of a maltreatment report, coded 1 when having a report at an age and 0 otherwise. The data source for first reports or recurrent reports was the Missouri Children's Division reporting information (1995-2009).

Table 1 Variable Description and Data Source.

Variables	Description	Data source
Level-1		
Outcome: CM report[1,2]	1=having a child maltreatment (CM) report; 0=no	CPS record
Child age[1,2]	Current child age (1 to 17; 1 unit=1 year)	Birth record
Current welfare[1]	1=on AFDC/TANF at current age; 0=no	Welfare record
Prior welfare[1,2]	% months on AFDC/TANF by prior age (1 unit=100%)	Welfare record
TANF time limit[1]	1=reaching TANF lifetime limit; 0=no	Welfare record
TANF no limit[1,2]	1=receiving TANF after 60-month limit; 0=no	Welfare record
Prior CPS report[1,2]	Number of prior CM reports	CPS record
FCS only[1,2]	1=prior CPS Family Centered Services only; 0=no	CPS record
IIS with or without FCS[1,2]	1=prior CPS Intensive In-home Services;0=no	CPS record
Child current injury[1,2]	1=emergency room (ER) injury record at current age; 0=no	ER record
Child prior injury[1,2]	1=ER injury record before current age; 0=no	ER record
Child current mental health[1]	1=ER mental health (MH) record at current age; 0=no	ER record
Child prior mental health[1]	1=ER MH record before current age; 0=no	ER record
Child mental health[2]	1=ER MH record, 0=no	ER record
Child mental delay[1]	1=ER mental delay record; 0=no	ER record
Child chronic health problem[1]	1=ER chronic/serious health problem record; 0=no	ER record
Child chronic medical issue[2]	1=ER record of mental delay or chronic/serious health; 0=no	ER record
Child current delinquency[1]	1=juvenile court (JC)/arrest record at current age; 0=no	JC/Arrest
Child prior delinquency[1]	1=JC/arrest record before current age; 0=no	JC/Arrest
Child delinquency[2]	1=JC/arrest record; 0=no	JC/Arrest
Child special education[1,2]	1=special education (SE) record; 0=no	SE record
Parent current conviction[1]	1=conviction record at current age; 0=no	Conviction record
Parent prior conviction[1]	1=conviction record before current age; 0=no	Conviction record
Parent conviction[2]	1=conviction record; 0=no	Conviction record
Parent current arrest[1]	1=arrest record at current age; 0=no	Arrest record
Parent prior arrest[1]	1=arrest record before current age; 0=no	Arrest record
Parent arrest[2]	1=arrest record; 0=no	Arrest record
Residential Moves[2]	# of residential moves at current age	Welfare record
Level-2		
Child race[1,2]	White, Black, Other	Birth record
Child birth weight[1,2]	Normal (≥2.5kg), low (<2.5kg, ≥1.5kg), very low (<1.5kg)	Birth record
Birth year[1,2]	1991-1994	Birth record
Child sex[1,2]	1=female, 0=male	Birth record
Medicaid at birth[1,2]	1=on Medicaid at subject child's birth; 0=no	Birth record
Mom no high school[1,2]	1=mom's no high school degree at subject child's birth; 0=no	Birth/CPS/Welfare
Mom teen birth[1,2]	1=mom was teen (< age 20) at subject child's birth; 0=no	Birth/CPS/Welfare
Caregiver foster care[1,2]	1=mom was placed in foster care during her youth; 0=no	CPS record
Baseline no AFDC[1,2]	1=no AFDC at baseline (for CAN sample); 0=no	Welfare record
Level-3		
Impoverishment[1,2]	Higher score=higher impoverishment	Census
Instability[1,2]	Higher score=higher instability	Census
Care burden[1,2]	Higher score=higher child care burden	Census
Poverty rate[1,2]	% persons whose income below poverty level	Census
Mobility rate[1,2]	% households that moved within last 5 years	Census
Child/adult ratio[1,2]	(# of children aged 0 to 13)/(# of adults aged 21+)	Census
Out of St. Louis[2]	1=residing out of St. Louis City/County, 0=no	Welfare record

[1] Variables for Aim-1 analyses. [2] Variables for Aim-2 analyses.

4.3.2 Level-1 Time-Varying Predictors

The values of the level-1 predictors were subject to change over time. Most of these predictors were used for both Aim-1 and Aim-2 analyses unless otherwise stated.

Child Age

The time variable of the current study was child age in years. This variable was measured as a continuous variable, ranging from 1 to 17 in the samples for Aim 1 and from 1 to 16 in the samples for Aim 2.

Welfare Receipt

Welfare receipt was measured by the receipt status of Aid to Families with Dependent Children (AFDC) before 1997 or Temporary Assistance for Needy Families (TANF) from 1997 on. Both AFDC and TANF income eligibility thresholds for a three-person family were $558 (53% of the poverty threshold in 1996) for applicants and short-term recipients and $382 (37% of the poverty threshold in 1996) for long-term recipients (U.S. Department of Health and Human Services, 1998; Urban Institute, n.d.). The asset limits were $1,000 for AFDC, $1,000 for TANF applicants, and $5,000 for TANF recipients (Missouri Secretary of State, 2017; Urban Institute, n.d.). The maximum monthly benefit for a three-person family was $292 for both AFDC and TANF (U.S. Department of Health and Human Services, 1998; Urban Institute, n.d.).

In AFDC and TANF records, the current study traced child cases rather than caregiver cases to reduce possible measurement errors. A caregiver case can be closed for non-economic reasons (e.g., failing drug testing requirements). When this happens, a protective payee is designated to help a child case remain open (Missouri Department of Social Services, 2015). Compared to caregiver cases, child cases would be therefore less vulnerable to possible errors in measuring SES. The data source was Missouri Department of Social Services income maintenance receipt records (1991-2009).

Current welfare. This variable was a binary measure of the receipt status of welfare (AFDC or TANF) at the current age. This variable was coded “1” when receiving welfare at the current age and “0” otherwise. This variable was not used for Aim 2 because all age-year observations were receiving welfare currently.

Prior welfare. This variable was a continuous measure of the percentage of months receiving welfare from the subject child’s birth prior to the current age.

TANF lifetime limit. This variable was a binary measure, coded “1” for age-year observations after reaching the TANF lifetime limit (i.e., 60 months) and “0” otherwise. As the Missouri TANF program has been started since July 1997 (Mosley & Stokes, 2004), some households reached this lifetime limit during the stud period. This variable was used to control for age-year observations which might have no welfare receipt due to the lifetime limit. This variable was not applicable to Aim-2 analyses as all age-year observations were receiving welfare currently.

TANF no limit. Some children continued receiving TANF beyond the 60-month lifetime limit. This variable was coded “1” for those age-year observations and “0” otherwise. This can happen for two different reasons. First, a child’s caregiver can be exempted from the lifetime limit if the caregiver is “under age 18 attending school, age 60 or over, is disabled or is needed in the home to care for a disabled family member” (Missouri Department of Social Services, 2015, p. 2). Second, a child may continue receiving TANF over 60 months if a child moves into another household whose householder has not yet reached the lifetime limit. This is because the lifetime limit of the Missouri TANF program is applied to a household, but not to a child (U.S. Department of Health and Human Services, 1998). In either case, the risk of maltreatment reporting for those receiving TANF beyond the lifetime limit may be different from that for others.

Prior CPS Involvement

Three level-1 predictors captured prior CPS involvement while differentiating the nature of involvement. The data source was Missouri child welfare system (1991-2009). It is important to note that having a prior CPS involvement is only relevant to future risk of re-reporting as only children beyond the stage of onset of reporting can have prior CPS involvement.

Prior CPS report. This variable measured the number of prior child maltreatment reports, indicating the cumulative history of prior exposure to reported maltreatment. For both Aim 1 and Aim 2, the number of prior maltreatment reports at the current age was ranged from 1 to 9 for the CAN sample and from 0 to 6 for the AFDC sample. This variable was categorized into "1" (reference group), "2", "3", and "4 or more" for the CAN sample and "0" (reference group), "1", "2", "3 or more" for the AFDC sample as a few children had more than three or four prior reports at an age in the AFDC and CAN samples respectively.

CPS often offers in-home preventive services to intact families after investigating (or assessing) maltreatment reports. Broadly, there are two sorts of services for intact families. More common services are Family Centered Services (FCS), which are less intensive case management services provided over a longer-term period (3 months or longer). Less common but more intensive services are Intensive In-home Services (IIS), which are offered to families in crisis to prevent foster care placement of their children and are usually provided in a short period (within 4 to 6 weeks). The current study measured these services separately as prior studies suggested that FCS generally acted as a protective factor, while IIS sometimes acted as a risk indicator in analyses.

Family Centered Services (FCS) only. FCS are usually provided without IIS, while IIS typically take place with FCS. For this reason, this variable measured prior participation of FCS only, coded "1" for having FCS only and "0" otherwise.

Intensive In-home Services (IIS) with or without FCS. This variable was coded "1" for any prior participation in IIS with or without FCS and "0" otherwise.

Child's Medical and Mental Health Problems

Child's medical and mental health problems were captured by six predictors based on Missouri emergency room (ER) records (1997-2009). It is worth noting that the problems captured in ER records may be relatively only those that require urgent medical attention. On the other hand, in many cases low income families may use emergency rooms for a source of regular medical care (Halfon, Newacheck, Wood, & St Peter, 1996; Orr, Charney, Straus, & Bloom, 1991). Table 2 exhibits the specific ER diagnoses and corresponding ICD-9 codes.

Child current injury. This variable measured any current ER visit for injury, coded "1" for having an ER visit with an injury diagnosis at the current age and "0" otherwise.

Child prior injury. This variable measured any prior ER visit for injury. This variable was coded "1" for having any ER injury diagnosis prior to the current age and "0" otherwise.

Child current mental health. This variable measured any current ER visit for mental health, coded "1" for any ER visit with a mental health diagnosis at the current age and "0" otherwise.

Table 2 Emergency Room Diagnoses and ICD-9 Codes.

Emergency Room Diagnosis	ICD-9 Code
Child Injury	
Poisoning (drug/alcohol)	969, 980, 965.0
Child abuse/neglect	783.41, 995.5, V200
Poisoning (not drug/alcohol)	960-968, 970-979, 981-989
Burns	940-949
Fractures (not skull/brain), Dislocation	805-829, 830-839
Skull/brain injuries	800-804, 850-854
Open wounds, blood vessel injuries, late effect of injuries, cellulitis, abscess	870-909, 682
Sprain	840-848
Internal injury	860-869
Crush, contusion	920-929
Superficial injuries	910-919
Exposure (heat or cold)	991-992, 994.4
Hunger/thirst	994.2, 994.3
Suffocation/drown	994.1, 994.7
Accidental injuries	E810-E829, E880-E888, E900-E919
Child Mental Health	
Mental health general	V40, V79, 648.4
Psychoses	294-298, 296.0-296.1, 296.4-296.9, 299.9
Anxiety/personality	300-302
Conduct, attention deficit, other MH specific to child/adolescent	312, 313, 314.0, 314.2
Depression	296.2, 296.3, 311
Other mental health	293, 306-310, 316
Child Mental Delay	
Developmental delay/disorder, Mental retardation	299.1, 299.8, 314.1, 315, 317-319
Autism	299.0
Child Chronic/Serious Health Problem	
Paralysis, epilepsy, recurrent seizures, spina bifida, nervous system/heart/circulatory system/hemolytic anomalies, Cystic fibrosis	344-345, 741-742, 745-747, 282, 277.0

Child prior mental health. This variable measured any prior ER visit for mental health, coded “1” for any ER diagnosis for mental health prior to the current age and “0” otherwise.

Child mental delay. This variable was a binary measure of ever having any ER visit for mental delay. This variable was coded “1” for any ER diagnosis for mental delay at or prior to the current age and “0” otherwise.

Child chronic health problem. This variable was a binary measure of ever having any ER visit for chronic or serious health problems. This variable was coded “1” for any ER diagnosis for such problems at or prior to the current age and “0” otherwise.

For Aim 2, some of these variables were combined—i.e., *child current mental health* and *child prior mental health* in *child mental health* ever, and *child mental delay* and *child chronic health problem* in *child chronic medical issue*. This was because the “yes” category (i.e., coded “1”) of these variables were almost empty in the samples for Aim 2 due to the smaller sample sizes.

Child’s Behavioral Problems

Child’s behavioral problems were captured by two predictors based on delinquency records. The data sources were Missouri juvenile court records (1993-2009), Missouri Division of Youth Services records (1992-2010), and Missouri highway patrol records (1988-2009).

Child current delinquency. This variable was a binary measure of a current delinquency problem, coded “1” for having a delinquency record at the current age and “0” otherwise.

Child prior delinquency. This variable was a binary measure of any prior delinquency problem, coded “1” for having a delinquency record prior to the current age and “0” otherwise.

For Aim 2, these variables were merged into *child delinquency* ever to avoid the empty cell issue which was mentioned above.

Child’s Educational Needs

Child’s Special Education. This variable was used as a proxy for child’s educational needs. This variable was measured at a binary scale, coded “1” for ever having an eligibility record for special education services and “0” otherwise. The data source was St Louis City Schools and St Louis Special School District special education eligibility records (1991-2006).

It is important to note that children rarely had delinquency records at younger ages (under age 9). Also, prior to preschool (under age 3), almost no child had a special education record. Since child age was controlled for, absence of these records at younger ages little influenced estimates of the relationships between these variables and maltreatment reports at older ages. These variables, however, could not catch behavioral issues and educational needs at younger ages.

Parent’s Criminal Issues

The current study used four predictors to capture parent’s criminal issues. The data sources were Missouri correction records (1975-2007) and Missouri highway patrol records (1963-2008).

Parent current conviction. This variable measured a parent’s current involvement of the criminal justice system due to a conviction, coded “1” for having any active probation, parole, or incarceration at the subject child’s current age and “0” otherwise. A small proportion of the current convictions resulted in incarceration, while about 90% received probation or parole. This suggested that most parents with a current conviction were still able to be with their children.

Parent prior conviction. This variable measured a parent’s prior involvement of criminal justice system due to a conviction, coded “1” for having any prior history of probation, parole, or incarceration which ended prior to the subject child’s current age and “0” otherwise.

Parent current arrest. This variable measured a parent’s current arrest, coded “1” for having any arrest record at the subject child’s current age and “0” otherwise.

Parent prior arrest. This variable measured a parent's prior arrest, coded "1" for having any arrest record prior to the subject child's current age and "0" otherwise.

Family's Residential Moves

Residential Moves. This variable captured the number of family's residential moves at the current age based on AFDC/TANF records. This variable was used only for Aim 2. At an age, children made 0 to 4 residential moves for the CAN sample and 0 to 3 moves for the AFDC sample. Since a few children made more than 2 moves, this variable was categorized as "0" (reference group), "1", and "2 or more".

4.3.3 Level-2 Child/Family-Level Predictors

In the current study, the child level was equivalent to the family level as one child was randomly selected per family. Unlike the time-varying predictors, the level-2 predictors measure static characteristics of children or families at or prior to the baseline.

Child race. This variable indicated the subject child's race: "White" (reference group), "Black", and "Other".

Child sex. This variable measured the subject child's sex, coded "1" for female and "0" for male.

Birth year. To control for any birth cohort effect, the current study measured the subject child's birth year at a categorical scale: "1991" (reference group), "1992", "1993", and "1994". The data sources of *child race, child sex,* and *birth year* were Missouri birth records (1991-1994), Missouri child welfare system (1991-1994), and Missouri income maintenance system (1991-1994).

Child birth weight. This variable measured the subject child's birthweight. This variable was categorized based on the clinical thresholds: "normal" for the birthweight $\geq$ 2.5kg (reference group), "low" for the birthweight $<$ 2.5kg and $\geq$ 1.5kg, and "very low" for the birthweight $<$ 1.5kg.

Medicaid at birth. This variable was a binary measure, coded "1" for receiving Medicaid at the subject child's birth and "0" otherwise. This variable was used to capture the family SES at the subject child's birth.

Mom teen birth. This variable was a binary measure of maternal age at the subject child's birth, coded "1" when a mother was a teenager (< age 20) at that moment and "0" otherwise. The data source of *child birth weight*, *Medicaid at birth*, and *mom teen birth* was Missouri birth records (1991-1994).

Mom no high school. This variable measured maternal education level at the subject child's birth, coded "1" for those with an education level below high school graduation or equivalent and "0" otherwise.

Caregiver foster care. This variable measured a mother's history of foster care placement as a minor during adolescence, coded "1" for having a placement and "0" otherwise.

Baseline no AFDC. This variable was applicable only to the CAN sample for both Aim 1 and Aim 2. This variable was a binary measure, coded "1" for children who had no AFDC record before their index report (i.e., the first-time ever report to be selected in the CAN sample) and "0" otherwise. The underlying idea was that children who started their lives with a maltreatment report but without welfare (AFDC) might be fundamentally different from those starting with experiencing both reported maltreatment and welfare, as suggested by Jonson-Reid et al. (2009).

4.3.4 Level-3 Neighborhood-Level Predictors

Sampson, Morenoff, and Gannon-Rowley (2002) defined neighborhoods as (1) natural areas developed through free-market competition or through imposed boundaries by outsiders, (2) collections of both individuals and institutions in spatially defined areas, and (3) "ecological units nested within successively larger communities" (p. 445). Yet, practically, neighborhoods are often operationalized to administratively defined areas such as zip codes, census tracts, and block groups (Aron et al., 2010; Lery, 2009; Sampson et al., 2002). The main concern with the administratively defined areas is that they are imperfect proxies for true neighborhood areas.

An alternative is resident-defined neighborhoods (Coulton, Korbin, Chan, & Su, 2001). The application of this alternative, however, may be a very challenging task because the defined neighborhood boundaries can be quite different among residents (Coulton et al., 2001). A more practical question is which one is more proper among administratively defined areas (e.g., counties, zip codes, tracts, and block groups).

A methodologically defensible choice of areal unit requires consideration of the modifiable areal unit problem (MAUP). MAUP refers to the trade-off relation between reliability and validity depending on the size of areal units (Nakaya, 2000). A smaller size would guarantee homogeneity among residents and therefore produce more valid neighborhood-level measures which can adequately represent contextual experiences of most residents (Aron et al., 2010). On the other hand, a larger size would assure reliability of neighborhood-level measures by providing, for example, stable counts of residents exposed to a certain condition (e.g., poverty)

(Aron et al., 2010). This is especially problematic when very rare events (e.g., child fatalities) are studied.

Some child welfare studies examined findings based on different sizes of areal units. Lery (2009) compared the associations of the key neighborhood variables (i.e., residential instability, impoverishment, and child care burdens) with the foster care entry while differing the level of aggregation (i.e., zip codes, tracts, and block groups). The study found that all three levels of aggregation produced very similar associations. Aron et al. (2010) investigated the correlations between poverty and child maltreatment report among four different levels of aggregation (i.e., counties, zip codes, tracts, and block groups). The study found that counties are too large to have homogeneous residents within a county, which may damage validity of neighborhood-level measures. The study also found that block groups are too small to produce reliable counts of child maltreatment incidents. Aron et al. (2010) suggest that census tracts are a safe choice and zip codes are also a desirable choice with a use of proper weighting or deletion of small population zip codes.

The existing empirical consensus supports the use of census tracts. Among ecological studies of child maltreatment in two current comprehensive review works (Coulton et al., 2007; Freisthler et al., 2006), the vast majority used census tracts as neighborhood units. In keeping with this trend, the current study operationalized neighborhoods as census tracts.

Neighborhood Factors

Prior multilevel studies of child maltreatment used neighborhood factors to examine contextual effects (Coulton et al., 1999; Freisthler & Maguire-Jack, 2015; Irwin, 2009; Kim, 2004; Merritt, 2009; Molnar et al., 2003). These studies measured and defined neighborhood factors in slightly different manners as they were conducted at different sites and times. The current study used principal components analyses with varimax rotation to explore various variables measuring neighborhood factors. Eleven neighborhood variables (Table 3) were considered based on a prior study (Irwin, 2009) which had an outcome variable (i.e., official maltreatment reports) similar to that of the current study.

For Aim 1, the measures of neighborhood characteristics were limited to residential tracts at the baseline. Since all sampled children were residing in St. Louis City or County at the baseline, all tracts in St. Louis City and County were used for principal components analyses (PCA) to measure the baseline neighborhood factors for Aim 1. The Census 1990 data were used for analyses.

For Aim 2, the current study traced changes of residential neighborhoods after the baseline. The neighborhood measures for this aim were therefore based on residential tracts at the current age. A number of sampled children were moving out of St. Louis and into other areas in Missouri during the study period (1995-2008). Those moving out of Missouri were excluded from analyses for Aim 2. All Missouri tracts from 1995 to 2008 were therefore used for PCA to measure neighborhood factors for Aim 2. For this, the current study used four available census data sets: Census 1990 (representing data in 1989), Census 2000 (representing data in 1999), American Community Survey (ACS) 2005-2009 (representing data in 2007), and ACS 2006-2010 (representing data in 2008). Since tract boundaries were different between data sets, tract boundaries of all data sets were re-delineated to Census 2000 boundaries by using census tract relationship files (U.S. Census Bureau, n.d.-b). Unavailable tract-year data (i.e., 1995-1998 and 2000-2006) were linearly interpolated based on these available census data sets. Table 3 reports the descriptive statistics of the neighborhood variables used for principal components analyses.

Table 3 Descriptive Statistics of Neighborhood Variables Constructing Neighborhood Factors.

	Aim 1 (N = 269)		Aim 2 (N = 18,480)	
Measures	Mean	SD	Mean	SD
% female-headed households $= \frac{\text{\# of female headed households with children}}{\text{\# of households with children}} \times 100$	28.39	24.63	24.05	18.48
% persons in poverty $= \frac{\text{\# of persons with income below poverty line}}{\text{\# of persons}} \times 100$	14.75	15.39	14.67	11.22
% unemployed persons $= \frac{\text{\# of unemployed persons aged 16+years in labor force}}{\text{civilian population aged 16+years in labor force}} \times 100$	8.05	7.19	7.00	5.88
% vacant housing units $= \frac{\text{\# of vacant housing units}}{\text{\# of housing units}} \times 100$	9.78	7.94	11.37	9.13
% Blacks $= \frac{\text{\# of Blacks}}{\text{\# of persons}} \times 100$	29.83	36.31	14.02	26.00
% moved in the last one year $= \frac{\text{\# of householders moved in the last year}}{\text{\# of occupied housing units}} \times 100$	18.26	8.36	19.26	9.58
% moved in the last five years $= \frac{\text{\# of householders moved in the last 5 years}}{\text{\# of occupied housing units}} \times 100$	44.39	13.03	41.58	13.99
% moved in the last ten years $= \frac{\text{\# of householders moved in the last 10 years}}{\text{\# of occupied housing units}} \times 100$	57.87	13.95	61.66	12.47
child/adult ratio $= \frac{\text{\# of children aged 0 to 13 years}}{\text{\# of adults aged 21+years}}$	0.27	0.11	0.28	0.09
% elders $= \frac{\text{\# of persons aged 65+years}}{\text{\# of persons}} \times 100$	15.11	6.61	13.81	5.81
male/female ratio $= \frac{\text{\# of adult male aged 21 to 64}}{\text{\# of adult female aged 21 to 64}}$	0.92	0.27	-	-

All 269 tracts in St. Louis City and County (1990 Census boundaries) were used for Aim 1. All 1,320 tracts in Missouri (2000 Census boundaries) from 1995 to 2008 (N=1,320×14 years=18,480 tact-years) were used for Aim 2.

Table 4 Results of Principal Components Analyses.

	Factor loading					
	Aim 1			Aim 2		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Factor 1: Impoverishment						
% female-headed household	**.9493**	.0859	.1030	**.8487**	.1267	.1452
% persons in poverty	**.9467**	.1608	.0790	**.8173**	.2712	-.0326
% unemployed persons	**.9258**	-.0341	.1708	**.8327**	.0161	.0857
% vacant housing units	**.8352**	.3999	.0208	**.6083**	.0334	-.4044
% Blacks	**.8688**	-.1349	.1843	**.8221**	-.0514	.2277
Factor 2: Instability						
% moved in the last one year	.1029	**.9170**	.0169	.1942	**.8970**	-.0577
% moved in the last five years	.0037	**.9722**	.0407	.0654	**.9350**	.0718
% moved in the last ten years	.1330	**.9355**	.0324	.0161	**.9112**	.1376
Factor 3: Care burden						
Child/adult ratio	.5470	-.0221	**.6813**	.2427	-.1234	**.7939**
% elders	.0562	-.2217	**-.8435**	.0294	-.3432	**-.7391**
Male/female ratio	-.2525	.2656	**-.3841**	-	-	-

Since the "male/female ratio" variable did not load well on any factor in Aim 2 (using all Missouri tracts for the PCA), analyses were conducted with the remaining 10 variables for this aim. For Aim 1 (using all St. Louis tracts for the PCA), all 11 neighborhood variables were used. Analyses revealed the following three neighborhood factors for both Aim 1 and 2 (Table 4):

- Impoverishment: A higher score indicated a higher level of impoverishment.
- Instability: A higher score indicated a higher level of instability.
- Care burden: A higher score indicated a higher level of child care burden.

These factors were used as level-3 (i.e., neighborhood-level) predictor variables in analyses.

Neighborhood Variables

According to measurement theory, a neighborhood *factor* based on multiple indicators may be better than a single neighborhood *variable* to measure a latent construct (DeVellis, 2003). A neighborhood variable, however, can be more practical than a neighborhood factor because the meaning of a variable (e.g., poverty rate) is more straightforward than of a factor (e.g., impoverishment). It also confers the advantage of comparability of the current study's work more readily to other works which use the more common and simple neighborhood measures. For this reason, the current study built separate models using neighborhood variables instead of neighborhood factors and presented these separate models as alternative models in comparison with models using neighborhood factors. The following three neighborhood variables were considered in alternative models:

- Poverty rate: % persons whose income below the federal poverty level.
- Mobility rate: % households moved in the last 5 years.
- Child/adult ratio: ratio of child (aged 0 to 13 years) to adult (aged 21+ years).

Moving Out of St. Louis

While all children were residing in St. Louis at baseline, some moved out of St. Louis during follow-up. This variable was considered to indicate a long-distance mobility which might be more likely to disconnect families from their social supports and networks in their prior residential neighborhoods in St. Louis. This variable was used only for Aim 2, coded “1” for moving out of St. Louis and “0” otherwise.

4.3.5 Grand-Mean Centering

Continuous variables (i.e., child age, prior welfare, impoverishment, instability, care burden, poverty rate, mobility rate, and child/adult ratio) were centered to their mean. This was to avoid multicollinearity issues while exploring interaction effects. The current study used grand-mean centering (i.e., centered to the entire sample’s mean) rather than group-mean centering (e.g., centered to each neighborhood’s mean) because group-mean centering was not adequate to estimate unique neighborhood contextual effects while controlling for lower-level predictors (Enders & Tofighi, 2007). The grand mean values of these variables are reported in Table 5.

4.4 Analysis

The current study used multilevel logistic growth curve models to estimate the likelihood of having a child maltreatment report at each age (in years) as a function of various risk/protective factors. The “lme4” package (version 1.1-15) in R (version 3.4.4) was used for the analyses (Bates, Mächler, Bolker, & Walker, 2015).

4.4.1 Multilevel Logistic Growth Curve Models

The current study’s models had three components, “multilevel”, “logistic”, and “growth curve”. In analyses, these components were considered altogether.

Multilevel Modeling

A multilevel design was adopted for both theoretical and statistical reasons. The theoretical reason was to test level-1 time-varying predictors, level-2 family/child-level predictors, and level-3 neighborhood-level predictors in a single model as the study hypotheses suggested. The statistical reason stemmed from the nested data structure. In the current study's data, age-year observations were nested in children and neighborhoods. This nested data structure would make observations not independent from a child to whom the observations belong. Children would be also not independent from a neighborhood where they were residing. The independent observations assumption of a traditional logistic regression model could be violated in this nested data structure. Applying a traditional model, therefore, might lead to severe type I errors. Multilevel modeling can appropriately handle these issues and estimate standard errors more conservatively (Luke, 2004).

As discussed above, the Aim-1 data and the Aim-2 data had different multilevel structures, which required different types of models. Three-level models were used for the Aim-1 data with a three-level structure, in which lower levels were nested in higher levels in a sequence. Cross-classified models were used for the Aim-2 data with a cross-classified structure, where the child level and the neighborhood level were crossed as children moved into new neighborhoods overtime. Fortunately, both types of models were under the hood of mixed-effects models, and the "lme4" package used exactly same computational methods for both types (Bates, 2010).

Logistic Modeling

The outcome variable of the current study was a binary measure of having a maltreatment report at an age (Y = 1, when having a report; otherwise, Y = 0). If a *general* linear model is applied, the model would estimate an expected value of Y (i.e., E(Y) or *p* which stands for a probability of having a report at an age). As Luke (2004) points out, however, applying a general linear model for a binary outcome has two potential limitations. First, the predicted probabilities can be outside of the theoretical range of 0 to 1. Second, the normality and homoscedasticity assumptions of a general linear model are often violated. A *generalized* linear model handles these issues by transforming a binary outcome, precisely by transforming E(Y) (= *p*). As the current study's outcome was a Bernoulli trial (i.e., yes/no experiment likewise flipping a coin), the expected proportion of yes's (i.e., having a report at an age) among a given number of age-year observations (i.e., sample size) followed a binomial distribution. A binomial model's typical transformation is the logit function which is also known as the log of odds: logit(p) = $\ln\left(\frac{p}{1-p}\right)$. Without a multilevel design, this type of generalized linear model is well known as a *logistic* regression. In generalized multilevel modeling, such a transformation is referred to a *link function* (Luke, 2004). The link function for a multilevel logistic regression (i.e., for a binary outcome) is:

$$\eta_{ijk} = \mathrm{logit}(p_{ijk})$$

Where p_{ijk} is the probability of having a maltreatment report for child_j in $\mathrm{neighborhood}_k$ at age_i.

Growth Curve Modeling

Growth curve modeling was used because the current study was interested in modeling longitudinal patterns of child maltreatment reporting. That is, the current study modeled changes of the likelihood of maltreatment reporting over time (i.e., child age).

4.4.2 Modeling Building Process

The current study's model-building process involved making decisions about parsimony versus model fit. A more complex model (i.e., a model with more parameters) always shows a better model fit than a simpler model (i.e., a model with fewer parameters). From a conceptual and methodological perspective, however, parsimonious models are preferred if there is no meaningful improvement in model fit by adopting a more complex model. The current study followed the model-building approach suggested by Raudenbush and Bryk (2002) and Snijders and Bosker (2012). The current study started with a simpler model and moved onto a more complex model until observing no meaningful improvement in model fit. The current study built models in a non-parallel manner between samples (i.e., Aim-1 CAN, Aim-1 AFDC, Aim-2 CAN, and Aim-2 AFDC samples) to find the best optimal model for each sample.

For decision-making, the current study used a model fit indicator, called Akaike Information Criterion (AIC). AIC introduces penalties for more complex models with more parameters to balance parsimony versus model fit. A lower AIC value indicates a better model. Despite of the absence of a consensus cut-point, there are some rough guidelines (Burnham & Anderson, 2004): (1) when an AIC value reduces by ≤ 2, there is no meaning improvement in model fit by adding parameters; (2) when an AIC value reduced by ≥ 4 and ≤ 7, there is considerable empirical support for a more complex model; and (3) when an AIC value reduced by ≥ 10, a simpler model had no empirical support over a more complex one. It is important to understand that the individual AIC values are not informative to assess model fit because AIC values are affected by other factors such as arbitrary constants and sample sizes (Burnham & Anderson, 2004). Differences between AIC values are not affected by these factors and therefore useful for model comparison (Burnham & Anderson, 2004).

Null Model

Model building was started with a null model, also called an *unconditional model*, which has no predictor serves as a useful baseline for modeling. The current study's null model is:

$$\eta_{ijk} = \gamma_{000} + u_{00k} + r_{0jk}$$

Where γ_{000} is the grand mean of η_{ijk} which is defined above, u_{00k} is the level-3 random effect which indicates the difference between the grand mean and the *posterior* mean (see Snijders & Bosker, 2012, p. 62) in $\mathrm{neighborhood}_{00k}$, and r_{0jk} is the level-2 random effect which indicates the difference between the posterior mean in $\mathrm{neighborhood}_{00k}$ and the posterior mean in child_{0jk}. It is worth noting that the random effects, u_{00k} and γ_{0jk}, are latent variables whose individual values can be predicted in the model, but the random effects are not statistical parameters and therefore are not subject of estimation (Snijders & Bosker, 2012). Instead, the variance components of the random effects (i.e., σ^2_{u00} and σ^2_{r0}) are subject of estimation. For example, σ^2_{u00} indicates the amount of the variance of the outcome located between neighborhoods. There is no level-1 residual term in the model. This is because in a binomial model, the variance for the level-1 residuals is not subject of estimation as the level-1 residuals are assumed to follow a logistic distribution whose variance is fixed to $\frac{\pi^2}{3}$.

A null model is useful to compute the intraclass correlation coefficient (ICC), specifically level-2 ICC ($\frac{\sigma^2_{r0}}{\sigma^2_{u00}+\sigma^2_{r0}+\frac{\pi^2}{3}}$) and the level-3 ICC ($\frac{\sigma^2_{u00}}{\sigma^2_{u00}+\sigma^2_{r0}+\frac{\pi^2}{3}}$). A level-2 ICC value indicates the proportion of variance in the outcome which was placed between the level-2 units (children/families). A level-3 ICC value indicates the proportion between the level-3 units (neighborhoods). Estimated ICC values, therefore, can inform the importance of characteristics at each level for explaining child maltreatment reports.

Unconditional Growth Curve Model

After fitting a null model, the current study moved on to an unconditional growth curve model. In growth curve modeling, the relationship between the time and the outcome is generally defined first without other predictors. Such a model is called an unconditional growth curve model. The unconditional growth curve model of the current study is:

$$\eta_{ijk} = \gamma_{000} + \gamma_{100}AGE_{ijk} + u_{00k} + r_{0jk}$$

Where γ_{100} is the coefficient of child age. It is worth noting that γ_{000} is no longer a grand mean, but an intercept which indicates $\mathrm{E}(\eta_{ijk})$ when all predictors are set to 0. Beyond this linear model, polynomial growth curve models were also explored to correctly define the relationship.

Models with Level-1, Level-2, and Level-3 Predictors

Other predictors were further added. The current study added level-1 predictors, level-2 predictors, and then level-3 predictors in turn:

$$\eta_{ijk} = \gamma_{000} + \gamma_{100}AGE_{ijk} + \Gamma_1 X_1 + u_{00k} + r_{0jk}$$

$$\eta_{ijk} = \gamma_{000} + \gamma_{100}AGE_{ijk} + \Gamma_1 X_1 + \Gamma_2 X_2 + u_{00k} + r_{0jk}$$

$$\eta_{ijk} = \gamma_{000} + \gamma_{100}AGE_{ijk} + \Gamma_1 X_1 + \Gamma_2 X_2 + \Gamma_3 X_3 + u_{00k} + r_{0jk}$$

Where *X's* are vectors of level-1 (X_1), level-2 (X_2), and level-3 (X_3) predictors, and Γ's are vectors of coefficients corresponding to these predictors. Interaction effects, including cross-level interactions (e.g., race × neighborhood poverty), were also explored.

Random Slope Models

So far, random intercept models are described, in which a coefficient (i.e., a slope of a variable) is assumed consistent across higher level units (i.e., children or neighborhoods).

However, the slope of child age, for example, can be different between children or residential neighborhoods. For this reason, random slope models were explored. A model with random slopes of child age is presented as an example:

$$\eta_{ijk} = \gamma_{000} + \gamma_{100}AGE_{ijk} + \Gamma_1 X_1 + \Gamma_2 X_2 + \Gamma_3 X_3 + u_{00k} + u_{10k}AGE_{ijk} + r_{0jk} + \mathrm{r}_{1\mathrm{jk}}AGE_{ijk}$$

Where u_{10k} is the level-3 random effect of child age and $\mathrm{r}_{1\mathrm{jk}}$ is the level-2 random effect of child age.

Finally, for parsimony, the current study trimmed models by including only parameters with meaningful contribution to model fit.

Chapter 5: Results

This chapter reports results of analyses, starting with descriptive findings.

5.1 Descriptive Analyses

Table 5 presents descriptive statistics for the variables used. It is worth noting that the current study followed up two different samples. The CAN sample consisted of children having a maltreatment report in early childhood (i.e., aged 3 or under). The AFDC sample included children having an active AFDC case but no maltreatment report in early childhood. For Aim 1, children were followed up at all child ages. For Aim 2, children were observed at only child ages receiving welfare (AFDC or TANF).

5.1.1 Outcome Variable

During the follow-up period, the probabilities of having a maltreatment report at a given age were, on average, 11.4% for the CAN sample and 5.5% for the AFDC sample for Aim 1. This indicated that the risk of future maltreatment reports among children with reported maltreatment in early childhood (the CAN sample) was higher than the risk among children with welfare receipt but no reported maltreatment in early childhood (the AFDC sample). For Aim 2, the current study selected all "age-year observations" receiving AFDC or TANF during follow-up. While receiving AFDC or TANF currently (Aim 2), these probabilities were higher: 19.7% for the CAN sample and 8.3% for the AFDC sample.

Table 5. Descriptive Statistics.

	% or M (SD)			
	Aim 1		Aim 2	
Variables	CAN sample	AFDC sample	CAN sample	AFDC sample
Level-1	*N_1=25,258*	*N_1=24,552*	*N_1=7,881*	*N_1=6,907*
CM report	11.4%	5.5%	19.7%	8.3%
Child age	8.87 (3.96)	8.91 (3.95)	6.63 (3.38)	6.55 (3.50)
Current welfare	35.6%	30.7%	-	-
Prior welfare	0.51 (0.37)	0.50 (0.32)	0.85 (0.22)	0.81 (0.23)
TANF time limit	3.9%	2.9%	-	-
TANF no limit	5.6%	3.7%	9.2%	6.9%
Prior CPS report:				
0	-	78.6%	-	78.6%
1	49.2%	13.5%	45.4%	13.6%
2	22.3%	4.5%	24.8%	4.3%
3 (3+ for AFDC sample)[a]	11.7%	3.4%	13.2%	3.5%
4+	16.8%	-	16.6%	-
FCS only	26.6%	7.6%	24.5%	8.7%
IIS with and without FCS	9.1%	2.8%	11.0%	3.1%
Child current injury	4.8%	4.5%	4.7%	4.4%
Child prior injury	29.6%	27.5%	21.3%	20.3%
Child current mental health	0.8%	0.4%	-	-
Child prior mental health	3.4%	1.8%	-	-
Child mental health	-	-	2.9%	1.5%
Child mental delay	0.5%	0.2%	-	-
Child chronic health problem	0.8%	0.3%	-	-
Child chronic medical issue	-	-	0.5%	0.3%
Child current delinquency	1.9%	1.3%	-	-
Child prior delinquency	3.9%	2.7%	-	-
Child delinquency	-	-	2.2%	1.7%
Child special education	16.4%	10.6%	11.2%	7.5%
Parent current conviction	1.1%	0.7%	-	-
Parent prior conviction	2.8%	1.4%	-	-
Parent conviction	-	-	2.3%	1.2%
Parent current arrest	0.7%	0.4%	-	-
Parent prior arrest	8.6%	4.5%	-	-
Parent arrest	-	-	9.1%	5.4%
Residential moves: 0	-	-	76.7%	79.9%
1	-	-	20.7%	18.2%
2+[b]	-	-	2.6%	1.9%

Table 5 (continued)

	% or M (SD)			
	Aim 1		Aim 2	
Variables	CAN sample	AFDC sample	CAN sample	AFDC sample
Level-2	*N_2=2,111*	*N_2=1,923*	*N_2=1,526*	*N_2=1,436*
Child race: White	32.3%	16.8%	22.7%	14.9%
Black	66.4%	81.5%	76.5%	83.6%
Other	1.3%	1.7%	0.8%	1.5%
Birth weight: Normal	89.5%	91.3%	88.0%	90.6%
Low	9.0%	7.4%	10.5%	8.2%
Very low	1.5%	1.3%	1.5%	1.2%
Birth year: 1991	33.2%	31.2%	31.1%	28.3%
1992	32.6%	32.5%	33.0%	31.7%
1993	25.7%	27.6%	26.9%	29.7%
1994	8.5%	8.7%	9.0%	10.3%
Child sex: female	47.9%	47.0%	48.5%	47.8%
Medicaid at birth	60.3%	65.3%	69.4%	67.9%
Mom no high school	53.3%	46.0%	62.9%	49.0%
Mom teen birth	27.2%	25.6%	32.0%	27.9%
Caregiver foster care	6.6%	3.4%	8.0%	4.3%
Baseline no AFDC	22.4%	-	8.7%	-
Level-3	*N_3=235*	*N_3=210*	*N_3=385*	*N_3=328*
Impoverishment	0.54 (1.05)	0.76 (0.99)	1.59 (1.42)	1.57 (1.38)
Instability	0.05 (0.94)	0.03 (1.00)	0.01 (0.95)	-0.02 (0.94)
Care burden	0.29 (0.83)	0.32 (0.85)	0.49 (0.98)	0.56 (1.00)
Poverty rate, %	22.56 (16.01)	25.37 (15.51)	26.18 (14.01)	25.67 (13.96)
Mobility rate, %	45.16 (11.90)	44.84 (12.42)	46.79 (12.96)	46.44 (12.86)
Child/adult ratio	0.33 (0.11)	0.34 (0.11)	0.34 (0.13)	0.34 (0.12)
Out of St. Louis	-	-	7.1%	5.4%

M = mean. SD = standard deviation. CAN = CAN sample. AFDC = AFDC sample. CM = child maltreatment. MH = mental health. N_1 = number of child-age observations. N_2 = number of children. N_3 = number of tracts.
[a] Three prior reports for the CAN sample and three or more prior reports for the AFDC sample
[b] For Aim 2, children made 0 to 4 residential moves at their current age for the CAN sample and 0 to 3 moves for the AFDC sample.

5.1.2 Level-1 Predictors

For Aim 1, over 80% to 90% of sampled children were followed up for 13 to 14 years (Table 6). For Aim 2, children were followed up for a shorter period as their age-year observations were limited to only those receiving welfare (Table 6). Since the current study followed up four birth cohorts (i.e., 1991 – 1994) during a fixed period (i.e., January 1995 – March 2009), there were fewer numbers of children toward the tails (i.e., age 1 and 17) of the *child age* distributions (Table 7). Yet, age-year observations at every age were sufficient in number for statistical analyses in all samples (Table 6). Child ages were covered from 1 to 17 years in the samples for Aim 1 and from 1 to 16 years in the samples for Aim 2. The mean child ages were slightly younger for the Aim-2 samples (6.63 for CAN and 6.55 for AFDC) than for the Aim-1 samples (8.87 for CAN and 8.91 for AFDC) (Table 5). This indicated that children were more likely to receive welfare at younger ages.

Sampled children frequently received welfare (AFDC or TANF) during the follow-up period. Regarding *current welfare*, the proportion of children receiving welfare at the current age was, on average, 35.6% for the CAN sample and 30.7% for the AFDC sample. *Current welfare* was not relevant for Aim 2 as all age-year observations were receiving welfare at a given age in the Aim-2 samples. With regard to *prior welfare*, children were on welfare for about 50% of their time (from birth prior to the current age) for the Aim-1 samples and over 80% of their time for the Aim-2 samples (Table 5).

Regarding other level-1 predictors (from *prior CPS report* to *parent arrest* as listed in Table 5), the CAN sample were in general more likely to have these factors at a given age than the AFDC sample for both Aim 1 and 2. When tracing family's residential moves for Aim 2, over 20% of children moved more than once at a given age. During the entire follow-up period, about 90% of both samples moved at least once.

Table 6 Numbers of Children by the Length of Follow-Up Years.

	Number of children (%)			
	Aim 1		Aim 2	
Number of follow-up years	CAN sample	AFDC sample	CAN sample	AFDC sample
1	55 (2.61%)	16 (0.83%)	223 (14.61%)	228 (15.88%)
2	49 (2.32%)	7 (0.36%)	201 (13.17%)	212 (14.76%)
3	30 (1.42%)	12 (0.62%)	165 (10.81%)	156 (10.86%)
4	42 (1.99%)	15 (0.78%)	148 (9.70%)	169 (11.77%)
5	47 (2.23%)	14 (0.73%)	117 (7.67%)	116 (8.08%)
6	12 (0.57%)	10 (0.52%)	133 (8.72%)	105 (7.31%)
7	18 (0.85%)	13 (0.68%)	137 (8.98%)	122 (8.50%)
8	19 (0.90%)	8 (0.42%)	171 (11.21%)	137 (9.54%)
9	11 (0.52%)	7 (0.36%)	88 (5.77%)	92 (6.41%)
10	13 (0.62%)	6 (0.31%)	38 (2.49%)	37 (2.58%)
11	11 (0.52%)	8 (0.42%)	25 (1.64%)	18 (1.25%)
12	14 (0.66%)	6 (0.31%)	28 (1.83%)	17 (1.18%)
13	1316 (62.34%)	1356 (70.51%)	52 (3.41%)	27 (1.88%)
14	474 (22.45%)	445 (23.14%)	-	-

Table 7 Numbers of Age-Year Observations by Child Age.

	Number of age-year observations (%)			
	Aim 1		Aim 1	
Child age in year	CAN sample	AFDC sample	CAN sample	AFDC sample
1	178 (0.70%)	167 (0.68%)	123 (1.56%)	137 (1.98%)
2	713 (2.82%)	698 (2.84%)	462 (5.86%)	483 (6.99%)
3	1373 (5.44%)	1320 (5.38%)	825 (10.47%)	799 (11.57%)
4	2042 (8.08%)	1905 (7.76%)	1127 (14.30%)	1009 (14.61%)
5	2010 (7.96%)	1889 (7.69%)	1010 (12.82%)	822 (11.90%)
6	1959 (7.76%)	1880 (7.66%)	837 (10.62%)	676 (9.79%)
7	1919 (7.60%)	1874 (7.63%)	709 (9.00%)	582 (8.43%)
8	1896 (7.51%)	1857 (7.56%)	629 (7.98%)	517 (7.49%)
9	1870 (7.40%)	1849 (7.53%)	542 (6.88%)	436 (6.31%)
10	1859 (7.36%)	1839 (7.49%)	434 (5.51%)	356 (5.15%)
11	1842 (7.29%)	1828 (7.45%)	335 (4.25%)	291 (4.21%)
12	1829 (7.24%)	1818 (7.40%)	278 (3.53%)	255 (3.69%)
13	1817 (7.19%)	1816 (7.40%)	234 (2.97%)	219 (3.17%)
14	1735 (6.87%)	1701 (6.93%)	179 (2.27%)	177 (2.56%)
15	1346 (5.33%)	1285 (5.23%)	111 (1.41%)	103 (1.49%)
16	735 (2.91%)	689 (2.81%)	46 (0.58%)	45 (0.65%)
17	135 (0.53%)	137 (0.56%)	-	-

5.1.3 Level-2 Predictors

Descriptive statistics of level-2 predictors were reported at the child level (e.g., % of Blacks among children). All of the AFDC children received AFDC at baseline because of the sampling approach used by the parent study. Most of the CAN samples also received AFDC at the baseline as only 22.4% (for Aim 1) to 8.7% (for Aim 2) were not on AFDC at baseline. Other socioeconomic indicators, such as *Medicaid at birth* and *mom no high school*, suggested that the study samples consisted of children mostly in low-SES families at the baseline.

For other risk factors, the proportion of children with low or very low birth weights were slightly higher for the CAN samples than the AFDC samples (9.0% vs 7.4% for Aim 1 and 10.5% vs 8.2% for Aim 2). The proportion of *caregiver foster care* was also higher for the CAN samples than the AFDC samples (6.6% vs 3.4% for Aim 1 and 8.0% vs 4.3% for Aim 2).

Regarding demographic characteristics, Blacks comprised 66.4% of the CAN sample and 81.5% of the AFDC sample. Compared to their representation (i.e., 35.1%) in the St. Louis child population (aged ≤ 3, 1993-1994) (Centers for Disease Control and Prevention, n.d.), Blacks were presented 1.9 times more in the CAN sample and 2.3 times more in the AFDC sample. This was consistent with national demographics showing higher representation of Blacks among poor compared to maltreated populations (Drake et al., 2011). Males and females were balanced in all samples, consistent with the gender composition in St. Louis children.

Both CAN and AFDC samples had fewer children born in 1994 than those born in prior years (1991-1993). This was because the window of sampling (i.e., 1993-1994) was much narrower for the 1994 cohort. On average, the 1994 cohort had a 6-month window, while the 1993 cohort had an 18-month window and the 1991 and 1992 cohorts had a full 24-month window.

5.1.4 Level-3 Predictors

Descriptive statistics for level-3 predictors were reported at the observation level (e.g., the mean of neighborhood impoverishment among age-year observations). For Aim 1, the mean of baseline neighborhood impoverishment was 0.54 for the CAN sample and 0.76 for the AFDC sample. Regarding neighborhood care burden, the mean was 0.29 for the CAN sample and 0.32 for the AFDC sample. These values indicated that at the baseline, AFDC children were slightly more likely to be residing in neighborhoods with a little higher impoverishment and care burden. In terms of neighborhood instability, sampled children were quite evenly distributed at the baseline as the mean values were close to 0.

During the follow-up period, sampled children for Aim 2 were residing in more impoverished and higher care-burden neighborhoods. The mean values of neighborhood impoverishment and care burden were higher for Aim 2 than for Aim 1. Yet, these values were not directly comparable because neighborhood factors for Aim 1 and 2 were measured based on different sets of neighborhoods (i.e., St. Louis versus Missouri). Rather, the higher mean values for Aim 2 appeared to be mainly because St. Louis neighborhoods were more impoverished and with higher care burden than other Missouri neighborhoods.

Regarding neighborhood variables (poverty rate, mobility rate, and child/adult ratio), the mean values were mostly similar between the CAN and AFDC samples. Only the mean of neighborhood poverty rate was slightly lower for the Aim-1 CAN sample than for other samples.

During the follow-up period, a small proportion of children (7.1% of the CAN sample and 5.4% of the AFDC sample for Aim 2) moved out of St. Louis while most children remained in St. Louis. Among those moving out of St. Louis, most (94% for the CAN sample and 96% for the AFDC sample) were moved in rural or suburban counties, and more than half (57% for the CAN sample and 55% for the AFDC sample) moved farther than adjacent counties of St. Louis.

5.2 Model Building

To find the most optimal model for each sample, the current study followed the model building process as described in the Methods section. All models were fitted as a multilevel logistic growth curve model. This section describes the formulation of the final model for each sample, starting with the null models. This will be followed by a discussion of significant predictors in the next section.

5.2.1 Null Models and ICC Values

Based on the results of the null model of each sample, the ICC values were calculated and reported in Table 8. The ICC values indicated that 23.41% to 40.01% of the variance in the likelihood of maltreatment reporting placed was between level-2 units (i.e., children/families), while 0.00% to 0.38% of the variance was located between level-3 units (i.e., neighborhoods). The rest of the variance (about 60% to 76%) was situated between level-1 units (i.e., age-year observations). These results indicated that the risk of maltreatment reporting varied mainly by time and between children (and their families), while the risk varied little between residential neighborhoods.

Table 8 The Proportion of the Variance of the Outcome at Each Level.

	Aim 1		Aim 2	
Proportion of the variance between	CAN sample	AFDC sample	CAN sample	AFDC sample
Level-2 units (= level-2 ICC)	0.3271	0.4001	0.2341	0.3778
Level-3 units (= level-3 ICC)	0.0038	0.0000	0.0005	0.0000

Note. The ICC values were calculated based on the results of the null model of each sample (Model 1 in Tables 9-12).

5.2.2 Aim 1: CAN sample

Table 9 presents the results of models for the Aim-1 CAN sample. Adding *child age* (Model 2) showed a substantially better model fit than the null model (Model 1). The AIC value reduced by 310.3 from Model 1 (AIC = 16942.7) to Model 2 (AIC = 16632.4). Polynomial growth curve models were explored by adding the quadratic term and the cubic term of *child age* in turn. There was no meaningful improvement of model fit by adding those terms (i.e., AIC values reduced by ≤ 2).

Adding level-1 predictors (Model 2 → 3) considerably improved the model fit as the AIC value dropped by 706.9. Adding level-2 predictors (Model 3 → 4) also meaningfully improved the model fit. However, neither adding baseline neighborhood factors (Model 4 → 5) nor adding baseline neighborhood variables (Model 4 → 6) improved the model fit to a meaningful degree.

Adding the interaction of *current welfare* and *prior welfare* (Model 5 → 7 and Model 6 → 8) meaningfully improved the model fit. Yet, adding the interaction of *child age* and *current welfare* (Model 7 → 9 and Model 8 → 10) had no meaningful contribution to the model fit. The current study explored other interactions (e.g., "*child race* × *child age*" and "*child race* × *current welfare*"). None of them improved the mode fit.

Next, the current study examined random slope models. Adding a level-2 random slope of *current welfare* (Model 7 → 11 and Model 8 → 12) improved model fit to a meaningful degree. This indicated that the impact of *current welfare* differed between children, which was not explained by predictors in the model. Oher random slopes were explored but, none of them increased the model fit.

For parsimony, the current study built a trimmed model (Model 13) by including only parameters with meaningful contribution to model fit. The current study chose the trimmed model as the final model because this model was the best optimal model in the balance between parsimony and model fit, which was supported by AIC.

5.2.3 Aim 1: AFDC sample

Table 10 reports the results of models for the Aim-1 AFDC sample. The model building process of this sample was almost same to that of the above Aim-1 CAN sample. The only difference was that adding interaction of *child age* and *current welfare* meaningfully improved model fit in this sample (Model 7 → 9 and Model 8 → 10). Other interactions (e.g., "*child race* × *child age*" and "*child race* × *current welfare*") had no meaningful contribution to model fit. Trimmed model (Model 13) was chosen as the final model for this sample.

5.2.4 Aim 2: CAN sample

Table 11 provides the results of models for the Aim-2 CAN sample. *Current welfare* and *TANF time limit* became irrelevant as the samples for Aim 2 selected only age-year observations on welfare (AFDC or TANF). Due to the reduced sample sizes, some variables were combined to avoid empty-cell issues. For example, *child current mental health* and *child prior mental health* were combined into *child mental health* ever (see the Methods section for greater details). As the Aim-2 samples traced changes of residential addresses, *residential moves* and *out of St. Louis* were further considered in analyses.

When adding *child age* (Model 1 → 2), level-1 predictors (Model 2 → 3), and level-2 predictors (Model 3 → 4) in sequence, model fit was meaningfully improved at each step. There was no meaningful improvement in model fit by adding neighborhood factors (Model 4 → 5), neighborhood variables (Model 4 → 6), the interaction between *child race* and *neighborhood* *impoverishment* (Model 5 → 7), or the interaction between *child race* and *neighborhood poverty rate* (Model 6 → 8). The current study observed no meaningful improvement of model fit by adding random slopes and other interactions (e.g., "*child race* × *child age*"). The trimmed model (Model 9) which included only parameters with meaningful contribution to model fit was the best optimal model, supported by AIC. The current study therefore selected the trimmed model as the final model.

5.2.5 Aim 2: AFDC sample

Table 12 shows the results of models for the Aim-2 AFDC sample. There were some interesting differences in results between this sample and the above Aim-2 CAN sample with regard to neighborhood characteristics and their interaction with child race. Adding neighborhood factors (Model 4 → 5) and neighborhood variables (Model 4 → 6) showed meaningful improvement in model fit. This was mainly due to the contribution of *neighborhood care burden* and *neighborhood child/adult ratio*. Adding the interaction between *child race* and *neighborhood impoverishment* (Model 5 → 7) and the interaction between *child race* and *neighborhood poverty rate* (Model 6 → 8) had no meaningful improvement in model fit. While building a trimmed model, however, the interaction between *child race* and *neighborhood poverty rate* became statistically meaningful as the AIC value reduced by "2.1". Although the improvement of model fit was marginal, the final model (Model 10) kept this interaction because of its theoretical interest. The trimmed model with neighborhood variables (Model 10) was presented as the final model because interpretations of findings were more straightforward and readily comparable to other study sites. The choice between neighborhood factors (Model 9) and neighborhood variables (Model 10) had little influence on the overall model fit as the AIC difference was ≤ 2. There was no meaningful improvement in model fit by adding random slopes and other interactions (e.g., "*child race* × *child age*").

Table 9 Aim 1: CAN Sample Models of Child Maltreatment Reporting Likelihoods.

	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6			Model 7			Model 8		
Fixed effect	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR
Level 1																								
Intercept	-2.446	.044	-	-2.490	.042	-	-3.163	.058	-	-3.074	.093	-	-3.069	.097	-	-3.062	.096	-	-3.019	.098	-	-3.012	.097	-
Child age[a]				-0.101	.006	**0.90**	-0.130	.009	**0.88**	-0.137	.009	**0.87**	-0.137	.009	**0.87**	-0.137	.009	**0.87**	-0.137	.009	**0.87**	-0.137	.009	**0.87**
Current welfare							0.568	.064	**1.76**	0.567	.064	**1.76**	0.567	.064	**1.76**	0.566	.064	**1.76**	0.679	.069	**1.97**	0.678	.069	**1.97**
Prior welfare[a] (1 unit=10% point)							0.055	.010	**1.06**	0.046	.012	**1.05**	0.046	.012	**1.05**	0.046	.012	**1.05**	0.077	.015	**1.08**	0.077	.015	**1.08**
Child age[a] × Current welfare																								
Current welfare × Prior welfare[a]																			-0.070	.019	**0.93**	-0.070	.019	**0.93**
TANF time limit							0.143	.132	1.15	0.165	.132	1.18	0.167	.132	1.18	0.167	.132	1.18	0.074	.134	1.08	0.074	.134	1.08
TANF no limit							-0.173	.107	0.84	-0.133	.109	0.88	-0.134	.109	0.87	-0.134	.109	0.87	-0.139	.109	0.87	-0.139	.109	0.87
Prior CPS report (ref. 1): 2							0.563	.064	**1.76**	0.555	.063	**1.74**	0.555	.063	**1.74**	0.554	.063	**1.74**	0.546	.063	**1.73**	0.544	.063	**1.72**
3							0.934	.076	**2.54**	0.928	.076	**2.53**	0.927	.076	**2.53**	0.926	.076	**2.52**	0.918	.076	**2.50**	0.917	.076	**2.50**
4+							1.201	.085	**3.32**	1.182	.085	**3.26**	1.179	.085	**3.25**	1.176	.085	**3.24**	1.164	.085	**3.20**	1.161	.085	**3.19**
FCS only							-0.302	.060	**0.74**	-0.277	.060	**0.76**	-0.279	.060	**0.76**	-0.279	.060	**0.76**	-0.285	.060	**0.75**	-0.285	.060	**0.75**
IIS with and without FCS							0.138	.080	1.15	0.171	.079	**1.19**	0.172	.080	**1.19**	0.173	.080	**1.19**	0.169	.080	**1.18**	0.169	.080	**1.18**
Child current injury							0.441	.088	**1.55**	0.442	.088	**1.56**	0.442	.088	**1.56**	0.442	.088	**1.56**	0.434	.089	**1.54**	0.434	.089	**1.54**
Child prior injury							0.104	.060	1.11	0.113	.061	1.12	0.112	.061	1.12	0.111	.061	1.12	0.108	.061	1.11	0.107	.061	1.11
Child current mental health							1.398	.172	**4.05**	1.381	.171	**3.98**	1.380	.171	**3.98**	1.380	.171	**3.97**	1.386	.172	**4.00**	1.386	.172	**4.00**
Child prior mental health							0.309	.121	**1.36**	0.297	.121	**1.35**	0.295	.121	**1.34**	0.293	.121	**1.34**	0.295	.121	**1.34**	0.293	.121	**1.34**
Child mental delay							0.038	.311	1.04	-0.024	.309	0.98	-0.026	.310	0.97	-0.026	.310	0.97	-0.019	.310	0.98	-0.018	.310	0.98
Child chronic health problem							0.479	.235	**1.61**	0.545	.233	**1.72**	0.550	.233	**1.73**	0.550	.233	**1.73**	0.541	.234	**1.72**	0.541	.234	**1.72**
Child current delinquency							0.797	.147	**2.22**	0.816	.147	**2.26**	0.817	.147	**2.26**	0.818	.147	**2.27**	0.805	.147	**2.24**	0.806	.147	**2.24**
Child prior delinquency							0.201	.129	1.22	0.210	.128	1.23	0.210	.129	1.23	0.210	.129	1.23	0.211	.129	1.24	0.211	.129	1.24
Child special education							0.178	.068	**1.19**	0.185	.069	**1.20**	0.187	.069	**1.21**	0.187	.069	**1.21**	0.183	.069	**1.20**	0.183	.069	**1.20**
Parent current conviction							0.198	.245	1.22	0.192	.245	1.21	0.194	.245	1.21	0.194	.245	1.21	0.197	.245	1.22	0.198	.245	1.22
Parent prior conviction							-0.536	.192	**0.59**	-0.520	.191	**0.59**	-0.520	.191	**0.59**	-0.519	.191	**0.59**	-0.540	.191	**0.58**	-0.540	.191	**0.58**
Parent current arrest							0.544	.206	**1.72**	0.523	.206	**1.69**	0.524	.206	**1.69**	0.524	.206	**1.69**	0.524	.206	**1.69**	0.524	.206	**1.69**
Parent prior arrest							0.039	.090	1.04	0.048	.090	1.05	0.049	.090	1.05	0.049	.090	1.05	0.043	.090	1.04	0.042	.090	1.04
Level 2																								
Child race (ref. White): Black										-0.162	.061	**0.85**	-0.179	.071	**0.84**	-0.189	.069	**0.83**	-0.185	.071	**0.83**	-0.195	.069	**0.82**
Other										-0.797	.331	**0.45**	-0.794	.331	**0.45**	-0.792	.332	**0.45**	-0.789	.332	**0.45**	-0.787	.332	**0.46**
Birth weight (ref. normal): low										-0.048	.088	0.95	-0.053	.088	0.95	-0.054	.088	0.95	-0.050	.088	0.95	-0.050	.088	0.95
very low										0.059	.210	1.06	0.055	.211	1.06	0.055	.211	1.06	0.049	.211	1.05	0.049	.211	1.05
Birth year (ref. 1991): 1992										-0.123	.063	0.88	-0.126	.063	**0.88**	-0.126	.063	**0.88**	-0.127	.063	**0.88**	-0.128	.064	**0.88**
1993										-0.212	.070	**0.81**	-0.213	.070	**0.81**	-0.215	.070	**0.81**	-0.210	.070	**0.81**	-0.212	.070	**0.81**
1994										-0.176	.098	0.84	-0.174	.099	0.84	-0.173	.099	0.84	-0.168	.099	0.85	-0.166	.099	0.85
Child sex: female										0.046	.051	1.05	0.048	.051	1.05	0.048	.051	1.05	0.046	.051	1.05	0.047	.051	1.05
Medicaid at birth										-0.065	.057	0.94	-0.061	.057	0.94	-0.060	.057	0.94	-0.066	.057	0.94	-0.065	.057	0.94
Mom no high school										0.279	.059	**1.32**	0.283	.059	**1.33**	0.282	.059	**1.33**	0.279	.059	**1.32**	0.279	.059	**1.32**
Mom teen birth										-0.027	.060	0.97	-0.025	.060	0.97	-0.025	.060	0.98	-0.042	.060	0.96	-0.041	.060	0.96
Caregiver foster care										0.218	.096	**1.24**	0.219	.096	**1.24**	0.222	.096	**1.25**	0.218	.096	**1.24**	0.222	.096	**1.25**
Baseline no AFDC										-0.053	.081	0.95	-0.048	.081	0.95	-0.046	.081	0.95	0.013	.083	1.01	0.014	.083	1.01
Level 3																								
Impoverishment[a]													0.007	.030	1.01				0.008	.030	1.01			
Instability[a]													-0.035	.027	0.97				-0.035	.027	0.97			
Care burden[a]													0.014	.031	1.01				0.013	.031	1.01			
Poverty rate[a] (1 unit=10% point)																0.016	.026	1.02				0.015	.026	1.02
Mobility rate[a] (1 unit=10% point)																-0.038	.022	0.96				-0.037	.022	0.96
Child/adult ratio[a] (1 unit=0.1)																-0.017	.035	0.98				-0.015	.035	0.99
Random effect	Variance			Variance			Variance			Variance			Variance			Variance			Variance			Variance		
Level-2: Intercept	1.6080			1.4267			0.3349			0.3011			0.3010			0.3019			0.3021			0.3030		
Level-2: Current welfare																								
Level-3: Intercept	0.0185			0.0127			0.0000			0.0000			0.0000			0.0000			0.0000			0.0000		
Model fit: AIC	16942.7			16632.4			15925.5			15895.3			15899.4			15898.4			15887.7			15886.7		

Table 9 (continued)

	Model 9			Model 10			Model 11			Model 12			Model 13		
Fixed effect	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR
Level 1															
Intercept	-3.022	.098	-	-3.015	.097	-	-3.113	.103	-	-3.107	.102	-	-3.153	.088	-
Child age[a]	-0.130	.011	**0.88**	-0.130	.011	**0.88**	-0.136	.010	**0.87**	-0.136	.010	**0.87**	-0.139	.009	**0.87**
Current welfare	0.664	.070	**1.94**	0.663	.070	**1.94**	0.851	.082	**2.34**	0.850	.082	**2.34**	0.840	.081	**2.32**
Prior welfare[a] (1 unit=10% point)	0.077	.015	**1.08**	0.077	.015	**1.08**	0.080	.015	**1.08**	0.080	.015	**1.08**	0.077	.013	**1.08**
Child age[a] × Current welfare	-0.018	.013	0.98	-0.018	.013	0.98									
Current welfare × Prior welfare[a]	-0.073	.019	**0.93**	-0.073	.019	**0.93**	-0.077	.019	**0.93**	-0.077	.019	**0.93**	-0.078	.019	**0.92**
TANF time limit	0.056	.135	1.06	0.056	.135	1.06	0.070	.146	1.07	0.070	.146	1.07			
TANF no limit	-0.090	.115	0.91	-0.090	.115	0.91	-0.136	.110	0.87	-0.136	.110	0.87			
Prior CPS report (ref. 1): 2	0.550	.063	**1.73**	0.549	.063	**1.73**	0.528	.064	**1.70**	0.527	.064	**1.69**	0.531	.064	**1.70**
3	0.924	.076	**2.52**	0.923	.076	**2.52**	0.900	.077	**2.46**	0.899	.077	**2.46**	0.903	.077	**2.47**
4+	1.175	.085	**3.24**	1.172	.085	**3.23**	1.149	.086	**3.16**	1.147	.086	**3.15**	1.153	.085	**3.17**
FCS only	-0.283	.060	**0.75**	-0.283	.060	**0.75**	-0.284	.061	**0.75**	-0.284	.061	**0.75**	-0.284	.061	**0.75**
IIS with and without FCS	0.171	.079	**1.19**	0.171	.079	**1.19**	0.160	.080	**1.17**	0.161	.080	**1.17**	0.161	.080	**1.17**
Child current injury	0.437	.089	**1.55**	0.437	.089	**1.55**	0.427	.090	**1.53**	0.427	.090	**1.53**	0.426	.090	**1.53**
Child prior injury	0.111	.061	1.12	0.110	.061	1.12	0.092	.062	1.10	0.091	.062	1.10	0.088	.062	1.09
Child current mental health	1.376	.172	**3.96**	1.376	.172	**3.96**	1.374	.176	**3.95**	1.374	.176	**3.95**	1.376	.176	**3.96**
Child prior mental health	0.294	.121	**1.34**	0.292	.121	**1.34**	0.316	.124	**1.37**	0.315	.124	**1.37**	0.324	.123	**1.38**
Child mental delay	-0.024	.309	0.98	-0.023	.310	0.98	0.029	.328	1.03	0.028	.328	1.03			
Child chronic health problem	0.536	.233	**1.71**	0.535	.233	**1.71**	0.622	.248	**1.86**	0.620	.248	**1.86**	0.618	.243	**1.86**
Child current delinquency	0.798	.147	**2.22**	0.800	.147	**2.22**	0.820	.150	**2.27**	0.821	.150	**2.27**	0.809	.150	**2.25**
Child prior delinquency	0.202	.129	1.22	0.202	.129	1.22	0.183	.133	1.20	0.183	.133	1.20	0.171	.132	1.19
Child special education	0.183	.069	**1.20**	0.183	.069	**1.20**	0.162	.071	**1.18**	0.162	.071	**1.18**	0.153	.070	**1.16**
Parent current conviction	0.190	.245	1.21	0.191	.245	1.21	0.173	.248	1.19	0.173	.248	1.19	0.159	.248	1.17
Parent prior conviction	-0.534	.191	**0.59**	-0.533	.191	**0.59**	-0.531	.193	**0.59**	-0.530	.193	**0.59**	-0.531	.192	**0.59**
Parent current arrest	0.526	.206	**1.69**	0.525	.206	**1.69**	0.536	.207	**1.71**	0.536	.207	**1.71**	0.522	.207	**1.69**
Parent prior arrest	0.042	.090	1.04	0.042	.090	1.04	0.052	.090	1.05	0.052	.091	1.05	0.049	.090	1.05
Level 2															
Child race (ref. White): Black	-0.186	.071	**0.83**	-0.196	.069	**0.82**	-0.193	.073	**0.82**	-0.201	.070	**0.82**	-0.175	.062	**0.84**
Other	-0.790	.332	**0.45**	-0.788	.332	**0.45**	-0.904	.347	**0.40**	-0.901	.347	**0.41**	-0.891	.347	**0.41**
Birth weight (ref. normal): low	-0.048	.088	0.95	-0.049	.088	0.95	-0.052	.088	0.95	-0.053	.088	0.95			
very low	0.048	.210	1.05	0.048	.211	1.05	-0.010	.215	0.99	-0.008	.215	0.99			
Birth year (ref. 1991): 1992	-0.128	.063	**0.88**	-0.129	.063	**0.88**	-0.142	.064	**0.87**	-0.142	.064	**0.87**	-0.142	.064	**0.87**
1993	-0.214	.070	**0.81**	-0.216	.070	**0.81**	-0.220	.070	**0.80**	-0.222	.070	**0.80**	-0.228	.070	**0.80**
1994	-0.176	.099	0.84	-0.175	.099	0.84	-0.165	.099	0.85	-0.163	.099	0.85	-0.179	.098	0.84
Child sex: female	0.047	.051	1.05	0.047	.051	1.05	0.032	.052	1.03	0.033	.052	1.03			
Medicaid at birth	-0.067	.057	0.94	-0.066	.057	0.94	-0.073	.057	0.93	-0.071	.058	0.93			
Mom no high school	0.277	.059	**1.32**	0.276	.059	**1.32**	0.282	.060	**1.33**	0.282	.060	**1.33**	0.261	.056	**1.30**
Mom teen birth	-0.042	.060	0.96	-0.042	.060	0.96	-0.046	.060	0.95	-0.046	.060	0.96			
Caregiver foster care	0.216	.096	**1.24**	0.219	.096	**1.25**	0.224	.096	**1.25**	0.228	.096	**1.26**	0.212	.095	**1.24**
Baseline no AFDC	0.016	.082	1.02	0.017	.082	1.02	0.004	.085	1.00	0.005	.085	1.01			
Level 3															
Impoverishment[a]	0.007	.030	1.01				0.012	.030	1.01						
Instability[a]	-0.035	.027	0.97				-0.029	.027	0.97						
Care burden[a]	0.013	.031	1.01				0.017	.031	1.02						
Poverty rate[a] (1 unit=10% point)				0.015	.026	1.02				0.019	.027	1.02			
Mobility rate[a] (1 unit=10% point)				-0.037	.022	0.96				-0.033	.022	0.97			
Child/adult ratio[a] (1 unit=0.1)				-0.015	.035	0.99				-0.019	.036	0.98			
Random effect	Variance			Variance			Variance			Variance			Variance		
Level-2: Intercept	0.2970			0.2979			0.6692			0.6683			0.6740		
Level-2: Current welfare							0.6089			0.6084			0.6165		
Level-3: Intercept	0.0000			0.0000			0.0000			0.0000			0.0000		
Model fit: AIC	15888.0			15887.0			15860.4			15859.6			15842.7		

[a] Centered to grand mean. ref. = reference group. γ = coefficient. SE = standard error. OR = odds ratio. Significant odds ratios ($p < .05$) are in boldface.

Table 10 Aim 1: AFDC Sample Models of Child Maltreatment Reporting Likelihoods.

	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6			Model 7			Model 8		
Fixed effect	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR
Level 1																								
Intercept	-3.647	.068	-	-3.644	.068	-	-3.785	.070	-	-3.727	.143	-	-3.779	.149	-	-3.753	.148	-	-3.737	.150	-	-3.712	.149	-
Child age[a]				-0.011	.008	0.99	-0.042	.013	**0.96**	-0.038	.014	**0.96**	-0.038	.014	**0.96**	-0.038	.014	**0.96**	-0.037	.014	**0.96**	-0.037	.014	**0.96**
Current welfare							0.360	.083	**1.43**	0.361	.084	**1.44**	0.363	.084	**1.44**	0.362	.084	**1.44**	0.539	.090	**1.71**	0.538	.090	**1.71**
Prior welfare[a] (1 unit=10% point)							0.082	.016	**1.09**	0.075	.016	**1.08**	0.076	.016	**1.08**	0.076	.016	**1.08**	0.117	.019	**1.12**	0.116	.019	**1.12**
Child age[a] × Current welfare																								
Current welfare × Prior welfare[a]																			-0.106	.027	**0.90**	-0.106	.027	**0.90**
TANF time limit							-0.024	.182	0.98	-0.043	.183	0.96	-0.040	.183	0.96	-0.042	.183	0.96	-0.167	.186	0.85	-0.169	.187	0.84
TANF no limit							-0.397	.165	**0.67**	-0.384	.166	**0.68**	-0.383	.166	**0.68**	-0.383	.166	**0.68**	-0.391	.166	**0.68**	-0.392	.166	**0.68**
Prior CPS report (ref. 0): 1							0.663	.107	**1.94**	0.584	.110	**1.79**	0.582	.109	**1.79**	0.583	.110	**1.79**	0.552	.110	**1.74**	0.553	.111	**1.74**
2							0.844	.163	**2.32**	0.733	.167	**2.08**	0.731	.167	**2.08**	0.731	.167	**2.08**	0.689	.169	**1.99**	0.689	.169	**1.99**
3+							1.163	.211	**3.20**	1.002	.214	**2.72**	1.001	.214	**2.72**	1.001	.214	**2.72**	0.947	.215	**2.58**	0.947	.216	**2.58**
FCS only							-0.233	.121	0.79	-0.252	.122	**0.78**	-0.247	.122	**0.78**	-0.250	.122	**0.78**	-0.258	.123	**0.77**	-0.261	.123	**0.77**
IIS with and without FCS							0.348	.162	**1.42**	0.398	.163	**1.49**	0.394	.163	**1.48**	0.395	.163	**1.48**	0.389	.164	**1.48**	0.391	.164	**1.48**
Child current injury							0.500	.121	**1.65**	0.517	.121	**1.68**	0.516	.121	**1.68**	0.517	.121	**1.68**	0.518	.121	**1.68**	0.518	.121	**1.68**
Child prior injury							0.154	.083	1.17	0.156	.085	1.17	0.158	.085	1.17	0.158	.085	1.17	0.149	.085	1.16	0.149	.085	1.16
Child current mental health							1.131	.276	**3.10**	1.080	.274	**2.94**	1.073	.274	**2.92**	1.076	.274	**2.93**	1.065	.275	**2.90**	1.068	.275	**2.91**
Child prior mental health							0.643	.191	**1.90**	0.667	.191	**1.95**	0.652	.191	**1.92**	0.659	.192	**1.93**	0.660	.193	**1.93**	0.666	.193	**1.95**
Child mental delay							-0.208	.651	0.81	-0.166	.659	0.85	-0.120	.659	0.89	-0.143	.660	0.87	-0.114	.660	0.89	-0.136	.661	0.87
Child chronic health problem							0.490	.524	1.63	0.512	.527	1.67	0.496	.528	1.64	0.504	.528	1.66	0.516	.531	1.67	0.524	.531	1.69
Child current delinquency							0.275	.229	1.32	0.295	.229	1.34	0.297	.229	1.35	0.297	.229	1.35	0.286	.230	1.33	0.286	.230	1.33
Child prior delinquency							0.248	.180	1.28	0.283	.181	1.33	0.278	.180	1.32	0.280	.181	1.32	0.293	.181	1.34	0.295	.181	1.34
Child special education							0.283	.106	**1.33**	0.278	.107	**1.32**	0.279	.107	**1.32**	0.278	.107	**1.32**	0.271	.108	**1.31**	0.269	.108	**1.31**
Parent current conviction							0.004	.346	1.00	-0.009	.345	0.99	-0.008	.345	0.99	-0.008	.345	0.99	-0.071	.346	0.93	-0.071	.346	0.93
Parent prior conviction							0.156	.282	1.17	0.156	.282	1.17	0.149	.282	1.16	0.151	.282	1.16	0.145	.283	1.16	0.148	.283	1.16
Parent current arrest							0.936	.317	**2.55**	0.912	.318	**2.49**	0.904	.318	**2.47**	0.906	.318	**2.48**	0.894	.318	**2.44**	0.897	.318	**2.45**
Parent prior arrest							0.485	.145	**1.62**	0.490	.146	**1.63**	0.491	.146	**1.63**	0.492	.146	**1.64**	0.489	.147	**1.63**	0.490	.147	**1.63**
Level 2																								
Child race (ref. White): Black										-0.432	.099	**0.65**	-0.373	.109	**0.69**	-0.403	.106	**0.67**	-0.376	.110	**0.69**	-0.406	.107	**0.67**
Other										-0.829	.357	**0.44**	-0.815	.358	**0.44**	-0.824	.358	**0.44**	-0.830	.361	**0.44**	-0.840	.362	**0.43**
Birth weight (ref. normal): low										0.146	.140	1.16	0.141	.140	1.15	0.142	.140	1.15	0.144	.141	1.15	0.145	.141	1.16
very low										0.375	.304	1.45	0.390	.304	1.48	0.381	.304	1.46	0.408	.307	1.50	0.400	.307	1.49
Birth year (ref. 1991): 1992										-0.053	.098	0.95	-0.049	.098	0.95	-0.051	.098	0.95	-0.048	.099	0.95	-0.050	.099	0.95
1993										0.086	.102	1.09	0.081	.103	1.08	0.084	.103	1.09	0.086	.104	1.09	0.089	.104	1.09
1994										0.038	.149	1.04	0.043	.149	1.04	0.041	.149	1.04	0.053	.151	1.05	0.051	.151	1.05
Child sex: female										0.133	.077	1.14	0.136	.077	1.15	0.134	.077	1.14	0.131	.077	1.14	0.129	.077	1.14
Medicaid at birth										-0.034	.085	0.97	-0.032	.085	0.97	-0.033	.085	0.97	-0.032	.086	0.97	-0.034	.086	0.97
Mom no high school										0.504	.086	**1.66**	0.506	.086	**1.66**	0.506	.086	**1.66**	0.516	.087	**1.68**	0.516	.087	**1.67**
Mom teen birth										-0.085	.090	0.92	-0.090	.090	0.91	-0.088	.090	0.92	-0.100	.091	0.91	-0.098	.091	0.91
Caregiver foster care										0.439	.180	**1.55**	0.446	.180	**1.56**	0.443	.180	**1.56**	0.439	.182	**1.55**	0.437	.182	**1.55**
Level 3																								
Impoverishment[a]													-0.050	.043	0.95				-0.048	.044	0.95			
Instability[a]													0.027	.038	1.03				0.031	.039	1.03			
Care burden[a]													0.001	.045	1.00				0.002	.045	1.00			
Poverty rate[a] (1 unit=10% point)																-0.016	.038	0.98				-0.015	.039	0.99
Mobility rate[a] (1 unit=10% point)																0.019	.032	1.02				0.022	.032	1.02
Child/adult ratio[a] (1 unit=0.1)																-0.002	.051	1.00				-0.003	.051	1.00
Random effect	Variance			Variance			Variance			Variance			Variance			Variance			Variance			Variance		
Level-2: Intercept	2.1944			2.1715			0.6814			0.6961			0.6924			0.6958			0.7219			0.7252		
Level-2: Current welfare																								
Level-3: Intercept	0.0000			0.0000			0.0000			0.0000			0.0000			0.0000			0.0000			0.0000		
Model fit: AIC	9684.0			9684.2			9462.4			9409.0			9413.0			9414.3			9399.5			9400.7		

Table 10 (continued)

	Model 9			Model 10			Model 11			Model 12			Model 13		
Fixed effect	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR
Level 1															
Intercept	-3.747	.149	-	-3.721	.148	-	-3.942	.167	-	-3.912	.165	-	-3.868	.131	-
Child age[a]	-0.014	.015	0.99	-0.014	.015	0.99	-0.011	.016	0.99	-0.011	.016	0.99	-0.012	.015	0.99
Current welfare	0.523	.091	**1.69**	0.522	.091	**1.68**	0.731	.132	**2.08**	0.727	.132	**2.07**	0.731	.131	**2.08**
Prior welfare[a] (1 unit=10% point)	0.123	.020	**1.13**	0.123	.020	**1.13**	0.129	.021	**1.14**	0.128	.021	**1.14**	0.117	.019	**1.12**
Child age[a] × Current welfare	-0.066	.019	**0.94**	-0.066	.019	**0.94**	-0.062	.019	**0.94**	-0.062	.019	**0.94**	-0.070	.018	**0.93**
Current welfare × Prior welfare[a]	-0.135	.028	**0.87**	-0.135	.028	**0.87**	-0.149	.030	**0.86**	-0.149	.030	**0.86**	-0.146	.029	**0.86**
TANF time limit	-0.256	.188	0.77	-0.258	.188	0.77	-0.206	.208	0.81	-0.209	.208	0.81			
TANF no limit	-0.230	.172	0.79	-0.230	.172	0.79	-0.255	.178	0.77	-0.256	.178	0.77			
Prior CPS report (ref. 0): 1	0.577	.109	**1.78**	0.578	.109	**1.78**	0.492	.115	**1.64**	0.492	.115	**1.64**	0.517	.112	**1.68**
2	0.731	.167	**2.08**	0.731	.167	**2.08**	0.587	.175	**1.80**	0.587	.175	**1.80**	0.610	.170	**1.84**
3+	1.021	.213	**2.78**	1.022	.214	**2.78**	0.918	.223	**2.50**	0.919	.223	**2.51**	0.968	.215	**2.63**
FCS only	-0.253	.122	**0.78**	-0.257	.122	**0.77**	-0.286	.127	**0.75**	-0.289	.127	**0.75**	-0.276	.126	**0.76**
IIS with and without FCS	0.387	.163	**1.47**	0.389	.163	**1.47**	0.423	.172	**1.53**	0.425	.172	**1.53**	0.434	.171	**1.54**
Child current injury	0.523	.121	**1.69**	0.524	.121	**1.69**	0.521	.125	**1.68**	0.522	.125	**1.69**	0.517	.124	**1.68**
Child prior injury	0.159	.085	1.17	0.159	.085	1.17	0.183	.089	**1.20**	0.183	.089	**1.20**	0.176	.087	**1.19**
Child current mental health	1.050	.275	**2.86**	1.054	.275	**2.87**	1.087	.288	**2.96**	1.090	.288	**2.97**	1.140	.285	**3.13**
Child prior mental health	0.625	.192	**1.87**	0.632	.192	**1.88**	0.714	.203	**2.04**	0.722	.203	**2.06**	0.720	.198	**2.05**
Child mental delay	-0.075	.655	0.93	-0.098	.656	0.91	-0.308	.708	0.74	-0.329	.709	0.72			
Child chronic health problem	0.507	.525	1.66	0.516	.525	1.67	0.706	.553	2.03	0.715	.553	2.04			
Child current delinquency	0.273	.229	1.31	0.273	.229	1.31	0.321	.236	1.38	0.322	.236	1.38			
Child prior delinquency	0.244	.181	1.28	0.246	.181	1.28	0.224	.190	1.25	0.226	.190	1.25			
Child special education	0.272	.107	**1.31**	0.270	.107	**1.31**	0.270	.114	**1.31**	0.269	.114	**1.31**	0.268	.112	**1.31**
Parent current conviction	-0.052	.345	0.95	-0.052	.345	0.95	-0.104	.359	0.90	-0.105	.359	0.90			
Parent prior conviction	0.134	.282	1.14	0.137	.282	1.15	0.228	.298	1.26	0.231	.299	1.26			
Parent current arrest	0.888	.317	**2.43**	0.890	.317	**2.44**	0.897	.326	**2.45**	0.901	.326	**2.46**	0.883	.326	**2.42**
Parent prior arrest	0.505	.145	**1.66**	0.506	.146	**1.66**	0.521	.153	**1.68**	0.522	.153	**1.69**	0.543	.147	**1.72**
Level 2															
Child race (ref. White): Black	-0.365	.109	**0.69**	-0.394	.106	**0.67**	-0.377	.114	**0.69**	-0.409	.112	**0.66**	-0.430	.103	**0.65**
Other	-0.821	.359	**0.44**	-0.831	.359	**0.44**	-0.866	.371	**0.42**	-0.878	.372	**0.42**	-0.850	.369	**0.43**
Birth weight (ref. normal): low	0.137	.140	1.15	0.138	.140	1.15	0.126	.146	1.13	0.128	.146	1.14			
very low	0.415	.303	1.52	0.407	.303	1.50	0.404	.321	1.50	0.395	.321	1.48			
Birth year (ref. 1991): 1992	-0.052	.098	0.95	-0.053	.098	0.95	-0.044	.103	0.96	-0.046	.103	0.96			
1993	0.069	.103	1.07	0.072	.103	1.07	0.069	.108	1.07	0.071	.108	1.07			
1994	0.029	.150	1.03	0.027	.150	1.03	0.066	.155	1.07	0.064	.155	1.07			
Child sex: female	0.125	.077	1.13	0.123	.077	1.13	0.104	.080	1.11	0.102	.080	1.11			
Medicaid at birth	-0.033	.085	0.97	-0.034	.085	0.97	-0.041	.089	0.96	-0.043	.089	0.96			
Mom no high school	0.506	.086	**1.66**	0.506	.086	**1.66**	0.526	.090	**1.69**	0.526	.090	**1.69**	0.489	.084	**1.63**
Mom teen birth	-0.103	.090	0.90	-0.101	.090	0.90	-0.111	.093	0.89	-0.110	.094	0.90			
Caregiver foster care	0.431	.179	**1.54**	0.429	.180	**1.53**	0.471	.186	**1.60**	0.469	.186	**1.60**	0.443	.184	**1.56**
Level 3															
Impoverishment[a]	-0.049	.043	0.95				-0.053	.045	0.95						
Instability[a]	0.029	.038	1.03				0.033	.040	1.03						
Care burden[a]	0.003	.045	1.00				0.006	.047	1.01						
Poverty rate[a] (1 unit=10% point)				-0.015	.038	0.98				-0.015	.040	0.98			
Mobility rate[a] (1 unit=10% point)				0.022	.032	1.02				0.024	.034	1.02			
Child/adult ratio[a] (1 unit=0.1)				-0.003	.051	1.00				-0.006	.053	0.99			
Random effect	Variance			Variance			Variance			Variance			Variance		
Level-2: Intercept	0.6830			0.6862			1.2369			1.2368			1.2349		
Level-2: Current welfare							1.3415			1.3423			1.3246		
Level-3: Intercept	0.0000			0.0000			0.0000			0.0000			0.0000		
Model fit: AIC	9389.0			9390.3			9358.4			9359.8			9339.2		

[a] Centered to grand mean. ref. = reference group. γ = coefficient. SE = standard error. OR = odds ratio. Significant odds ratios ($p < .05$) are in boldface.

Table 11 Aim 2: CAN Sample Models of Child Maltreatment Reporting Likelihoods.

	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6			Model 7			Model 8			Model 9		
Fixed effect	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR
Level 1																											
Intercept	-1.622	.050	-	-1.631	.047	-	-1.950	.068	-	-1.660	.132	-	-1.716	.140	-	-1.717	.139	-	-1.753	.161	-	-1.751	.150	-	-1.791	.112	-
Child age[a]				-0.053	.010	**0.95**	-0.112	.014	**0.89**	-0.119	.016	**0.89**	-0.121	.016	**0.89**	-0.120	.016	**0.89**	-0.120	.016	**0.89**	-0.119	.016	**0.89**	-0.127	.012	**0.88**
Prior welfare[a] (1 unit=10% point)							0.011	.016	1.01	0.010	.018	1.01	0.013	.018	1.01	0.012	.018	1.01	0.012	.018	1.01	0.012	.018	1.01			
TANF no limit							-0.242	.146	0.78	-0.198	.149	0.82	-0.197	.150	0.82	-0.193	.150	0.82	-0.200	.150	0.82	-0.195	.150	0.82			
Prior CPS report (ref. 1): 2							0.450	.083	**1.57**	0.439	.083	**1.55**	0.437	.083	**1.55**	0.436	.083	**1.55**	0.435	.083	**1.54**	0.434	.083	**1.54**	0.446	.082	**1.56**
3							0.824	.100	**2.28**	0.810	.100	**2.25**	0.811	.101	**2.25**	0.811	.101	**2.25**	0.813	.101	**2.25**	0.814	.101	**2.26**	0.830	.099	**2.29**
4+							1.245	.108	**3.47**	1.212	.109	**3.36**	1.208	.109	**3.35**	1.207	.109	**3.34**	1.203	.109	**3.33**	1.206	.109	**3.34**	1.225	.107	**3.40**
FCS only							-0.278	.082	**0.76**	-0.243	.082	**0.78**	-0.249	.082	**0.78**	-0.248	.082	**0.78**	-0.247	.082	**0.78**	-0.246	.082	**0.78**	-0.245	.082	**0.78**
IIS with and without FCS							0.067	.105	1.07	0.105	.105	1.11	0.111	.105	1.12	0.111	.105	1.12	0.112	.105	1.12	0.111	.105	1.12	0.101	.104	1.11
Child current injury							0.255	.137	1.29	0.252	.138	1.29	0.242	.138	1.27	0.239	.138	1.27	0.243	.138	1.27	0.239	.138	1.27			
Child prior injury							-0.084	.093	0.92	-0.078	.094	0.92	-0.084	.095	0.92	-0.084	.095	0.92	-0.085	.095	0.92	-0.084	.095	0.92			
Child mental health							0.431	.183	**1.54**	0.424	.183	**1.53**	0.428	.183	**1.53**	0.431	.183	**1.54**	0.431	.183	**1.54**	0.434	.183	**1.54**	0.457	.178	**1.58**
Child chronic medical issue							0.183	.419	1.20	0.221	.420	1.25	0.214	.421	1.24	0.213	.421	1.24	0.209	.421	1.23	0.208	.421	1.23			
Child delinquency							0.636	.212	**1.89**	0.686	.212	**1.99**	0.710	.212	**2.03**	0.712	.213	**2.04**	0.707	.212	**2.03**	0.709	.212	**2.03**	0.624	.210	**1.87**
Child special education							0.174	.107	1.19	0.142	.108	1.15	0.155	.108	1.17	0.154	.108	1.17	0.157	.108	1.17	0.152	.108	1.16			
Parent conviction							-0.096	.239	0.91	-0.099	.238	0.91	-0.087	.238	0.92	-0.086	.238	0.92	-0.085	.238	0.92	-0.085	.238	0.92			
Parent arrest							0.141	.117	1.15	0.144	.116	1.15	0.125	.117	1.13	0.126	.117	1.13	0.122	.117	1.13	0.120	.117	1.13			
Residential moves (ref. 0): 1							-0.074	.075	0.93	-0.084	.076	0.92	-0.089	.076	0.92	-0.088	.076	0.92	-0.087	.076	0.92	-0.087	.076	0.92			
2+							0.189	.178	1.21	0.154	.178	1.17	0.143	.179	1.15	0.143	.179	1.15	0.145	.179	1.16	0.145	.179	1.16			
Level 2																											
Child race (ref. White): Black										-0.245	.087	**0.78**	-0.197	.098	**0.82**	-0.194	.095	**0.82**	-0.163	.124	0.85	-0.161	.110	0.85	-0.250	.084	**0.78**
Other										-1.106	.563	**0.33**	-1.053	.564	0.35	-1.061	.565	0.35	-3.822	2.07	0.02	-2.026	1.11	0.13	-1.088	.563	0.34
Birth weight (ref. normal): low										0.008	.106	1.01	0.004	.106	1.00	0.004	.106	1.00	0.005	.106	1.01	0.006	.106	1.01			
very low										-0.555	.323	0.57	-0.558	.324	0.57	-0.555	.324	0.57	-0.556	.324	0.57	-0.555	.324	0.57			
Birth year (ref. 1991): 1992										-0.144	.084	0.87	-0.148	.084	0.86	-0.148	.084	0.86	-0.148	.084	0.86	-0.148	.084	0.86	-0.138	.083	0.87
1993										-0.242	.092	**0.79**	-0.245	.092	**0.78**	-0.243	.092	**0.78**	-0.245	.092	**0.78**	-0.245	.092	**0.78**	-0.262	.089	**0.77**
1994										-0.160	.130	0.85	-0.153	.130	0.86	-0.150	.130	0.86	-0.149	.130	0.86	-0.145	.130	0.86	-0.184	.126	0.83
Child sex: female										-0.074	.066	0.93	-0.074	.067	0.93	-0.074	.067	0.93	-0.074	.067	0.93	-0.074	.067	0.93			
Medicaid at birth										-0.132	.075	0.88	-0.131	.075	0.88	-0.132	.075	0.88	-0.128	.075	0.88	-0.130	.075	0.88			
Mom no high school										0.302	.076	**1.35**	0.301	.076	**1.35**	0.301	.076	**1.35**	0.300	.076	**1.35**	0.299	.076	**1.35**	0.287	.074	**1.33**
Mom teen birth										-0.167	.075	**0.85**	-0.157	.076	**0.86**	-0.158	.076	**0.85**	-0.157	.076	**0.85**	-0.159	.076	**0.85**	-0.158	.074	**0.85**
Caregiver foster care										0.303	.114	**1.35**	0.297	.115	**1.35**	0.298	.115	**1.35**	0.298	.115	**1.35**	0.301	.115	**1.35**	0.300	.113	**1.35**
Baseline no AFDC										-0.051	.141	0.95	-0.060	.142	0.94	-0.062	.142	0.94	-0.062	.142	0.94	-0.064	.142	0.94			
Level 3																											
Out of St. Louis													0.225	.133	1.25	0.222	.131	1.25	0.216	.135	1.24	0.214	.132	1.24			
Impoverishment[a]													0.000	.030	1.00				-0.027	.068	0.97						
Race_Black × Impoverishment[a]																			0.037	.073	1.04						
Race_Other × Impoverishment[a]																			-2.221	1.28	0.11						
Instability[a]													0.004	.038	1.00				0.008	.039	1.01						
Care burden[a]													0.003	.036	1.00				0.005	.036	1.00						
Poverty rate[a] (1 unit=10% point)																-0.009	.031	0.99				-0.044	.065	0.96			
Race_Black × Poverty rate[a]																						0.045	.068	1.05			
Race_Other × Poverty rate[a]																						-1.033	.732	0.36			
Mobility rate[a] (1 unit=10% point)																0.008	.030	1.01				0.010	.030	1.01			
Child/adult ratio[a] (1 unit=0.1)																0.017	.033	1.02				0.017	.033	1.02			
Random effect	Variance			Variance			Variance			Variance			Variance			Variance			Variance			Variance			Variance		
Level-2: Intercept	1.0065			0.9290			0.2255			0.1901			0.1926			0.1943			0.1915			0.1917			0.1945		
Level-3: Intercept	0.0023			0.0000			0.0127			0.0156			0.0158			0.0136			0.0151			0.0139			0.0145		
Model fit: AIC	7582.9			7557.8			7438.0			7414.2			7419.2			7418.8			7416.7			7419.3			7403.5		

[a] Centered to grand mean. ref. = reference group. γ = coefficient. SE = standard error. OR = odds ratio. Significant odds ratios ($p < .05$) are in boldface.

Table 12 Aim 2: AFDC Sample Models of Child Maltreatment Reporting Likelihoods.

	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6			Model 7			Model 8		
Fixed effect	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR	γ	SE	OR
Level 1																								
Intercept	-3.131	.105	-	-3.131	.105	-	-3.053	.103	-	-3.195	.241	-	-3.330	.249	-	-3.321	.250	-	-3.037	.286	-	-3.127	.265	-
Child age[a]				0.000	.015	1.00	-0.068	.023	**0.93**	-0.054	.025	**0.95**	-0.050	.025	**0.95**	-0.045	.026	0.96	-0.049	.025	0.95	-0.045	.026	0.96
Prior welfare[a] (1 unit=10% point)							-0.025	.024	0.98	-0.035	.026	0.97	-0.034	.026	0.97	-0.035	.026	0.97	-0.032	.026	0.97	-0.033	.026	0.97
TANF no limit							-0.231	.237	0.79	-0.270	.242	0.76	-0.285	.243	0.75	-0.265	.244	0.77	-0.306	.244	0.74	-0.283	.245	0.75
Prior CPS report (ref. 0): 1							0.552	.173	**1.74**	0.410	.179	**1.51**	0.416	.177	**1.52**	0.403	.179	**1.50**	0.420	.177	**1.52**	0.403	.178	**1.50**
2							0.949	.265	**2.58**	0.742	.274	**2.10**	0.766	.271	**2.15**	0.752	.273	**2.12**	0.769	.270	**2.16**	0.759	.272	**2.14**
3+							1.232	.314	**3.43**	1.002	.323	**2.72**	0.973	.320	**2.65**	0.962	.323	**2.62**	0.962	.320	**2.62**	0.940	.323	**2.56**
FCS only							-0.445	.197	**0.64**	-0.461	.203	**0.63**	-0.421	.202	**0.66**	-0.432	.203	**0.65**	-0.433	.202	**0.65**	-0.441	.203	**0.64**
IIS with and without FCS							0.431	.251	1.54	0.446	.259	1.56	0.437	.258	1.55	0.436	.259	1.55	0.432	.259	1.54	0.435	.260	1.54
Child current injury							0.507	.203	**1.66**	0.527	.205	**1.69**	0.541	.205	**1.72**	0.536	.205	**1.71**	0.544	.205	**1.72**	0.537	.205	**1.71**
Child prior injury							0.000	.151	1.00	-0.008	.155	0.99	0.014	.154	1.01	0.018	.155	1.02	0.014	.155	1.01	0.014	.155	1.01
Child mental health							1.020	.345	**2.77**	1.087	.353	**2.96**	0.975	.353	**2.65**	0.987	.354	**2.68**	0.975	.355	**2.65**	0.994	.357	**2.70**
Child chronic medical issue							0.948	.705	2.58	1.032	.730	2.81	0.930	.734	2.53	0.931	.740	2.54	0.918	.737	2.50	0.937	.742	2.55
Child delinquency							0.123	.383	1.13	0.119	.388	1.13	0.112	.390	1.12	0.124	.391	1.13	0.100	.392	1.11	0.123	.392	1.13
Child special education							0.086	.207	1.09	0.063	.213	1.07	0.098	.213	1.10	0.096	.213	1.10	0.089	.213	1.09	0.085	.214	1.09
Parent conviction							0.374	.421	1.45	0.437	.431	1.55	0.382	.431	1.47	0.387	.433	1.47	0.373	.432	1.45	0.389	.433	1.48
Parent arrest							0.689	.209	**1.99**	0.692	.217	**2.00**	0.690	.214	**1.99**	0.689	.216	**1.99**	0.680	.215	**1.97**	0.675	.217	**1.96**
Residential moves (ref. 0): 1							0.023	.121	1.02	-0.004	.123	1.00	-0.011	.123	0.99	-0.010	.123	0.99	-0.009	.123	0.99	-0.007	.123	0.99
2+							0.611	.276	**1.84**	0.543	.280	1.72	0.516	.279	1.68	0.520	.280	1.68	0.515	.280	1.67	0.517	.280	1.68
Level 2																								
Child race (ref. White): Black										-0.284	.166	0.75	-0.149	.177	0.86	-0.183	.176	0.83	-0.429	.224	0.65	-0.361	.195	0.70
Other										-1.266	.690	0.28	-1.198	.688	0.30	-1.200	.690	0.30	-1.632	.780	**0.20**	-1.644	.829	**0.19**
Birth weight (ref. normal): low										0.179	.200	1.20	0.166	.198	1.18	0.167	.199	1.18	0.163	.199	1.18	0.167	.200	1.18
very low										0.147	.489	1.16	0.199	.483	1.22	0.186	.486	1.20	0.190	.484	1.21	0.179	.488	1.20
Birth year (ref. 1991): 1992										0.120	.154	1.13	0.130	.152	1.14	0.141	.153	1.15	0.117	.153	1.12	0.124	.154	1.13
1993										0.226	.160	1.25	0.238	.158	1.27	0.254	.160	1.29	0.230	.159	1.26	0.239	.161	1.27
1994										0.141	.226	1.15	0.169	.225	1.18	0.191	.227	1.21	0.159	.226	1.17	0.183	.229	1.20
Child sex: female										-0.022	.116	0.98	-0.021	.115	0.98	-0.025	.116	0.98	-0.027	.116	0.97	-0.028	.116	0.97
Medicaid at birth										-0.057	.131	0.94	-0.066	.130	0.94	-0.066	.131	0.94	-0.072	.130	0.93	-0.076	.132	0.93
Mom no high school										0.490	.130	**1.63**	0.475	.129	**1.61**	0.484	.129	**1.62**	0.477	.129	**1.61**	0.488	.130	**1.63**
Mom teen birth										0.003	.129	1.00	0.012	.128	1.01	0.010	.129	1.01	0.006	.128	1.01	0.005	.129	1.00
Caregiver foster care										0.562	.243	**1.75**	0.569	.240	**1.77**	0.574	.242	**1.78**	0.572	.241	**1.77**	0.576	.243	**1.78**
Level 3																								
Out of St. Louis													0.366	.220	1.44	0.404	.216	1.50	0.435	.224	1.54	0.432	.218	**1.54**
Impoverishment[a]													-0.006	.043	0.99				0.223	.127	1.25			
Race_Black × Impoverishment[a]																			-0.251	.133	0.78			
Race_Other × Impoverishment[a]																			-0.539	.515	0.58			
Instability[a]													0.106	.056	1.11				0.089	.057	1.09			
Care burden[a]													-0.124	.052	**0.88**				-0.128	.052	**0.88**			
Poverty rate[a] (1 unit=10% point)																0.021	.045	1.02				0.226	.116	1.25
Race_Black × Poverty rate[a]																						-0.227	.121	0.80
Race_Other × Poverty rate[a]																						-0.863	.556	0.42
Mobility rate[a] (1 unit=10% point)																0.083	.044	1.09				0.076	.044	1.08
Child/adult ratio[a] (1 unit=0.1)																-0.104	.046	**0.90**				-0.102	.046	**0.90**
Random effect		Variance			Variance			Variance			Variance			Variance			Variance			Variance			Variance	
Level-2: Intercept		1.9980			1.9990			0.7482			0.8864			0.8268			0.8577			0.8445			0.8820	
Level-3: Intercept		0.0000			0.0000			0.0000			0.0000			0.0000			0.0000			0.0000			0.0000	
Model fit: AIC		3774.0			3776.0			3743.8			3735.7			3729.9			3732.1			3730.0			3730.8	

Table 12 (continued)

Fixed effect	Model 9 γ	Model 9 SE	Model 9 OR	Model 10 γ	Model 10 SE	Model 10 OR
Level 1						
Intercept	-2.901	.240	-	-2.993	.217	-
Child age[a]	-0.056	.021	**0.95**	-0.058	.021	**0.94**
Prior welfare[a] (1 unit=10% point)						
TANF no limit						
Prior CPS report (ref. 0): 1	0.439	.174	**1.55**	0.426	.175	**1.53**
2	0.797	.266	**2.22**	0.785	.266	**2.19**
3+	0.936	.314	**2.55**	0.910	.315	**2.48**
FCS only	-0.450	.201	**0.64**	-0.454	.202	**0.64**
IIS with and without FCS	0.404	.258	1.50	0.409	.259	1.51
Child current injury	0.544	.204	**1.72**	0.540	.204	**1.72**
Child prior injury	0.027	.152	1.03	0.024	.153	1.02
Child mental health	1.065	.348	**2.90**	1.091	.350	**2.98**
Child chronic medical issue						
Child delinquency						
Child special education						
Parent conviction						
Parent arrest	0.740	.207	**2.10**	0.734	.209	**2.08**
Residential moves (ref. 0): 1						
2+						
Level 2						
Child race (ref. White): Black	-0.473	.221	**0.62**	-0.395	.192	**0.67**
Other	-1.597	.781	**0.20**	-1.608	.828	0.20
Birth weight (ref. normal): low						
very low						
Birth year (ref. 1991): 1992						
1993						
1994						
Child sex: female						
Medicaid at birth						
Mom no high school	0.454	.120	**1.57**	0.461	.121	**1.58**
Mom teen birth						
Caregiver foster care	0.576	.240	**1.78**	0.578	.242	**1.78**
Level 3						
Out of St. Louis	0.485	.221	**1.62**	0.487	.215	**1.63**
Impoverishment[a]	0.250	.126	**1.28**			
Race_Black × Impoverishment[a]	-0.295	.130	**0.74**			
Race_Other × Impoverishment[a]	-0.537	.512	0.58			
Instability[a]						
Care burden[a]	-0.133	.052	**0.88**			
Poverty rate[a] (1 unit=10% point)				0.271	.114	**1.31**
Race_Black × Poverty rate[a]				-0.263	.119	**0.77**
Race_Other × Poverty rate[a]				-0.854	.550	0.43
Mobility rate[a] (1 unit=10% point)						
Child/adult ratio[a] (1 unit=0.1)				-0.101	.047	**0.90**
Random effect	Variance			Variance		
Level-2: Intercept	0.8633			0.8999		
Level-3: Intercept	0.0000			0.0000		
Model fit: AIC	3710.9			3711.9		

[a] Centered to grand mean. ref. = reference group. γ = coefficient. SE = standard error. OR = odds ratio. Significant odds ratios ($p < .05$) are in boldface.

5.3 Final Models

This section reports the results of the final multilevel growth curve models which were identified through the above model building processes described in section 5.2.

5.3.1 Final Models for Aim 1

Table 13 presents the final models for Aim 1.

Child Age

The risk of maltreatment reporting was substantially higher at younger ages. The likelihood of maltreatment reporting decreased by 13% per every one-year increase of child age in the CAN sample (OR = 0.87, 95% CI = 0.86-0.88). While the main term of child age was not significant in the AFDC sample (OR = 0.99, 95% CI = 0.96-1.02), child age was associated with maltreatment reports through interacting with current welfare. Per one-year increase of child age decreased the effect of current welfare by 7% in the AFDC sample (OR = 0.93, 95% CI = 0.90-0.97).

Current and Prior Welfare Receipt

Welfare receipt (AFDC or TANF) largely increased the risk of maltreatment reporting. The current receipt of welfare (current welfare) increased the likelihood of maltreatment reporting by 2.32 times in the CAN sample (OR = 2.32, 95% CI = 1.98-2.71) and by 2.08 times in the AFDC sample (OR = 2.08, 95% CI = 1.61-2.68). This relationship was substantially impacted by child age in the AFDC sample. The increase of the likelihood of a report related to current welfare receipt was 2.08 times at the mean age (child age was centered to its mean of 8.91), which was larger at younger ages (e.g., a 3.62-fold increase at age 1) and smaller at older ages (e.g., a 18% increase at age 17) in the AFDC sample.

The relationship between prior welfare (i.e., % of months on welfare from birth to the prior age) and maltreatment reports varied by current welfare. The main term of prior welfare indicated the relationship while not receiving welfare currently. When receiving welfare at the current age, the relationship was determined by the sum of the *prior welfare* main effect and the *current welfare* $\times$ *prior welfare* interaction effect.[3] While not receiving welfare currently, every 10-percentage-point increase in *prior welfare* increased the likelihood of maltreatment reporting by 8% for the CAN sample (OR = 1.08, 95% CI = 1.05-1.11) and by 12% for the AFDC sample (OR = 1.12, 95% CI = 1.08-1.17). While receiving welfare, this relationship disappeared for both the CAN sample (OR = 1.00, 95% CI = 0.97-1.03) and the AFDC sample (OR = 0.97, 95% CI = 0.93-1.02).

TANF time limit and no limit were considered for the control purposes during the modeling building processes. These predictors were not statistically significant in either sample (refer back to Table 9 and 10) and therefore not included in the final models.

Other Level-1 Predictors

Many other level-1 predictors were significantly associated with maltreatment reports (Table 13). Prior CPS involvement was related to current maltreatment reports. The direction of the association, however, differed by the nature of involvement. More prior maltreatment reports

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[3] Here and after, the sum of two coefficients and its standard error (SE), odds ratio (OR), and 95% confidence interval (CI) were calculated as follows:

Coefficient: $\gamma_3 = \gamma_1 + \gamma_2$

SE: $SE(\gamma_3) = \sqrt{\left(SE(\gamma_1)\right)^2 + \left(SE(\gamma_2)\right)^2 + 2 \times cov(\gamma_1, \gamma_2)}$

OR: $\exp(\gamma_3)$

95% CI: $\exp\left(\gamma_3 \pm 1.96 \times SE(\gamma_3)\right)$

were associated with higher likelihoods of maltreatment reporting in both samples. Family Centered Services were identified as a protective factor. Participating in these services was associated with 25% lower likelihoods of maltreatment re-reporting for the CAN sample (OR = 0.75, 95% CI = 0.67-0.85) and 24% for the AFDC sample (OR = 0.76, 95% CI = 0.59-0.97). Conversely, participating in Intensive In-home Services was found to be a risk indicator. Children who received Intensive In-home Services showed 17% higher likelihoods of re-reporting for the CAN sample (OR = 1.17, 95% CI = 1.00-1.37) and 54% for the AFDC sample (OR = 1.54, 95% CI = 1.10-2.16).

Children's emergency room (ER) visits were associated with risk of maltreatment reporting, but strength of effects differed by diagnoses and the timing of visit. Current visits had larger effect sizes than prior visits. For example, child current injury (i.e., having a current ER injury diagnosis) significantly increased the report likelihood by 53% in the CAN sample (OR = 1.53, 95% CI = 1.28-1.82) and by 68% in the AFDC sample (OR = 1.68, 95% CI = 1.31-2.14), while child prior injury had a smaller or nonsignificant effect. With regard to different effect sizes by diagnoses, child mental health had a larger effect size than child injury in both samples. Child current mental health significantly heightened the report likelihood by 3.96 times in the CAN sample (OR = 3.96, 95% CI = 2.80-5.59) and by 3.13 times in the AFDC sample (OR = 3.13, 95% CI = 1.79-5.47). Child prior mental health had a smaller effect size, but significantly increased the report likelihood by 38% in the CAN sample (OR = 1.38, 95% CI = 1.09-1.76) and by 2.05 times in the AFDC sample (OR = 2.05, 95% CI = 1.39-3.03). Other ER diagnoses (i.e., mental delay and chronic health problem) were entered without considering the timing of the visit (i.e., current versus prior) because of the nature of the conditions. Indication of a child's chronic health problem significantly increased the report likelihood by 86% in the CAN sample (OR = 1.86, 95% CI = 1.15-2.99).

Child behavioral issues and educational needs were related to maltreatment reports. Child current delinquency was significantly associated with higher risks of maltreatment reporting only in the CAN sample. Prior delinquency had no significant association in both samples. Child special education significantly increased the report likelihood in both samples.

Parent criminal issues were related to maltreatment reports in an interesting manner. Parent current conviction (prison, parole, or probation) did not significantly increase the report likelihood. Parent prior conviction decreased the report likelihood by 41% in the CAN sample (OR = 0.59, 95% CI = 0.40-0.86). On the other hand, parent current arrests generally increased the risk of maltreatment reporting in both samples. Parent prior arrest was significantly associated with the increased likelihood of maltreatment reporting in the AFDC sample.

Child Race

In both samples, non-White children showed lower risks of maltreatment reporting than White children while controlling for other predictors. Compared to Whites, the likelihood of maltreatment reporting for Blacks was 16% lower in the CAN sample (OR = 0.84, 95% CI = 0.74-0.95) and 35% lower in the AFDC sample (OR = 0.65, 95% CI = 0.53-0.80). The “other” race group also had a significantly lower likelihood of maltreatment reporting than Whites in both samples.

Other Level-2 Predictors

Several level-2 predictors were related to reports of child maltreatment. Children whose mothers had no high school degree at their birth had a significantly higher likelihood of maltreatment reporting than others in both samples. Mother’s own foster care placement in her youth also significantly increased the report likelihood in both samples. Child birth year was considered for control purposes, and the 1991 birth cohort tended to have somewhat higher risks of maltreatment reports than other cohorts in the CAN sample. Child sex, mother's teenage status at the subject child's birth, the receipt of Medicaid at the subject child's birth, and the baseline receipt of AFDC (for the CAN sample) had no significant association with maltreatment reports (refer back to Table 9 and 10) and therefore were not included in the final models.

Level-3 Predictors

No baseline neighborhood characteristic was significantly related to maltreatment reports. All baseline neighborhood factors (i.e., impoverishment, instability, and care burden) and variables (poverty rate, mobility rate, and child/adult ratio) showed no significant contribution to the model fit (refer back to Tables 9 and 10). Neighborhood-level predictors were therefore not included in the final models.

5.3.2 Final Models for Aim 2

The second aim of the current study (Aim 2) was to examine neighborhood contextual effects while tracing changes of residential neighborhoods. To avoid selection biases in updating residential addresses, observations were limited to only ages receiving welfare (AFDC or TANF) for Aim 2 as discussed in the "Methods" section. Table 14 reports the final models for Aim 2.

While no neighborhood-level predictors were statistically significant in the CAN sample, several were significantly associated with maltreatment reports in the AFDC sample. Compared to those staying in St. Louis, those moving out of St. Louis during follow-up showed 63% higher likelihoods of maltreatment reporting (OR = 1.63, 95% CI = 1.07-2.48) in the AFDC sample. The relationship between neighborhood poverty and maltreatment reporting was substantially different by child race in the AFDC sample. For Whites, every 10-percentage-point increase in neighborhood poverty rate significantly increased the report likelihood by 31% (OR = 1.31, 95% CI = 1.05-1.64). This relationship was significant neither for Blacks (OR = 1.01, 95% CI = 0.92-1.10) nor for other-race children (OR = 0.56, 95% CI = 0.19-1.60). Regarding child/adult ratio, children in neighborhoods with proportionally more children showed a somewhat lower likelihood of maltreatment reporting (OR = 0.90, 95% CI = 0.82-0.99) in the AFDC sample.

Compared to the final models for Aim 1, fewer predictors were significantly related to the risk of maltreatment reporting in the final models for Aim 2. This was mainly because the sample sizes for Aim 2 were smaller than for Aim 1 as observations were limited to only ages receiving welfare for Aim 2. Nevertheless, estimated likelihoods of maltreatment reporting were consistent between Aim-1 and Aim-2 models. This point will be further elaborated in the following "Prediction Graphs" section.

Table 13 Aim 1: Final Models of Child Maltreatment Reporting Likelihoods.

	CAN sample (N_1=25,258, N_2=2,111, N_3=235)			AFDC sample (N_1=24,552, N_2=1,923, N_3=210)		
Fixed effect	γ	SE	OR (95% CI)	γ	SE	OR (95% CI)
Level 1 predictors						
Intercept	-3.1529	.0878	-	-3.8676	.1307	-
Child age[a]	-0.1394	.0087	**0.87 (0.86, 0.88)**	-0.0125	.0147	0.99 (0.96, 1.02)
Current welfare	0.8402	.0807	**2.32 (1.98, 2.71)**	0.7311	.1307	**2.08 (1.61, 2.68)**
Prior welfare[a] (1 unit=10% point)	0.0768	.0130	**1.08 (1.05, 1.11)**	0.1174	.0192	**1.12 (1.08, 1.17)**
Child age[a] × Current welfare				-0.0704	.0183	**0.93 (0.90, 0.97)**
Current welfare × Prior welfare[a]	-0.0782	.0187	**0.92 (0.89, 0.96)**	-0.1457	.0288	**0.86 (0.82, 0.91)**
Prior CPS report:						
0	-	-	-			Reference group
1			Reference group	0.5165	.1122	**1.68 (1.35, 2.09)**
2	0.5308	.0638	**1.70 (1.50, 1.93)**	0.6097	.1696	**1.84 (1.32, 2.57)**
3 (3+ for AFDC sample)	0.9031	.0769	**2.47 (2.12, 2.87)**	0.9683	.2154	**2.63 (1.73, 4.02)**
4+	1.1529	.0852	**3.17 (2.68, 3.74)**	-	-	-
FCS only	-0.2842	.0610	**0.75 (0.67, 0.85)**	-0.2757	.1262	**0.76 (0.59, 0.97)**
IIS with and without FCS	0.1611	.0797	**1.17 (1.00, 1.37)**	0.4337	.1707	**1.54 (1.10, 2.16)**
Child current injury	0.4258	.0895	**1.53 (1.28, 1.82)**	0.5170	.1242	**1.68 (1.31, 2.14)**
Child prior injury	0.0877	.0620	1.09 (0.97, 1.23)	0.1760	.0875	**1.19 (1.00, 1.42)**
Child current mental health	1.3759	.1760	**3.96 (2.80, 5.59)**	1.1404	.2852	**3.13 (1.79, 5.47)**
Child prior mental health	0.3241	.1233	**1.38 (1.09, 1.76)**	0.7202	.1982	**2.05 (1.39, 3.03)**
Child chronic health problem	0.6179	.2429	**1.86 (1.15, 2.99)**	-	-	-
Child current delinquency	0.8090	.1500	**2.25 (1.67, 3.01)**	-	-	-
Child prior delinquency	0.1714	.1322	1.19 (0.92, 1.54)	-	-	-
Child special education	0.1527	.0699	**1.16 (1.02, 1.34)**	0.2682	.1122	**1.31 (1.05, 1.63)**
Parent current conviction	0.1591	.2477	1.17 (0.72, 1.91)	-	-	-
Parent prior conviction	-0.5307	.1925	**0.59 (0.40, 0.86)**	-	-	-
Parent current arrest	0.5223	.2071	**1.69 (1.12, 2.53)**	0.8828	.3256	**2.42 (1.28, 4.58)**
Parent prior arrest	0.0487	.0903	1.05 (0.88, 1.25)	0.5430	.1469	**1.72 (1.29, 2.30)**
Level 2 predictors						
Child race (ref. White): Black	-0.1751	.0622	**0.84 (0.74, 0.95)**	-0.4301	.1035	**0.65 (0.53, 0.80)**
Other	-0.8907	.3470	**0.41 (0.21, 0.81)**	-0.8503	.3688	**0.43 (0.21, 0.88)**
Birth year (ref. 1991): 1992	-0.1422	.0638	**0.87 (0.77, 0.98)**	-	-	-
1993	-0.2278	.0698	**0.80 (0.69, 0.91)**	-	-	-
1994	-0.1793	.0982	0.84 (0.69, 1.01)	-	-	-
Mom no high school	0.2613	.0563	**1.30 (1.16, 1.45)**	0.4886	.0837	**1.63 (1.38, 1.92)**
Caregiver foster care	0.2118	.0946	**1.24 (1.03, 1.49)**	0.4426	.1843	**1.56 (1.08, 2.23)**
Random effect	Variance			Variance		
Level-2: Intercept	0.6740			1.2349		
Level-2: Current welfare	0.6165			1.3246		
Level-3: Intercept	0.0000			0.0000		

[a] Centered to grand mean. N_1 = number of age-year observations. N_2 = number of children. N_3 = number of baseline residential tracts. ref. = reference group. γ = coefficient. SE = standard error. OR = odds ratio. CI = confidence interval. Significant odds ratios (p < .05) are in boldface.

Table 14 Aim 2: Final Models of Child Maltreatment Reporting Likelihoods.

Fixed effect	CAN sample (N_1=7,881, N_2=1,526, N_3=385)			AFDC sample (N_1=6,907, N_2=1,436, N_3=328)		
	γ	SE	OR (95% CI)	γ	SE	OR (95% CI)
Level 1 predictors						
Intercept	-1.7906	.1115	-	-2.9935	.2166	-
Child age[a]	-0.1269	.0119	**0.88 (0.86, 0.90)**	-0.0579	.0207	**0.94 (0.91, 0.98)**
Prior CPS report:						
0	-	-	-			Reference group
1			Reference group	0.4264	.1748	**1.53 (1.09, 2.16)**
2	0.4460	.0821	**1.56 (1.33, 1.83)**	0.7846	.2663	**2.19 (1.30, 3.69)**
3 (3+ for AFDC sample)	0.8301	.0993	**2.29 (1.89, 2.79)**	0.9099	.3153	**2.48 (1.34, 4.61)**
4+	1.2249	.1067	**3.40 (2.76, 4.20)**	-	-	-
FCS only	-0.2449	.0817	**0.78 (0.67, 0.92)**	-0.4535	.2019	**0.64 (0.43, 0.94)**
IIS with and without FCS	0.1012	.1043	1.11 (0.90, 1.36)	0.4095	.2592	1.51 (0.91, 2.50)
Child current injury	-	-	-	0.5401	.2042	**1.72 (1.15, 2.56)**
Child prior injury	-	-	-	0.0242	.1527	1.02 (0.76, 1.38)
Child mental health	0.4565	.1780	**1.58 (1.11, 2.24)**	1.0912	.3505	**2.98 (1.50, 5.92)**
Child delinquency	0.6239	.2102	**1.87 (1.24, 2.82)**	-	-	-
Parent arrest	-	-	-	0.7342	.2089	**2.08 (1.38, 3.14)**
Level 2 predictors						
Child race (ref. White): Black	-0.2497	.0840	**0.78 (0.66, 0.92)**	-0.3953	.1922	**0.67 (0.46, 0.98)**
Other	-1.0881	.5627	0.34 (0.11, 1.01)	-1.6078	.8279	0.20 (0.04, 1.01)
Birth year (ref. 1991): 1992	-0.1379	.0826	0.87 (0.74, 1.02)	-	-	-
1993	-0.2619	.0892	**0.77 (0.65, 0.92)**	-	-	-
1994	-0.1835	.1260	0.83 (0.65, 1.07)	-	-	-
Mom no high school	0.2871	.0743	**1.33 (1.15, 1.54)**	0.4605	.1210	**1.58 (1.25, 2.01)**
Mom teen birth	-0.1580	.0735	**0.85 (0.74, 0.99)**	-	-	-
Caregiver foster care	0.3003	.1135	**1.35 (1.08, 1.69)**	0.5783	.2422	**1.78 (1.11, 2.87)**
Level 3 predictors						
Out of St. Louis	-	-	-	0.4870	.2150	**1.63 (1.07, 2.48)**
Poverty rate[a] (1 unit=10% point)	-	-	-	0.2711	.1140	**1.31 (1.05, 1.64)**
Race_Black × Poverty rate[a]	-	-	-	-0.2630	.1192	**0.77 (0.61, 0.97)**
Race_Other × Poverty rate[a]	-	-	-	-0.8543	.5497	0.43 (0.14, 1.25)
Child/adult ratio[a] (1 unit=0.1)	-	-	-	-0.1013	.0467	**0.90 (0.82, 0.99)**

Random effect	CAN sample Variance	AFDC sample Variance
Level-2: Intercept	0.1945	0.8999
Level-3: Intercept	0.0145	0.0000

[a] Centered to grand mean. N_1 = number of age-year observations. N_2 = number of children. N_3 = number of baseline residential tracts. ref. = reference group. γ = coefficient. SE = standard error. OR = odds ratio. CI = confidence interval. Significant odds ratios (p < .05) are in boldface.

5.4 Prediction Graphs

The current study plotted prediction graphs to clarify the complex interactions among predictors. The estimated probabilities of maltreatment reporting by child age, child race, and the receipt of welfare (AFDC or TANF) based on the final models for Aim 1 are presented in Figures 1, 2, and 3. For these estimates, all other predictors were fixed to their grand mean. Overall, the report probability was much higher for the CAN sample than for the AFDC sample, especially at younger child ages (Figure 1). The report probability decreased substantially with the increase of child age in the CAN sample regardless welfare receipt. In the AFDC sample, the report probability decreased by increasing child age among children currently on welfare, while the probability was held almost constant across ages among those currently not on welfare (Figure 1). The gap in the report probability between current welfare recipients and non-recipients persisted throughout most ages in both samples, but substantially diminished at older ages in the AFDC sample (Figure 1). Regarding prior welfare, a longer stay on welfare (i.e., 75% versus 25% of the time) increased future report probabilities only for those currently not on welfare (Figure 2). Current welfare appeared to overrule the effect of prior welfare in both samples as prior welfare did not increase the report probability when children were currently receiving welfare. In the CAN sample, the effect size of prior welfare was practically "0" when currently receiving welfare, and accordingly the corresponding prediction lines (i.e., "Current welfare=yes, Prior welfare=75%" and "Current welfare=yes, Prior welfare=25%" lines) were almost completely overlapped (Figure 2). Among the AFDC-sample children currently on welfare, those with a *longer* history of prior welfare had a slightly *lower* report probability (Figure 2). This difference, however, was statistically meaningless. In terms of child race, Blacks had a significantly lower probability of maltreatment reporting than Whites while controlling for risk and protective factors (Figure 3).

Figure 4 presents the estimated report probabilities by child age and race based on the final models for Aim 2. As children were observed only while receiving welfare currently for Aim 2, it was expected that the prediction lines based on Aim-2 models were similar to those lines for children currently on welfare (i.e., Current welfare=yes) based on Aim-1 models. As expected, these lines were similar (see Figure 3 and 4), suggesting that estimated report probabilities were consistent between the Aim-1 and Aim-2 models. This consistency provided further confidence in neighborhood-level findings by the Aim-2 models.

Figure 5 presents the predicted probability of maltreatment reporting by child race and neighborhood poverty by Aim-2 models. For the CAN sample, the full model (Model 8 in Table 11) was used instead of the final model. For the AFDC sample, the final model was used. In the CAN sample, there was no significant association between neighborhood poverty and child maltreatment reports for both Whites and Blacks. In the AFDC sample, interactions between race and neighborhood poverty was found. For Whites, the report probability increased with the increase of neighborhood poverty rates, while the probability was held almost constant across the levels of neighborhood poverty for Blacks. As a result, Whites were at a higher risk of maltreatment reporting than Blacks in high-poverty neighborhoods while controlling for other predictors. Modeling this interaction between race and neighborhood poverty, however, had marginal improvement of model fit. This was because White children residing in high-poverty neighborhoods were small in number (Figure 5).

Estimates for "Other" race are not presented due to the rarity of children fitting this category in the St. Louis child population and thus in the current study's samples.

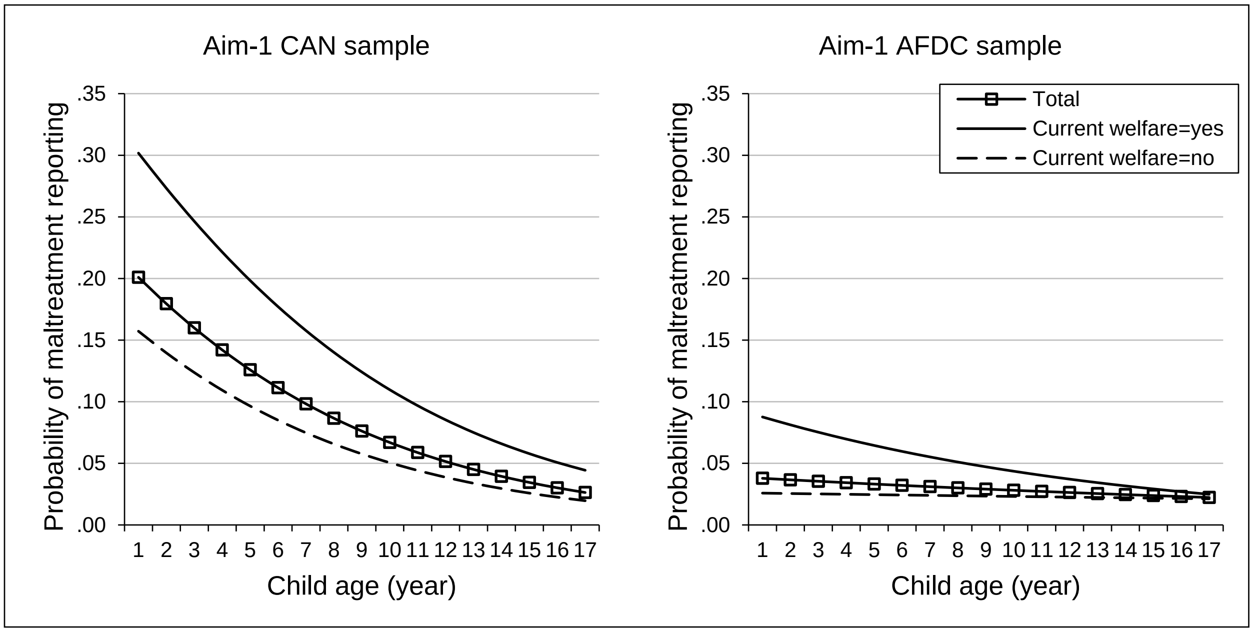

Figure 1. Estimated report likelihoods by child age and current welfare (Aim 1).
Note: Estimates are based on the Aim-1 final models. All other variables are fixed to their grand mean.

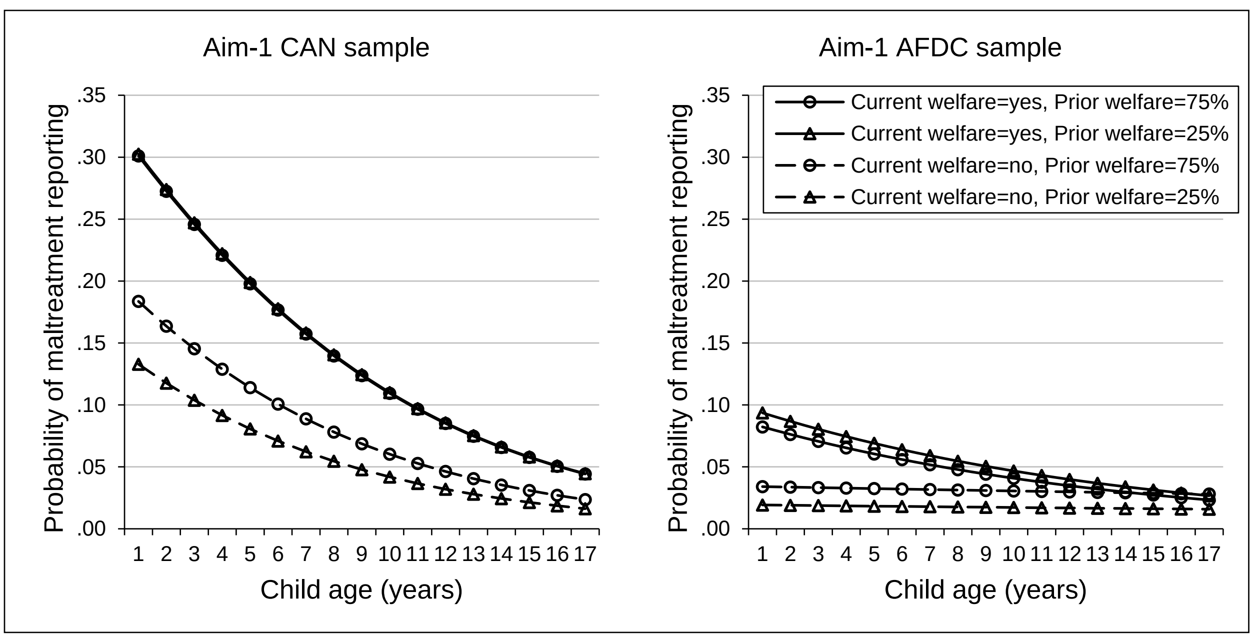

Figure 2. Estimated report likelihoods by child age, current welfare and prior welfare (Aim 1).
Note: Estimates are based on the Aim-1 final models. All other variables are fixed to their grand mean.

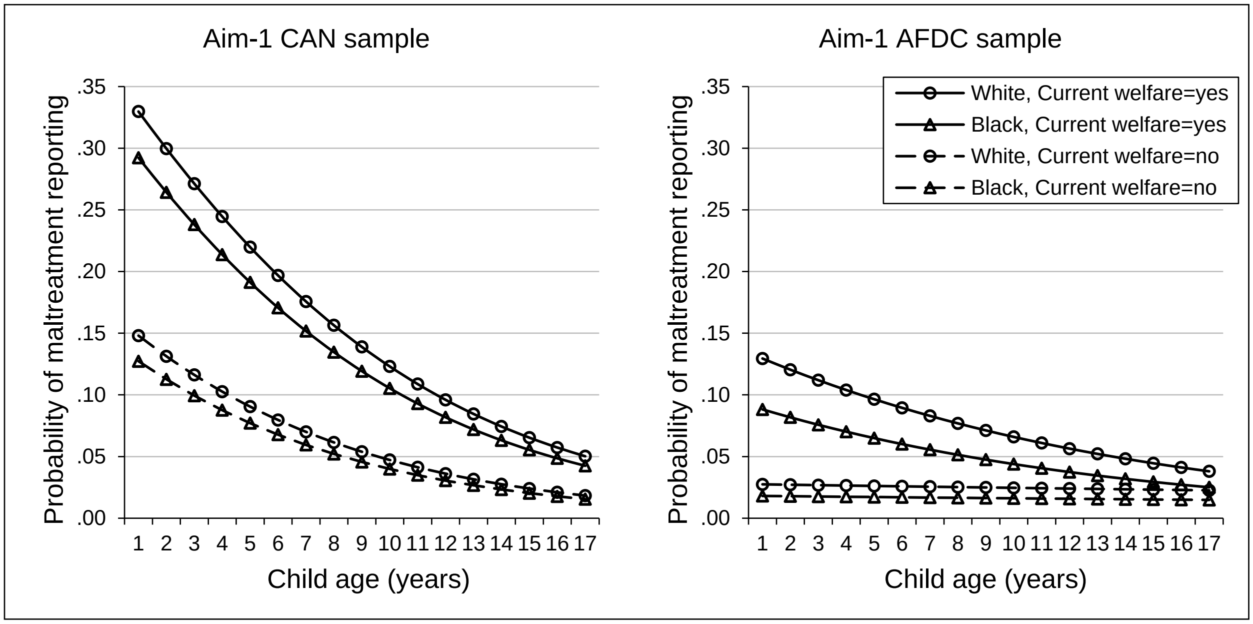

Figure 3. Estimated report likelihoods by child age, current welfare and child race (Aim 1).
Note: Estimates are based on the Aim-1 final models. All other variables are fixed to their grand mean.

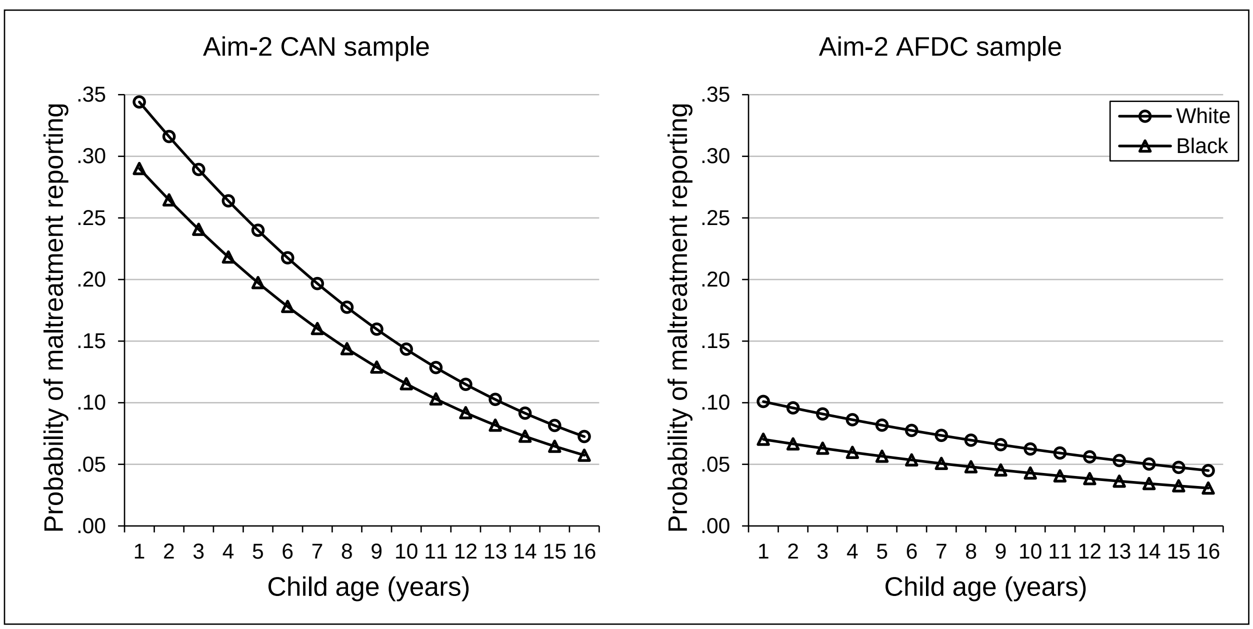

Figure 4. Estimated report likelihoods by child age and child race (Aim 2).
Note: Estimates are based on the Aim-2 final models. All other variables are fixed to their grand mean.

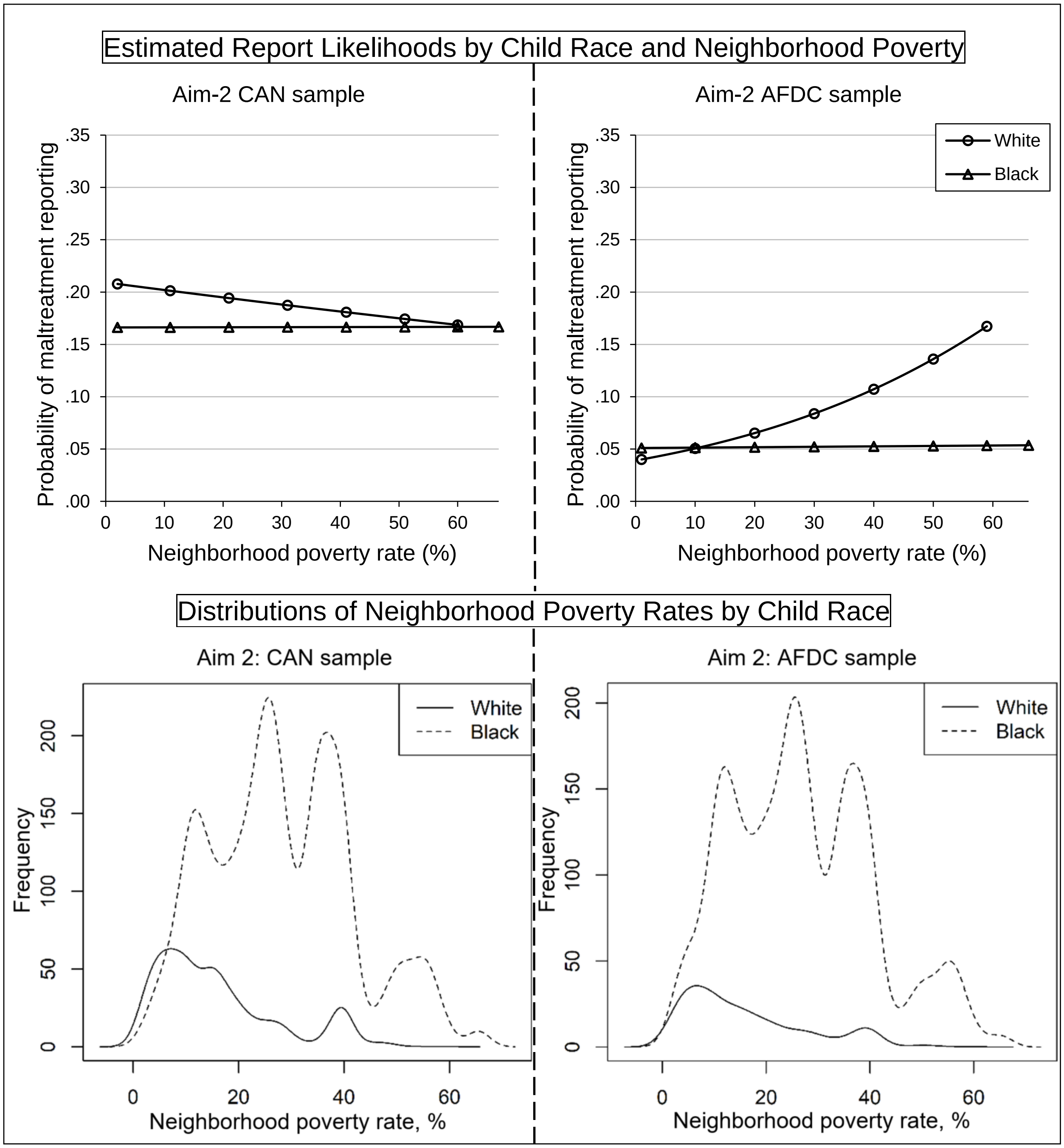

Figure 5. Child race, neighborhood poverty, and child maltreatment reports (Aim 2).
Note: It is worth noting that for Aim 2, only age-year observations on welfare were selected for both CAN and AFDC samples. This selection made these samples socioeconomically similar. Both samples were on welfare currently by this section. Furthermore, 91.3% of the CAN sample were on welfare at the baseline, and 100% of the AFDC sample were on welfare at the baseline. The mean percentage of months on welfare (Prior Welfare) was 85% for the CAN sample and 81% for the AFDC sample (refer back to Table 5). Estimates for the CAN sample are based on Model 8 in Table 11. Estimates for the AFDC sample are based on Model 10 in Table 12. All other variables are fixed to their grand mean. Horizontal ranges of graphs are corresponding race-specific ranges of neighborhood poverty rates.

Chapter 6 Discussion

Along with the increased use of ecological perspectives in child welfare, our understanding of risk and protective factors for child maltreatment within the broader community and policy contexts has rapidly advanced (Drake & Jonson-Reid, 2014; Drake & Zuravin, 1998; Pelton, 1978, 1994, 2015). The current study first examined child age, welfare receipt, race, and baseline neighborhood contexts in their relationships with child maltreatment reports in a longitudinal setting while tracing children from age 1 to 17 years and considering other various risk and protective factors (Aim 1). Then, the relationships between current neighborhood contexts and child maltreatment reports were examined (Aim 2).

6.1 Summary of Findings

This section *provides an overview of* findings to answer the research questions. The findings will be *discussed* in the following section.

6.1.1 Aim 1 (to examine longitudinal patterns of maltreatment reports)

Question 1. *Does the risk of maltreatment reporting vary by child age?* The current study found that the risk of maltreatment reporting was generally higher at younger ages. In the CAN sample, the risk decreased with the increase of child age. In the AFDC sample, the relationship between child age and maltreatment reporting differed by current welfare (AFDC/TANF) receipt. While receiving welfare currently, the risk was more pronounced at younger ages. While not receiving welfare currently, the risk was not significantly higher at younger ages.

Question 2. *Does the risk of maltreatment reporting vary by welfare (AFDC/TANF) receipt?* It was found that current welfare receipt was strongly associated with the risk of maltreatment reporting. In the CAN sample, the current receipt of welfare was associated with increasing the risk by 2.32 times. While there was no interaction between current welfare receipt and child age in the CAN sample, the relationship between current welfare receipt and the risk of maltreatment reporting was more pronounced at younger ages in the AFDC sample. Current welfare receipt increased risk by 3.62 times at age 1 but, by only 18% at age 17 in the AFDC sample. The current study found a significant interaction effect between current welfare receipt and prior welfare receipt in both samples. Prior welfare receipt increased the risk only for those children not currently receiving welfare. While currently receiving welfare, prior welfare receipt did not additionally increase the risk.

Question 3. *Does the risk of maltreatment reporting vary by child race?* This study found that the risk of maltreatment reporting was lower for non-White children than for White children in both samples. Compared to Whites, the risk was lower for Blacks by 16% in the CAN sample and 35% in the AFDC sample. The risk was also substantially lower for other-race children than for Whites in both samples. It was found that child race had no interaction with child age and welfare receipt, suggesting that non-White children consistently had a lower risk than White children at all levels of child age and welfare receipt status in both samples.

Question 4. *Does the risk of maltreatment reporting vary by baseline neighborhood characteristics?* The current study examined *baseline* neighborhood factors (i.e., impoverishment, instability, and care burden) and variables (i.e., poverty rate, mobility rate, and child/adult ratio). No *baseline* neighborhood characteristic was found to be significantly associated with the risk of maltreatment reporting in both samples.

Question 5. *Does the risk of maltreatment reporting vary by other risk and protective factors?* The current study found that various other risk and protective factors were associated with the risk of maltreatment reporting. The risk was higher for children with more prior maltreatment reports in both samples. The risk was lower for children who received Family Centered Services, but the risk was higher for children who received Intensive In-home Services in both samples. The risk also varied by time-varying child characteristics, including child current injury (both samples), child prior injury (the AFDC sample), child current and prior mental health (both samples), child chronic health problem (the CAN sample), child current delinquency (the CAN sample), and child special education (both samples). Parent prior conviction decreased the risk (the CAN sample), while parent arrest increased the risk (both samples). Among baseline characteristics, maternal low education and history of foster care placement were associated with increased risk (both samples). Regarding the time proximity of a problem, the current status of a problem (e.g., child current mental health) generally increased the risk to a larger degree than the prior history of the same problem (e.g., child prior mental health) in both samples.

6.1.2 Aim 2 (to examine neighborhood contextual effects)

Question 6. *Does the risk of maltreatment reporting vary by neighborhood characteristics?* For Aim 2, the current study selected only age-year observations on welfare (AFDC/TANF) to trace changes of residential neighborhoods based on welfare records. In the CAN sample, no neighborhood characteristic had a significant association with the risk of maltreatment reporting. In the AFDC sample, some neighborhood characteristics were related to the risk. First, neighborhood poverty increased the risk for White children, while risk was almost constant across the levels of neighborhood poverty for Black children (the AFDC sample). Second, risk was lower for children residing in neighborhoods with proportionally more children (the AFDC sample). Last, risk was higher for children moving out of St. Louis than for those staying in St. Louis (the AFDC sample). In both samples, neither neighborhood instability nor neighborhood mobility rate were significantly associated with risk.

Question 7. *Does the risk of maltreatment reporting vary by other risk and protective factors?* The current study found that fewer risk and protective factors were significantly associated with the risk of maltreatment reporting in the (CAN and AFDC) samples for Aim 2 than for Aim 1. This was mainly because of the smaller size of the Aim-2 samples. Yet, the remaining significant predictors were generally associated with the risk in a similar way between Aim 1 and 2. There were two primary differences. First, family residential moves were considered in only the Aim-2 samples and there was no significant association between family residential moves and the risk of maltreatment reporting in both Aim-2 (CAN and AFDC) samples. Second, in the Aim-2 CAN sample, the mother being a teenager at the time of the subject child's birth decreased the risk of maltreatment reporting during the follow up period.

6.2 Discussion of Findings

This section provides a discussion of the study findings.

6.2.1 Time and Child Age

Prior multilevel studies found that 93% or more of the variance in child maltreatment risks was between individuals (i.e., children or families), while 7% or less of the variance was between neighborhoods (Coulton et al., 1999; Irwin, 2009; Kim & Drake, 2017; Kim, 2004; Merritt, 2009; Molnar et al., 2003). By longitudinally tracing children from early childhood to adolescence, the current study was able to separate out, for the first time, the proportion of the variance between age-year observations within children. It was found that 33% to 40% of the variance was between children and less than 1% was between neighborhoods. Over 60% of the variance was attributable to between-observation variation.

These findings indicated that the risk of maltreatment reporting mainly varied by time. A substantial part of the variance was between children. That was, however, much smaller than the portion of variance attributable to time. This suggests that although there are children who are generally at high risk, these risks often vary by time rather than remaining constant over the life course. The absence of low-risk children in the study samples might slightly increase the proportion of the variance between age-year observations because the risks of those children might be most likely to stay at low levels over time.

With regard to a more directional relationship between time and child maltreatment, prior longitudinal studies have found that the risk of child maltreatment was substantially higher at younger ages in general populations at the bivariate level (Kim et al., 2017; Sabol et al., 2004; Wildeman et al., 2014) and at the multivariate level (Irwin, 2009). The current study found a similar trend among high-risk children. This is also consistent with a prior longitudinal study of recurrent maltreatment which finds a very high recidivism rate for children reported in early childhood (Putnam-Hornstein, Simon, Eastman, & Magruder, 2015). It is possible that the risk of child maltreatment decreases as children get older due to reduced age-related vulnerabilities (e.g., autonomy and care burden).

The current study extended prior work by examining this trend by risk level. It was found that this trend was more pronounced among those children with more or higher degrees of risk factors. First, the negative association between child age and the risk of maltreatment reports was stronger in the CAN sample than in the AFDC sample. The rate of maltreatment reports decreased from 20.0% to 2.6% for the CAN sample and from 3.8% to 2.2% for the AFDC sample while child age increased from 1 to 17 years (Figure 1). There might be underlying risk factors (i.e., not observed by the current study) among the CAN children which led to their experience of reported maltreatment in early childhood (i.e., at baseline) might also link to increasing the risk of recurrence during follow-up, especially at younger ages. Conversely, the AFDC children had no reported maltreatment in early childhood while experiencing low family SES. This suggested that the AFDC children might have underlying protective factors which prevented their low SES leading to early childhood maltreatment and also lowered the future maltreatment risk.

The current study also found a similar trend in the interaction between child age and current welfare (AFDC/TANF) receipt. In the AFDC sample, the difference in the risk of maltreatment reporting between AFDC/TANF recipients and non-recipients was more evident at younger ages (Figure 1). A similar interaction was also found in a prior study following up a general child population for six years (Irwin, 2009). These findings suggest differential sensitivity in parental behaviors to welfare receipt by child age.

During the follow-up period (i.e., 1995-2009), there was a decrease of both rates of children receiving AFDC/TANF and proportions of eligible families participating in AFDC/TANF in the US and also Missouri (ACF, n.d.; ASPE, 2017). This may suggest that the sensitivity of the current study's welfare receipt indicator to catch eligible families might be reduced at older child ages (i.e., the later period of follow-up). If this is the case, the interaction between child age and the current welfare receipt might be at least partly explained by this historical trend.

The current study's findings support the critical importance of early intervention. It was found that children with reported maltreatment in early childhood (the CAN sample) had a substantially higher risk of future reporting than children who merely received welfare (AFDC) with no reported maltreatment in early childhood (the AFDC sample). This finding suggests that the family context in early childhood substantially shaped the future risk of maltreatment reporting.

When longitudinally tracing children, the risk of maltreatment reporting was much higher at younger ages, especially for those at a higher risk of future maltreatment. This also supports the need for early intervention.

6.2.2 AFDC/TANF Receipt

The current study examined the relative contributions of current and prior history of welfare (AFDC/TANF) receipt to the risk of maltreatment reporting. With regard to current welfare receipt, it was found that the risk was much higher when receiving welfare currently than when not receiving welfare. For children with reported maltreatment in early childhood (the CAN sample), this gap was maintained at a 2.3-fold difference across a range of ages (Figure 1). Among children without reported maltreatment but with an active AFDC case in early childhood (the AFDC sample), the gap was more pronounced at younger ages and highest at age 1, showing a 3.6-fold difference.

Interestingly, the current study found a considerable interaction between current and prior welfare receipt. The cumulative history of prior welfare receipt increased the risk of maltreatment reporting for only those children not currently receiving welfare (Figure 2). Current welfare receipt appeared to be more important than the impact of prior welfare receipt (Figure 2). Unfortunately, there is a lack of evidence allowing generalization of this interaction to other populations or a more advanced discussion of possible theoretical rationales for this interaction.

The current study took TANF time limits into account. It was found that TANF time limits had no significant association with the risk of maltreatment reporting. This might be because the 60-month time limit was mostly relevant to older ages, at which the risk of maltreatment reporting was much lower and the gap in the risk by welfare receipt was also much narrower.

Bias and Confounding

The link between welfare (AFDC/TANF) receipt and maltreatment reporting has several concerns relating to bias and confounding. The first concern is the allegedly increased visibility to professional reporters because of participating in welfare services. Emerging evidence, however, clearly stands against the idea of visibility bias as discussed in Chapter 2. A prior study using Missouri statewide data, in which the current study's site was nested, found no evidence for the increased visibility to a public sector due to poverty at the neighborhood level (Drake et al., 2009). A different prior study using national data also showed that the increase of poverty was not associated with proportionally more reports from professionals than from non-professionals at both county and individual levels (Kim et al., 2018). Two studies employing different data sets found no evidence of substantial bias due to surveillance by service providers (Chaffin & Bard, 2006; Drake et al., 2017). Further very few reports proportionally come from social service providers across the nation; social service providers comprise only about 11% of all reports made (U.S. Department of Health and Human Services, 2018).

The second concern is in the matter of a possible differential reports to CPS because of class bias rather than an actual effect of economic conditions. The idea here is that welfare recipients are more likely to be reported due to the purported negative prejudice toward "poor" families. As previously discussed, recent evidence rebuts this idea. The parent study, from which the current study's data were drawn, found no evidence of increased reports due to class bias (Jonson-Reid et al., 2009). Rather, the study found evidence which is exactly opposite to what the class bias hypothesis would suggest.

Another issue relates to the possible confounding effect of marital status. Single-parent families dominate the TANF caseload. In 2009, the proportion of single parents among adult recipients was 85.6% nationally and 89.8% in Missouri (Office of Family Assistance, 2010). This strong relationship between marital status and TANF receipt suggests that it was possible that the welfare-maltreatment relationship could be largely confounded by marital status. Prior studies in this area suggest that this is unlikely. These studies all found that welfare receipt (Epstein, 2001; Irwin, 2009; McDaniel & Slack, 2005; Slack et al., 2003) and socioeconomic indicators (e.g., employment, economic hardship, and socioeconomic disadvantages) (Courtney et al., 2005; Dworsky et al., 2007; Epstein, 2001; Maguire-Jack & Klein, 2015) were strongly associated with child maltreatment while controlling for marital status and other variables. Conversely, these studies mostly found that marital status was not significant while controlling for other variables including welfare receipt or socioeconomic indicators.

AFDC/TANF Receipt as a Possible Proxy of Economic Conditions

The current study had no data to directly evaluate economic conditions for recipients and non-recipients of AFDC/TANF. As study samples received AFDC at baseline mostly (the CAN sample) or entirely (the AFDC sample), it might be possible that the difference in economic conditions by welfare receipt status during follow-up were not large enough to meaningfully differentiate the risk of maltreatment reporting. So-called "welfare leavers" studies, which investigate economic conditions of those who exit AFDC/TANF, may be informative here. Several studies investigated earnings (i.e., income from work) of an exit cohort (i.e., those being off AFDC/TANF at least two months after the exit). These studies consistently found a sharp increase of earnings after exit. One study followed up the 1996 and 1998 exit cohorts of Cuyahoga County (Ohio) and found that median quarterly earnings of both cohorts increased from about $1,500 (pre-exit) to over $2,500 (post-exit) (Verma & Coulton, 2001). A different study for the 1998 exit cohort of three counties in California found a similar trend and found that median quarterly earnings were about $2,000 prior to exit and increased to over $3,000 after exit (Moses, Mancuso, & Lieberman, 2000). Other studies examined income while including all incomes sources (e.g., earnings, welfare benefits, and child support) of welfare leavers. A study using data from multiple states (not necessarily statewide) including California, Connecticut, Florida, Georgia, Michigan, Minnesota, Ohio, Oklahoma, Oregon, and Vermont (C. Miller, 2002) identified that the average monthly income of leavers ($1,517) and cyclers ($1,443) were higher than that of stayers ($1,237). There is another prior study which surveyed the 1996 exit cohort (i.e., those staying off AFDC/TANF for at least two months after exit) in Missouri, where the current study's site is nested (Acs & Loprest, 2001). That study found that post-exit monthly incomes were $1,427 (mean) and $1,166 (median) both of which were higher than the maximum possible income while being on TANF. Consistent with these findings for increasing earnings or incomes after exiting AFDC/TANF, prior studies have found that improvement in economic conditions is the prevailing reason for leaving TANF (Coulton, Lickfelt, Lalich, & Cook, 2005; Loprest, 2002; Moses et al., 2000; Ovwigho et al., 2003). These welfare leaver studies suggest that there might be a meaningful difference in economic conditions by welfare (AFDC/TANF) receipt status in the current study's data.

A prior experimental study found that a moderate increase of income (about $100) reduced the risk of maltreatment reporting at a statistically significant level (Cancian et al., 2013). The observed increase of the post-exit income by welfare leavers studies was substantially higher than that found in this experimental study. Given the tight income eligibility limit for Missouri AFDC/TANF programs, it is possible that several hundred dollars increase of monthly income may be able to substantially reduce the risk of maltreatment reporting for welfare leavers. If this is the case, the current study's findings may suggest a strong relationship between maltreatment reporting and economic conditions, especially a far more powerful relationship with current economic conditions than with cumulative history of prior economic conditions.

There is also recent evidence suggesting causal links between economic factors and child maltreatment (Cancian et al., 2013; Rostad et al., 2017; Slack et al., 2017). Hypothetically, if poverty or low income is associated with maltreatment (either onset or recurrence) then intervening to alleviate economic conditions at some level should reduce risk. Such approaches are only beginning to be adequately tested but results do support the idea that economic factors have a causal impact on maltreatment.

AFDC/TANF Receipt as a Possible Proxy of Non-Economic Factors

Prior studies have found that families recently leaving AFDC/TANF may make more money, but still face high levels of material hardship (Boushey & Gundersen, 2001; C. Miller, 2002). This suggests that given the fact that all or most of study samples were on AFDC at baseline, their "exit" of AFDC/TANF during follow-up might provide only a small improvement of their economic conditions. If this is the case, welfare receipt should proxy non-economic factors to explain a substantial part of the over two times increase of the risk by welfare receipt in the current study. There are two possibilities. First, receiving welfare *per se* (e.g., administrative burden) may possibly increase the risk. Second, family characteristics may play a role in welfare receipt status, and may be associated with risk.

It may be that the welfare-maltreatment relationship derives from the influence of receiving welfare *per se*—for example, secondary to administrative burdens experienced while participating in AFDC/TANF. Moynihan and colleagues identify three broad types of administrative burdens: learning, psychological, and compliance burdens (Moynihan, Herd, & Harvey, 2015). Welfare recipients may need to learn about AFDC/TANF programs, benefits, and eligibility (learning burdens). While receiving AFDC/TANF, participants may encounter stigma, loss of autonomy due to program rules, and stresses from administrative processes (psychological burdens). Maintaining benefits requires following various requirements, such as documentation, work activities, and drug test requirements (compliance burdens). Several types of psychological distress have been suggested relating to such administrative burdens—for example, anxiety, depression (Cheng, 2007), stress (Moynihan et al., 2015), and stigma (Moffitt, 1983; Stuber & Schlesinger, 2006). It is possible that experiencing such administrative burdens is the main reason for the increased risk by welfare receipt in the current study.

Another possibility is that qualified families for welfare (AFDC/TANF) may be more likely to receive or not receive benefits due to other factors. These same other factors might also be related to the risk of maltreatment reporting. First, prior studies have identified that among eligible families, recipients are more likely to be unemployed, to have lower income, and not to own a car (Moffitt, 1992; Nicoll, 2015; Zedlewski, 2002). These characteristics suggest that non-recipients are economically somewhat better off than recipients, supporting the idea that welfare receipt indicates lower economic conditions even among eligible families. Second, prior studies have found that parental age, child age, education level, race, and neighborhood contexts (i.e., poverty or unemployment rates) are related to welfare receipt among eligible families (Moffitt, 1992; Nicoll, 2015; Zedlewski, 2002). These characteristics, however, were controlled for in the current study. Third, marital status (e.g., living alone, never married, or female headed household) was found to be related to welfare receipt of eligible families (Moffitt, 1992; Nicoll, 2015; Zedlewski, 2002). Prior studies found, however, that after controlling for economic conditions marital status was not significantly related to neither welfare receipt (Nicoll, 2015) nor maltreatment reporting (Courtney et al., 2005; Dworsky et al., 2007; Epstein, 2001; Maguire-Jack & Klein, 2015; McDaniel & Slack, 2005; Slack et al., 2003). Finally, other characteristics have been found to be related to increasing welfare receipt among eligible families, such as having poor mental/physical health, having an individual with a disability, and having more children (Moffitt, 1992; Nicoll, 2015; Zedlewski, 2002). These other characteristics were not controlled for in the current study and might be related to higher risk of maltreatment reporting among welfare recipients in the current study. Unfortunately, the current study has no data to evaluate what proportion of the increased risk by welfare receipt is explained by economic conditions and non-economic factors.

The contribution of the present study in this area is dependent upon what welfare (AFDC/TANF) receipt status proxies. If welfare receipt status proxies economic conditions, the identified strong relationship between welfare receipt and maltreatment is supported by mounting evidence and theoretical relationships suggesting at least some unique role of economic conditions in child maltreatment (Drake & Jonson-Reid, 2014; Jonson-Reid et al., 2009; Pelton, 2015; Slack et al., 2017). In this case, a contribution of the current study may be the identification of temporal patterns between economic conditions and maltreatment reports, especially a far stronger association of maltreatment reports with current economic conditions than with prior economic conditions. It is also possible that welfare receipt status among low-income families may proxy non-economic factors, such as administrative burdens or family characteristics predisposing to welfare receipt. Unfortunately, the current study has no data to confidently evaluate whether the large gap in the risk of maltreatment reporting by welfare receipt status is mainly explained by economic conditions or non-economic factors. In either case, however, interventions are warranted for welfare recipients, especially current recipients, to address future child maltreatment reporting.

6.2.3 Race

Prior studies found that Blacks were proportionately about twice as likely to be reported to CPS as Whites. (Drake et al., 2011; Irwin, 2009; Putnam-Hornstein & Needell, 2011). Likewise, the current study found that Blacks were 1.9 times more likely to be present in the CAN sample, which included all first-time reported children aged 3 or under in St. Louis from 1993 to 1994. There is no room for epidemiological disagreement about the simple fact that Black children are more often reported than White children *absent controls for poverty*.

Two different perspectives have been developed to explain this disparity. One longstanding perspective claims that racial disparity is mainly due to an unfair racial bias which leads unnecessarily more reports of Blacks to CPS (Hill, 2004, 2006; Morton, 1999). A competing perspective argues that racial disparity in maltreatment reports reflects the higher risk of maltreatment among Blacks because of their differentially higher exposure to risk factors, especially low SES (Bartholet, 2009; Drake et al., 2011, 2009; Font et al., 2012).

The current study's data strongly support the second perspective. If race has a large function in maltreatment reporting through bias, racial disparity would be maintained even after controlling for risk and protective factors. This study found precisely the opposite, that Black children were slightly less likely to be reported than similarly situated White children, while controlling for various risk and protective factors. Essentially all recent relevant studies have found that after controlling for SES, Blacks have report rates similar to those for Whites (Courtney et al., 2005; Irwin, 2009; Putnam-Hornstein & Needell, 2011; Slack et al., 2004) or often even lower rates than Whites (Cancian et al., 2013; Drake et al., 2011, 2009; Dworsky et al., 2007; Putnam-Hornstein, Needell, et al., 2013; Sedlak, McPherson, & Das, 2010). The disappearance of the large Black-White disparity in official child maltreatment after controlling for risk and protective factors is a prevailing effect here and supports the idea of differential risk exposure rather than reporting or CPS system bias.

Emerging evidence, including the current study, suggests a small tendency for a somewhat higher risk of maltreatment reporting among poor Whites than poor Blacks. This tendency is theoretically intriguing and is becoming more generally accepted. This tendency has been found in official maltreatment data by a range of studies from different research teams using different data (Cancian et al., 2013; Drake et al., 2011, 2009; Dworsky et al., 2007; Putnam-Hornstein, Needell, et al., 2013; Sedlak, McPherson, & Das, 2010). Such a tendency has also recently been observed also in studies using survey data, showing that poor Whites were slightly more likely to have adverse childhood experiences than poor Blacks (Mersky & Janczewski, 2018; Slopen et al., 2016).

A possible explanation for this tendency is related to the idea of "differential assortment" (Drake et al., 2009). This idea suggests that historic and present structural advantages for Whites may make it more difficult for them to fall into severe poverty. Those Whites who do fall into poverty may have more factors, including endogenous factors (e.g., severe substance abuse, a predisposition towards low impulse control, etc…) which jeopardize financial security than Blacks in poverty. It is possible that these endogenous factors may increase the risk of child maltreatment.

The current study found that the relationship between child race and maltreatment reporting varied by neither current welfare receipt nor child age. This finding was consistent with prior work in this area (Irwin, 2009) and further extended this prior work to middle childhood and adolescence. The fact that no interaction between child race and current welfare receipt was present suggests that among both welfare recipients and non-recipients, Blacks had a lower risk of maltreatment reporting than their White counterparts. Since sampled children were mostly receiving welfare at the baseline, non-recipients during the follow-up period might be mostly in near poverty. This limited generalizability of the finding to those children with high family SES. No race-age interaction was identified, suggesting that underlying race-specific risk and protective factors (if present) might have a persistent role in shaping the risk of maltreatment reporting.

6.2.4 Neighborhood Contexts

For Aim 1, the current study found that none of the measured "baseline" neighborhood characteristics were significantly associated with the risk of maltreatment reporting during the follow-up period. A prior study in this area, however, found that baseline neighborhood impoverishment and instability increased risk (Irwin, 2009). Two differences between these studies might explain this inconsistency. First, the current study used samples from high-risk populations, while Irwin (2009) used samples from a general population. It is possible that the impact of neighborhood characteristics might be more evident among low-risk families. Second, children were followed up for a much longer period in the current study (13 to 14 years) than in Irwin's study (6 years). The second possible reason might be that impacts of baseline characteristics might be less detectable in a long run, given the frequent residential moves—especially for more disadvantaged families (Coulton et al., 2012).

To address the second possible reason, the current study traced changes of residential neighborhoods during the follow-up period based on address information in welfare records. For this, only age-year observations on welfare were selected for the Aim-2 analyses. It was found over 20% of children moved at a given age and about 90% of children were moved at least once during the entire follow-up period.

The Aim-2 analyses found that no neighborhood characteristic was significant in the CAN sample, while some characteristics (poverty rate, child/adult ratio, and out of St. Louis) were significant in the AFDC sample. It might be possible that neighborhood contexts do not contribute to the risk of future maltreatment re-reporting for children experienced a maltreatment report in early childhood (the CAN sample).

Regarding the Aim-2 AFDC sample, this study found neighborhood poverty increased the risk of maltreatment reporting for Whites while the risk did not vary by neighborhood poverty for Blacks (Figure 5). A prior study found a similar interaction (Irwin, 2009). A possible explanation for this interaction is relevant to the above discussed “differential assortment” (Drake et al., 2009). That is, structural advantages for Whites leading to a higher chance of economic success than Blacks may also prevent Whites from living in high poverty neighborhoods. Indeed, Whites are far less likely to live in high poverty neighborhoods than Blacks in the US (Drake & Rank, 2009). Given these structural advantages, those few Whites who are assorted into poor neighborhoods might have more underlying risk factors, resulting in a higher risk of maltreatment reporting than Blacks. The second possible explanation is related to the idea of being “out of place” (Drake et al., 2009; McDaniel & Slack, 2005). This idea suggests that when children are numerical minorities in a community (i.e., being out of place), these children may be more visible and thus more reported to CPS. In the current study data, Blacks dominated in high poverty neighborhoods while Whites dominated in low poverty neighborhoods. It is possible that the report rates of Whites in high poverty neighborhoods and of Blacks in low poverty neighborhoods might be increased by the effect of being out of place (Figure 5). Although this interaction is theoretically interesting, the practical importance seems to be small, as only a few Whites reside in high poverty neighborhoods and are subject to this interaction (Figure 5).

With regard to neighborhood child/adult ratio (or care burden), the current study found that residing in neighborhoods with proportionally more children lowered the risk of maltreatment reporting in the AFDC sample. This negative association was surprising as prior studies using samples from a general population found no association (Freisthler & Wolf, 2016; Irwin, 2009) or a positive association (Coulton et al., 1999; Merritt, 2009). A possible explanation is that the environment of neighborhoods with more children can be more favorable for low-SES families but less favorable for high-SES families. We need more evidence in order to better refine theoretical rationales for neighborhood care burden (or child/adult ratio) and to develop a better understanding of its differential function by family SES and maltreatment risk levels.

Regarding neighborhood instability (or mobility rate), it was found that both family-level instability (i.e., residential moves) and neighborhood-level instability brought no significant contribution to the risk of maltreatment reporting. Previous evidence in this area was somewhat inconsistent in terms of significance and the outcome of interest (e.g., official reports, CTS scores, and CAPI scores) (Coulton et al., 1999; Freisthler & Maguire-Jack, 2015; Freisthler & Wolf, 2016; Irwin, 2009; Kim, 2004; Merritt, 2009; Molnar et al., 2003). A prior study using a sample from a general population found neighborhood instability increased the risk of maltreatment reporting (Irwin, 2009). The current study's null finding for high-risk families might suggest that neighborhood instability might be more pronounced among low-risk families.

Regarding long-distance mobility, the current study found that children who moved out of St. Louis had a higher risk of maltreatment reporting than those who stayed in St. Louis among children who merely received welfare (AFDC) with no reported maltreatment at baseline (the AFDC sample). This might be because families who moved a long distance may experience dramatic changes of physical, social, and cultural contexts. Among those moving out of St. Louis, more than half (55%) moved in counties farther away than those counties adjacent to St. Louis. It was also possible, however, that the identified relationship was confounded by urban, suburban, and rural settings as most (96%) of those moving out of St. Louis (urban) moved to rural or suburban counties. This relationship was not found among the CAN children who already experienced reported maltreatment at baseline and at high risk of recurrence during follow-up. The overall impact was small, as only very few children moved out of St. Louis (5.4%) during the follow-up period. Again, limited prior evidence prohibits drawing any conclusion with regard to this issue.

In brief, the current study highlighted the importance of tracing residential neighborhoods in a longitudinal study. While doing so, the current study identified some neighborhood effects. Yet, these effects were small in contribution to the overall risk and were less observable among more vulnerable children. The findings of the current study have limited generalizability to low-risk families, which may explain some inconsistencies with prior studies. Nevertheless, this study's findings may be practically and theoretically important as they have strong external validity for high-risk populations.

6.2.5 Other Findings

It was found that the risk of maltreatment reporting was generally higher among children with medical, mental health, behavioral, and educational issues. In the current study, the measurement approach (e.g. using emergency room records) may have made it more likely to detect more serious events. From a longitudinal standpoint, the current study highlighted the importance of recency among risk factors. While a prior history of child mental health had an enduring association with the risk of maltreatment reporting, child current mental health had a larger effect. For child injury and delinquency, only recent status was significantly associated with the risk of maltreatment reporting.

The occurrence of problematic behaviors or other indicators such as injury have been used by other studies both as risk factors predicting child maltreatment (Brown et al., 1998; Drake et al., 2006; Hamilton & Browne, 1999; Jonson-Reid, Emery, et al., 2010; Spivey et al., 2009; Sullivan & Knutson, 2000), and also as consequences of child maltreatment (Anda et al., 2006; Felitti et al., 1998; Hildyard & Wolfe, 2002; Jonson-Reid, Presnall, et al., 2010; Jonson-Reid et al., 2004, 2009, 2012; Lanier et al., 2010; Lansford et al., 2002). In the current study, these issues are measured through service system contact, rather than by attempting direct measurement, such as through individual interviews.

It is extremely difficult to attempt to specify causality between risk/outcome factors (such as emergency room use) and child maltreatment. This also suggests caution in interpreting findings from the current study. Events noted in the administrative data history, such as Emergency Room visits, could be predictive of maltreatment or could be resultant from maltreatment. In either case, noting such events is clearly of value when attempting to determine which families would benefit from preventative services. Whether these variables are evidence of maltreatment or are evidence of risk of maltreatment, services are warranted.

There is some evidence that several prevention programs targeting these issues, such as Nurse-Family Partnership, System Triple P, and The Incredible Years, lower the risk of future maltreatment (California Evidence-Based Clearinghouse for Child Welfare, n.d.). The findings from the current study suggest that identified risk factors could be used as a means to identify families which could benefit from such interventions. The finding that proximity in time is important in predicting maltreatment suggests that timely provision of such services when indicated is also likely to be helpful.

The current study found that prior CPS involvement was significantly associated with the risk of maltreatment reporting. It was found that prior maltreatment reports increased future re-report risks, consistent with many prior findings (Courtney et al., 2005; Dworsky et al., 2007; McDaniel & Slack, 2005; Ovwigho et al., 2003; Slack et al., 2003, 2007). One finding of particular interest was that the role of CPS in-home preventive services was altered by the risk level of target clients. Family Centered Services (FCS), a less intensive service for lower risk clients, were identified as protective against future risk of re-reporting. Conversely, Intensive In-home Services (IIS), a more intensive service for higher risk clients, was associated with increased risk of re-reporting. These findings are consistent with the results of a meta-analysis (Al et al., 2012) which cast doubt on whether IIS services can be effective on families currently experiencing maltreatment. These findings are not new and consistent with prior findings in this area (Drake et al., 2006, 2003). Another study which adopted a more rigorous approach to control for the history of prior maltreatment reports in addition to careful controls of other risk and protective factors found that both FCS and IIS reduced re-reporting risks (Jonson-Reid, Emery, et al., 2010). It is difficult to determine if the apparent failure of IIS to reduce future reporting is due to ineffectiveness of IIS, or due to the presence of unmeasured risk factors in families receiving IIS, which would cause the intervention to show more positive effects if they had been measured and included in the predictive models.

Given the current trend towards new interventions supplementing or replacing current “as usual” CPS practice (Jonson-Reid et al., 2017), there is a need to chronicle current program effectiveness to determine if the new interventions are more or less effective than existing practice. Hopefully, the findings from this study can be useful in that regard. Nationally, the largest number of families served receive preventive services through CPS (Jonson-Reid et al., 2017). These findings suggest that delivery of services through CPS may be an attractive idea.

Parent criminal issues were found to be related to maltreatment reports, but in an interesting way. Current involvement of the criminal system due to a conviction (i.e., prison, parole and probation) did not significantly increase the risk of maltreatment reporting. More interestingly, it appeared that resolved criminal issues (i.e., after finishing prison, parole, or probation) had a protective function for maltreatment reporting among families who experienced reported maltreatment at baseline. While controlling for convictions, parent arrests increased the risk of maltreatment reporting. It is possible that unresolved criminal issues among some parents may increase risk. Another possibility is that arrests which do not proceed to convictions may be very different from those eventually ending to convictions. More study, ideally focusing on the precise nature and timing of arrests and convictions, is warranted to provide further answers in this area.

An unexpected finding was that the risk of maltreatment reporting was lower for mothers who were teenagers at the subject child's birth than others in the Aim-2 CAN sample. For other three samples of the current study, maternal teenage status at birth had no significant contribution to risk. A possible explanation for the non-significant findings was that the impact of maternal age might be less pronounced among more disadvantaged families. This tendency was observed in prior studies—for example, the effect size of maternal age at birth was much smaller for children on Medicaid at birth than for those not on Medicaid at birth (Putnam-Hornstein & Needell, 2011). It is also possible that maternal age does not substantial alter the risk of maltreatment reporting as several prior findings identify no significant relationship between maternal age and maltreatment reports (Dworsky et al., 2007; Irwin, 2009; McDaniel & Slack, 2005).

The lower risk for maternal teenage at birth in the Aim-2 CAN sample might be explained by the nature of the sample. This sample included mothers with both low SES and reported maltreatment in early childhood of their children. Some might have both conditions due to teenage birth. Others might have both conditions despite of non-teenage birth, suggesting that non-teenage mothers might generally have more underlying risk factors than teenage mothers in this sample. During the follow-up, risk factors relevant to teenage status (e.g., lack of experiences and knowledge about parenting) might be addressed over time while underlying risk factors for non-teenage mothers might be not. Another line of thought is that low-SES *teen* parents might have more supporting systems then other low-SES parents. It may be possible that teen parents were more likely to stay with their parents or that there might be more supportive services available for teen parents from their school and community. It is also plausible that the lower risk for teenage mothers may be due to higher risks of maltreatment reporting among older mothers as some prior studies did identify higher risks for older mothers (Cancian et al., 2013; Jonson-Reid, Emery, et al., 2010). Unfortunately, the current study cannot provide a clear set of answers responsive to these questions.

6.3 Strengths and Limitations

The current study has several strengths. This is the first study tracing children for such a long period, allowing a better longitudinal understanding of the risk of maltreatment reporting across almost the entire period of childhood from age 1 to 17 years. The use of longitudinal data also unveiled some interesting dynamics such as the interactions among child age, current welfare receipt, and prior welfare receipt and the importance of time proximity of risk factors. This was only possible by using secondary data from a parent study which had traced children in various Missouri administrative datasets (Jonson-Reid et al., 2009). Second, the use of previously linked administrative data allowed the current study to measure maltreatment reports and relevant risk and protective factors across a long period with little threat of recall bias. Third, the current study is the first study to track changes in neighborhoods so comprehensively. This allowed the current study to better locate children’s current residential neighborhoods and measure their current neighborhood contexts. The current study therefore was able to examine influences of “current” neighborhood contexts. Fourth, the current study’s findings can be added to recently emerging evidence informing current debates on the possible reasons for the Black-White racial disparity in CPS. Fifth, the use of multilevel growth modeling was a clear strength. Multilevel growth curve modeling is very powerful and flexible means to handle missing or censored observations and to examine longitudinal changes and cross-level influences simultaneously (Luke, 2008). Sixth, the current study established clear temporal ordering relative to between predictors and outcomes. Finally, the large sample size allowed the current study to have sufficient statistical power.

Some limitations are worth noting. First, despite the ability to establish temporal precedence in the predictor-outcome relationship, this study can only evaluate associations. Implications regarding causality must be drawn cautiously, if at all. Nevertheless, associations are important because randomization is generally nearly or absolutely impossible for key study variables (e.g., age, welfare receipt, race, and neighborhood contexts). Also, instead of randomizing study subjects, observing them in their contexts is often vital to understanding a complex process such as child maltreatment while considering longitudinal changes and socio-ecological interactions. While implications relative to causality are necessarily and sharply limited, external validity is strong.

Second, low-risk children with neither reported maltreatment nor welfare (AFDC) receipt in early childhood were excluded from the current study's samples due to the parent study's sampling design. The current study, therefore, can tell us little about such populations. The current study's use of two separate samples for each of two main aims, however, was a clear strength. It allowed the current study to test study hypotheses on two different populations, children experiencing reported maltreatment during early childhood and children experiencing welfare receipt but no reported maltreatment during early childhood. These populations are vulnerable to future child maltreatment and therefore important from a practical standpoint.

Third, due to the sampling design of the parent study, the current study was not able to produce estimates for age 0. National data have identified that children aged less than 1 year have an exceptionally higher risk of maltreatment reporting than any other ages (Kim et al., 2017; U.S. Department of Health and Human Services, 2018; Wildeman et al., 2014). The estimated age slope in the current study cannot be confidently extended to age 0.

Fourth, the current study was not able to trace families who moved out of Missouri because those families were invisible to state administrative systems. In the current study, however this problem is mitigated as more disadvantaged populations tend to make shorter moves even if they make more moves (Coulton et al., 2012). In fact, over 90% of children remained in St. Louis during the follow-up period in the current study's data for Aim 2 which traced residential neighborhoods.

Fifth, the current study's outcome of interest was child maltreatment reports, not all maltreatment events. A sizable number of maltreatment events go unreported in the US (Drake & Jonson-Reid, 2007; Sedlak, Mettenburg, et al., 2010). Some of these events (e.g. maltreatment of a preverbal child leaving no evidence) simply cannot be measured unless the perpetrator volunteers the information. Despite this, the emerging evidence suggests that there is surprisingly strong convergence between maltreatment reports and self-reported maltreatment in terms of long-term cumulative prevalence (see Chapter 1). In the short term, however, many maltreated children do not come to the immediate attention of CPS. Nevertheless, the estimates of the current study are useful as the risk of maltreatment reporting itself is important theoretically, practically, and also because of the need to inform policy.

Sixth, while the current study purposively included unsubstantiated reports (see Chapter 1), screened-out referrals were excluded from the sample. This was because screened-out referrals are not individually documented in Missouri and in most other states. Due to the scant literature on screened-out cases, it is difficult to discuss any possible impact of this exclusion on sensitivity and specificity in measuring child maltreatment. Each year in Missouri, about 25% of referrals are screened-out for the following reasons: (1) no child maltreatment allegation; (2) out of state incidents; (3) no information to locate families; and (4) victim is not a child (i.e., aged 18 years or older) (Missouri Department of Social Services, 2011). It is unknown what proportion of screened-out referrals are due to each criterion.

Seventh, some limitations are relevant to the use of administrative records in measuring predictors. This study's measures are vulnerable to unidentified cases by administrative systems and recording errors among identified cases. Furthermore, measures based on emergency room records should be interpreted cautiously. For example, emergency room diagnoses for mental health may indicate severe cases rather than moderate ones.

Finally, it is unclear whether welfare (AFDC/TANF) receipt status is a proxy for economic conditions or non-economic factors among mostly low-income families. Prior welfare leavers studies find that among previous AFDC/TANF recipients, leavers have higher incomes than stayers (Acs & Loprest, 2001; Coulton et al., 2005; Loprest, 2002; C. Miller, 2002; Moses et al., 2000; Ovwigho et al., 2003; Verma & Coulton, 2001). Several studies for eligible families for AFDC/TANF also find that recipients are economically somewhat better off than non-recipients (Moffitt, 1992; Nicoll, 2015; Zedlewski, 2002). Unfortunately, the current study had no data to directly evaluate economic conditions by welfare receipt among sampled families who mostly had low incomes at baseline. Caution is warranted in interpreting the current study's findings regarding welfare receipt.

6.4 Implications

The current study has a range of theoretical, practical, and research implications.

6.4.1 Theoretical Implications

The current study's findings complement existing evidence on child maltreatment, yielding a deeper understanding of how risk and protective factors change over the course of a child's life in shaping the age-specific risk of child maltreatment. This study is the first to consider child age over almost the entire period childhood. This expands our longitudinal understanding of child maltreatment from early childhood to middle childhood and adolescence. By examining risk and protective factors in longitudinal and multilevel contexts, the current study provides a better understanding of how these factors are interplaying in such contexts.

This study allows us to evaluate the proportion of variance in future maltreatment attributable to different domains, such as the child, the neighborhood and time. Prior studies identified that 93% or more variance of child maltreatment was between individuals and 7% or less variance was between neighborhoods. By taking "time" into account, the current study identified that majority (60% to 67%) of the variance was between age-year observations (i.e., between different time points), a considerable proportion (33% to 40%) was between individuals, and a trivial fraction (less than 1%) was between neighborhoods. This indicates that the risk of maltreatment reporting mainly varies by time. This is profoundly interesting theoretically. It is tempting to categorize individuals as "at risk" or not and assume that is an unchanging characteristic. The current study suggests that this is not so, that children may change over time with regard to their degree of risk. This suggests that we need to consider longitudinal changes among risk and protective factors to better understand changes of child maltreatment risk over time.

Study findings regarding child age, especially its interplay with welfare receipt, child maltreatment reports, and early childhood experience, also may be of theoretical interest. These findings suggest that age-related vulnerabilities (e.g., more dependence on caregivers, lower autonomy, and higher care burden) may not necessarily lead to maltreatment reporting. The current study found that among children having neither a prior report in early childhood nor current welfare receipt (i.e., the AFDC children not on welfare currently), the risk of maltreatment reporting or re-reporting was not practically higher at younger ages. This finding suggests that for those with few risk factors, age may not independently predispose to maltreatment. Age certainly increases vulnerability to long term injury or fatality (Commission to Eliminate Child Abuse and Neglect Fatalities, 2016), but further research is needed to determine if it is best conceptualized as an independent risk factor per se.

With regard to family SES, there are plausible theoretical explanations for a causal link between family SES and child maltreatment. These include insufficient material resources to meet a child's basic needs, increased supervision burden due to inadequate housing, under-investment to children due to fewer expected returns, and a high level of stress provoked by low SES which may make parents depressed (increasing neglect risk) or angry (increasing physical abuse risk).

To the degree that the welfare receipt status proxies economic conditions, the current study provides evidence useful in evaluating the theoretical association between family SES and child maltreatment. The most notable contribution may be finding a continued contribution of welfare (AFDC/TANF) receipt to maltreatment risk while considering changes of both current and cumulative history of welfare receipt over time. The current study found that current welfare receipt is associated with child maltreatment risk (not necessary causally) far more powerfully than the cumulative history of welfare receipt. It is particularly interesting to note that for families currently receiving welfare, their prior welfare receipt does not additionally increase child maltreatment risk. If welfare receipt proxies low family SES, this observation is useful when evaluating different theoretical explanations of the link between SES and maltreatment. For example, a mediation theory positing that current SES causes stress resulting in maltreatment may appear more attractive than a model suggesting that prior SES disadvantage operates cumulatively, perhaps through long term allostatic load mechanisms.

With regard to race, the current study found that Blacks showed no higher maltreatment risk than White while controlling for family SES. This is not new, and virtually all recent findings support disappearance or reversal of Black overrepresentation in reported maltreatment once family SES is controlled for (Cancian et al., 2013; Courtney et al., 2005; Dworsky et al., 2007; Kim & Drake, 2017; Needell et al., 1999; Putnam-Hornstein, Needell, et al., 2013; Slack et al., 2003, 2004, 2007). The current study's findings add to this emerging evidence, which clearly stands against the idea that the Black-White disparity in CPS is mainly due to racially biased treatment by CPS. As study findings stand against the "bias" hypothesis, they support the "differential risk" hypothesis, particularly with regard to racial disparity in SES.

Also interesting is the finding that Blacks are at a lower risk than Whites of maltreatment after SES controls are employed. This is also not new and is one of the most interesting and consistent recent findings in child maltreatment epidemiology (Drake et al., 2009; Mersky & Janczewski, 2018; Putnam-Hornstein, Needell, et al., 2013; Slopen et al., 2016). Theoretically, *Differential assortment* (see section 6.2.3) is one recently proposed explanation, but this theory has not been subjected to extensive empirical validation, being supported mainly by correlational evidence. Unfortunately, the current study cannot evaluate this theory directly beyond adding additional confirmation to the body of knowledge which already exists. In the current study, lower risk for Blacks are maintained regardless welfare receipt and child age, suggesting the function of race-specific risk and protective factors (if present) may not vary by welfare receipt and child age.

Theoretical perspectives relating to neighborhood contextual effects were not robustly supported by the current study. Social ties are both important and find empirical support within both the sociological and psychological perspectives, and neighborhood stability is important to build social ties because the establishment of social ties takes time (Belsky, 1980, 1993; Cicchetti & Lynch, 1993; Sampson & Groves, 1989; Sampson et al., 1999, 1997). Nevertheless, the current study found no significant relationship between neighborhood instability and child maltreatment. This was not due to lack of proper control of individual-level mobility as a family's number of residential moves was taken into account.

Neighborhood care burden was also examined in the current study. The idea of neighborhood care burden is that neighborhoods with more adults (possible caregiving resources) may have lower rates of child maltreatment. The current study's findings either do not support this idea (in the CAN sample) or may even stand as evidence against it (in the AFDC sample). This may suggest that neighborhoods with a higher proportion of children may be more favorable to children, especially those exposed to low SES and not reported for maltreatment in early childhood. It is possible that neighborhoods with more children, and thus more parents, may provide more opportunities for intergenerational closure (i.e., parents know the parents of their children's friends) and reciprocal exchange (i.e., interfamilial exchange of resources for childrearing), which are some of key components expected to build collective efficacy for child well-being (Sampson et al., 1999). Neighborhood poverty (or impoverishment) was also only significant for White children in the AFDC sample. That is, only White children who received welfare (AFDC) with no reported maltreatment in early childhood showed higher risk of child maltreatment when residing in poorer neighborhoods. It may be possible that there is differential sensitivity of racial groups to neighborhood contexts, perhaps due to cultural factors. Several competing explanations are also possible, such as *differential assortment* (i.e., poor Whites have more risk factors than poor Blacks) and *being out of place* (i.e., fewer Whites in poorer neighborhoods are therefore more visible). Understanding the interaction between race and neighborhood poverty may be of theoretical interest, although this interaction can ultimately explain little at the population level as only very few Whites reside in high-poverty neighborhoods. As discussed here, some neighborhood contexts showed small impacts for the AFDC sample, but even such small impacts were not observed for the CAN sample. It is possible that for children who have already experienced reported maltreatment, neighborhood contexts do not further alter their future recurrence risk.

6.4.2 Practical Implications

The current study informs prevention efforts in three ways. These include first, better understanding where and when maltreatment occurs so that services can be better targeted, second, emphasizing the importance of immediate economic support in suppressing maltreatment, and third, understanding that the risk of children may vary substantially over time. In addition to these core themes, implications regarding community interventions and race will be discussed.

First, epidemiological data about maltreatment risk can inform service targeting. As Finkelhor (1999) pointed out, identifying the location and source of child maltreatment is an essential part of prevention. The estimates from the current study are useful in identifying not only high-risk families, but also high-risk situations and unfavorable neighborhoods. Timely intervention among younger children in more difficult contexts may pay dividends in reducing future maltreatment. When determining which factors are most useful in targeting, findings from this study reinforce prior data showing the importance of considering factors such as child mental health, injury, and educational needs. Parental factors are also indicative of risk, including parental criminal issues, maternal education, and maternal foster care placement history.

Second, to the degree the welfare receipt status represents economic conditions, the current study's findings align with Pelton's view (1994, 2015) that addressing child poverty is among the most promising strategies to reduce child maltreatment. Given that this study's data show that current welfare receipt is more predictive than past welfare receipt, this may imply that timely provision of material support or concrete services may help reduce child maltreatment reports if welfare receipt is mainly a proxy of low economic conditions.

Third, the large variation of child maltreatment risk by time provides several important practical implications. First, this conveys an optimistic view regarding efforts to prevent future maltreatment. That is, if a family's risk largely varies by time (rather than static over time) in ecological contexts, it may be very possible to substantially alter the risk with various intervention approaches. Another implication is that understanding recency of risk factors may help to locate families at imminent risk of child maltreatment. Use of various administrative records may be helpful for this purpose. To use such records as a means of engaging supportive (rather than punitive) interventions is attractive, as is changing current child protective systems to be more supportive (Kohl et al., 2009; Pelton, 2015).

The importance of time has other general implications regarding prediction, screening and monitoring. These implications may apply to child protection practice generally. For example, various areas are considering the use of Predictive Risk Models (PRM) in screening and even, perhaps, in case finding (Panattoni, Vaithianathan, Ashton, & Lewis, 2011). This study finds that the risk experienced by children changes substantially over time. This informs how any predictive system should be built and what inputs it should use. For example, with PRM, models which use only data available at the time of a child's birth should be less effective than models which can incorporate more recent data. To the degree to which study findings of variability in risk over time are true, the need to update any predictive model with more recent data sources becomes more important.

The current study also informs recent community-level prevention efforts. With growing theoretical attention to the role of communities in child maltreatment, community-level prevention programs are gaining popularity (Daro & Dodge, 2009; Molnar, Beatriz, & Beardslee, 2016). Compared to prior multilevel studies using samples from a general population, the current study found that neighborhood effects were smaller in contribution to the overall risk among low-SES families and were less observable among families with prior reported maltreatment. These findings suggest that when we develop and implement community-level prevention programs, we need to consider the effectiveness of those programs among the most vulnerable families.

Finally, the findings on race in the current study can be added to the current evidence-base relative to racial bias interventions. Virtually all recent studies suggest that the Black-White racial disparity in CPS is due to the racial disparity in socio-economic conditions rather than racial bias in CPS or among reporters. Some recent studies including the current study even find that the evidence suggests a slight but consistent underreporting of Black children (Kim & Drake, 2017; Maloney, Jiang, Putnam-Hornstein, Dalton, & Vaithianathan, 2017; Putnam-

Hornstein, Needell, et al., 2013). Racial bias interventions, however, are still on-going and cultural competency training for CPS workers is considered as a progressive policy. While such interventions may be valuable for other reasons, there is no reason to believe they will reduce racial disparity to any meaningful degree. Conversely, this approach could be potentially harmful if workers are given the implied mandate to further reduce screen-ins, investigations, and services to an already underrepresented population. Any cultural competency training must be selected and implemented in a way conditioned by the understanding that racial inequality starts from the society (e.g., historical, structural, and systematic racism leading to the racial disparity in socio-economic conditions) rather than from the CPS system (e.g., racial discrimination due to the lack of cultural competency in reporters, CPS report-screening units, and CPS investigators). Addressing differential risk between Blacks and Whites, especially racial disparity in SES, may be a more promising strategy to reduce racial disparity in CPS than racial bias interventions.

6.4.3 Research Implications

This work has generated a number of implications relating to future research. First, the findings from the current study suggest the importance of considering "time" in analyses. Given the substantial variation of child maltreatment risk by time, it is necessary to consider changes in risk and protective factors over time. When possible, specific constructs (e.g., SES, injury, and mental health) should be evaluated using measures reflecting both current status and the prior history. Consideration of time is also important in measuring neighborhood characteristics. Moving from one neighborhood to another does not necessarily mean a dramatic change of neighborhood characteristics (e.g., moving into a similar SES neighborhood). Yet, given the frequency of changes in residential neighborhoods, we may need to take such changes into account to improve measurement of "current" neighborhood contexts.

Another implication has to do with the use of multilevel growth curve modeling. This use allows simultaneous consideration of time, individuals, and neighborhoods. Looking at maltreatment risk at a given age including the first event and any subsequent event beyond that point is only possible by using a per-age approach (i.e., estimating age-specific risks) coupled with the use of multilevel modeling. Re-reports are common and bear high costs for CPS (Loman, 2006). In order to better develop our understanding of child maltreatment reporting beyond initial onset and the first recurrence, the increased use of multilevel modeling seems warranted.

The limitations encountered in the current project can also inform future research. Welfare receipt, especially current welfare receipt, was found to be a powerful factor predicting future risk of child maltreatment. The identified interaction between current and cumulative history of welfare receipt is also an interesting finding with notable theoretical and practical implications. Unfortunately, the mechanisms underlying this interaction remain largely unknown. It is also not clear whether welfare receipt status is a proxy for economic conditions or non-economic factors among mostly low-income families. Future studies should attempt to address these.

Longitudinal data were analyzed by multilevel modeling in the current study. One reason for this was because the current study was interested in examining racial and neighborhood effects in the given socioeconomic strata. This approach, however, was not ideal in understanding individual-level and neighborhood-level mobility (downward or upward) and any resultant impact on child maltreatment. That is, the current study's estimates contrasted maltreatment risks between current low SES and current not-low SES (if welfare receipt proxies low SES) or between current residence in high-poverty neighborhoods and in low-poverty neighborhoods, but the current study's estimates were not necessarily about the impacts of dropping into low SES and moving into a poorer neighborhood. Future studies may be interested in specifically addressing upward (or downward) mobility and their relationships with child maltreatment. Fixed effect modeling may be a helpful approach for this purpose.

The current study used secondary data from a parent study which had linked various administrative records. The use of administrative data has considerable benefits (e.g., low recall bias, lower cost than survey data…). A notable limitation in the use of administrative data, however, is that administrative data can only catch things visible to administrative systems. It is therefore important to triangulate findings from administrative data (including the ones from the current study) with other findings from survey data. A more scientifically rigorous approach may be linkage of survey data with administrative data (Stahlschmidt et al., 2018). Future studies in this area may consider using survey data or data linking survey and administrative records.

The current study's samples were limited to children with reported maltreatment or welfare (AFDC) receipt in early childhood in a Midwest metropolitan region. This led to lack of non-poor and non-maltreated children at baseline, insufficient representation of racial/ethnic groups (especially Hispanics) other than Whites and Blacks, and no true rural population at baseline. To generalize the current study's findings, future studies may need to use a general population. Due to the increased availability of statewide and national data, this approach is increasingly common (Irwin, 2009; Maloney et al., 2017; Putnam-Hornstein & Needell, 2011). Hispanic populations deserve special attention, given their low risk of child maltreatment despite of their low SES. This trend is often referred to as "Hispanic paradox" in the child welfare literature (Drake & Jonson-Reid, 2014; Putnam-Hornstein, Needell, et al., 2013) but is more well-known relative to health outcomes (Acevedo-Garcia & Bates, 2007). Given the large size of the Hispanic population, and the relative lack of studies focusing on this population, inclusion of a substantial Hispanic sample is recommended for future studies. Rural populations represent another area where research has lagged. We have yet to invest substantial effort in examining children and families in rural contexts and this is an obvious next step in advancing child maltreatment research. This may be facilitated by the use of administrative data, which can often have broader inclusion of rural contexts than sampled data.

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