A Population-Based Study of Child Maltreatment-Related Hospitalizations and Child Protection Responses

Rebecca Rebbe

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Reading Committee:
Melissa Martinson, Chair
Megan Moore
Peter Pecora

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Abstract

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Rebecca Rebbe

Chair of the Supervisory Committee:

Professor Melissa Martinson

School of Social Work

Despite the breadth of the identified impacts and costs of child maltreatment, a primary challenge in our understanding of child maltreatment is that we still do not have solid numbers of children who experience it. Further, despite child protection systems (CPS) being reliant on mandated reporters to bring concerns of child maltreatment to their attention, there is little information about how systems respond to concerns of child maltreatment. Informed by the public health approach and ecological systems theory, this dissertation utilizes a novel linked administrative dataset of birth, hospital discharge, and CPS records to provide new knowledge about hospitalizations related to child maltreatment. It does so in three ways: identifying the incidence and prevalence of child maltreatment-related hospitalizations, the risk and protective factors of these hospitalizations, and the systems responses to these hospitalizations, as measured by CPS reports and removals by CPS. Results indicate that most common form of child maltreatment-related hospitalizations was neglect and, more specifically, supervisory neglect. Identified risk factors included child's low birth weight, mothers who were teenagers at the time of birth, non-first born children, maternal residence in zip codes with high concentrated disadvantage, and a prior CPS report. System responses were dependent on the subtype of maltreatment and type of diagnostic code used. Specifically, physical abuse and codes specifically related to maltreatment had higher rates of CPS reports and removals compared to the other maltreatment subtypes and diagnostic codes not specifically related to maltreatment.

These results provide new knowledge regarding child maltreatment. The results can be used to target prevention programming, which are identifiable at birth, increasing their utility. The new knowledge identified through this study has important implications for our understanding of child maltreatment, how we can prevent it, and how current systems are responding to it.

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CHAPTER 1:
INTRODUCTION

Child maltreatment continues to be a substantial problem in the United States. The most recent official reports from government child welfare agencies indicated that more than 674,000 children were the victims of child maltreatment in 2018 with 1,720 children dying as a result of abuse and neglect (USHHS, 2019). A study utilizing a synthetic cohort life table approach also using official reports estimated that 12.5% of all U.S. children experience confirmed maltreatment before turning 18 (Wildeman et al., 2014) while 37.4% of all U.S. children will experience a child protection investigation before age 18 (Kim et al., 2017). Financially, lifetime costs of nonfatal child maltreatment have been estimated to be $210,012 per victim, placing the year cohort totals in the hundreds of billions of dollars (Fang et al., 2012). In 2014, a total of $29.1 billion in federal, state, and local funds were spent on child welfare services (Rosinsky & Connelly, 2016).

Despite the breadth of the impacts and costs of child maltreatment that have been identified, a primary challenge in our understanding of child maltreatment is that we still do not have solid numbers of children who experience child maltreatment. Counts of maltreatment usually rely on two sources. The first is reports to child protection system (CPS) agencies, which was the source for the statistics in the previous paragraph. The second source is retrospective surveys of adults. However, it is unlikely that all maltreated children are reported to CPS (Sedlak et al., 2010) and surveys have issues with memory bias and differences in definitions (Jud, Fegert, & Finkelhor, 2016). Further, too often the information we have regarding child maltreatment is limited to a single point in time or a single aspect of maltreatment. In reality, child maltreatment occurs in a context that is complex and multifaceted. If the ultimate goal is to

prevent child maltreatment from ever occurring, then a more robust understanding of the family's trajectory that begins with the child's birth, including interactions with various systems, is needed (Jonson-Reid & Drake, 2008). Similarly, to improve child protection systems (CPS), information is required not just of which families are reported to CPS, but which families are *not* reported to CPS.

A second challenge in our understanding of child maltreatment is that many of the available data sources do not allow researchers to track how the systems responsible for responding to child maltreatment do so. This is the result of most of the information about children and the systems they interact existing in silos (Putnam-Hornstein, Webster, Needell, & Magruder, 2011). Consequently, if a child is identified as experienced maltreatment by one service system, the lack of integrated data prevents the examination of how that child might move from that system to another system and if mandated reporters report suspected child maltreatment to government child protection agencies. CPS agencies rely on reports, or referrals, to come to the agency in order for the CPS agency to open a case. Nationally, in 2017, about two-thirds of these reports came from professionals who work with children (USHHS, 2019). But because of a lack of integrated data, there is only information about who mandated reporters decide to report and not information about the broader population of children who they may consider to report.

Given these gaps, I use a public health approach (CDC, 2015) to address them and generate new knowledge regarding the connections between prevalence and risk and protective factors of, and the system responses to, child maltreatment that results in hospitalization. This dissertation adds to an expanding field within child maltreatment that utilizes linked administrative data to provide more complete understandings of the child maltreatment-related

trajectories in a population, including the prevalence of child maltreatment, the risk and protective factors identifiable at birth, and how maltreated children are reported to, and if they are removed by, state CPS agencies.

Additionally, ecological systems theory identifies that the many contexts that an individual lives within influence the individual's life (Bronfenbrenner, 1979). This is a useful theory to utilize to examine the complex and multifaceted context that child maltreatment occurs in. A study of child maltreatment informed by ecological systems theory takes a social justice orientation by investigating how social structures and environments may be contributing to the problem of child maltreatment. This recognizes that the etiology of child maltreatment may not solely rest with parents and that a more equitable society may reduce child maltreatment.

This is the first study, to my knowledge, to utilize data that link birth records, CPS records, and hospitalization records to examine child maltreatment. The innovation of this dissertation is the ability to measure child maltreatment through hospital medical records and then track which hospitalized children are referred to CPS. I do this using the census of records for an entire state over a time period that spans more than a decade while comparing sociodemographic variables from the birth records to the entire population. Informed by ecological systems theory, this approach allows for an examination of the broader context of child maltreatment, beyond the data collected for a single system, including the longitudinal trajectory of children from birth to hospitalization to CPS system involvement. This adds new information about regarding two aspects of child maltreatment: 1) the children who experience child maltreatment that results in hospitalization are and 2) how systems respond to these children and their families, as measured by reports to CPS and removals by CPS. The inclusion of the broader context of child maltreatment is a social justice oriented approach to examining

the distribution and determinants of child maltreatment. I first provide an overview of the public health approach, followed by the research questions for this dissertation. I then provide background information for each of the three aims of this dissertation.

Public Health Approach

A public health approach to maltreatment prevention is defined as a four-step process that starts with 1) surveillance to define the problem in the population followed by 2) the identification of risk and protective factors which are used to 3) develop and test prevention strategies which are then 4) adopted widely (CDC, 2015). Figure 1 presents the basic public health approach. Traditionally in the U.S., public agencies have approached child maltreatment from a "child protection" orientation that focuses on the individual actions (and/or failures) of parents (Gilbert, 1997). This framework is inherently reactionary and does not consider the factors outside of the family that may put a child at increased risk of experiencing child maltreatment or the patterns in the general population. Additionally, the narrow focus on problems within a family is often a cross-sectional one without consideration of the family's trajectory.

In contrast, a public health approach has been advocated as an effective framework for child maltreatment prevention (Covington, 2013; Klika, Lee, & Lee, 2017). Rivara and Johnston (2013) argue that as this approach has been used to promote bicycle helmet use to prevent brain injury and the promotion of supine sleeping to prevent sudden infant death. This approach can be applied to child maltreatment and has the potential to have successful outcomes. A key aspect of a public health approach is on intervening "early and comprehensively to enhance protective factors and reduce risk factors, thus minimizing the impact before problems emerge or worsen"

(Herrenkohl et al., 2015, p. 24). In practice, this approach represents a shift from a focus on tertiary responses, like legislated responses to CPS reports, to secondary services, targeting families at risk of CPS involvement (Higgins, 2015).

Figure 1. Public Health Approach

However, there is a critical concern with the first step of the public health approach in regards to child maltreatment. The predominant sources of population-based surveillance (or data) used to define and measure the problem of child maltreatment, official child welfare reports, have been criticized as limited because not all maltreated children are reported to child welfare agencies (Sedlak et al., 2010). Additionally, they do not contain important variables for prevention efforts, such as family-level characteristics, due to their primary function as administrative data (Putnam-Hornstein, Webster, Needell, & Magruder, 2011). Indeed, the child demographics included in the National Child Abuse and Neglect Data System (NCANDS) are limited to age, sex, race/ethnicity, and living arrangements (Fallon et al., 2010). As a result, this primary source of data both underestimates the prevalence of the problem and does not provide sufficient sociodemographic information to create robust prevention programs and policies.

Thus, approaches to gathering data on the problem of maltreatment that are broader than administrative data alone are needed to fully understand the scope of the problem of child maltreatment. Putnam-Hornstein et al. (2011) posits that linkages of administrative records from different sources can address the deficits of CPS administrative data alone by providing sociodemographic characteristics that can be utilized in identifying risk factors for the development of prevention strategies. Indeed, the linkage of administrative datasets regarding child maltreatment has numerous strengths including the inclusion of key predictors such as birth weight, gestational age, and parental age, the avoidance of some measurement issues such as selection bias and recall bias, and the inclusion of the entire population that has interacted with the agency (Brownell & Jutte, 2013).

Congruent with these methods, this dissertation adds new child maltreatment surveillance knowledge regarding hospitalizations related to child maltreatment by identifying the prevalence, risk factors, hospitalization-related reports to CPS, and subsequent responses by CPS (including substantiations and removals). Health professionals are important in regards to child maltreatment. The term "health professionals" is used here and throughout this dissertation to be purposefully broad and to include a multitude to health professionals that may interact with children and their families in a health or medical setting. This term is meant to include, but is not limited to, physicians, social workers, nurses, mental health providers, physical therapists, and radiologists. Health professionals are critical for the intervention of child maltreatment and to prevent continued or increasingly severe child maltreatment (Jackson et al., 2015; Letson et al., 2016). Historically, it was the identification of "battered child syndrome" in 1961 by pediatric radiologist, C. Henry Kempe that instigated many of the modern policy responses to child maltreatment such as mandated reporting laws (Reich, 2005). Currently, there is increased

research regarding previous minor, visible but suspicious injuries like bruises, referred to as sentinel injuries, which are highly concerning for future child maltreatment (Sheets et al., 2015). The identification that many of these sentinel injuries have been missed by medical professionals prior to more severe injuries resulting from maltreatment have escalated the call for medical professionals to play a more active role in the identification of child maltreatment (Berger & Lindberg, 2019). The design of child welfare systems in the U.S. are reliant on mandated reporters, like health professionals, to report and intervene when there are concerns of child maltreatment given the proximity to families and the expertise of these professionals.

Further, health professionals and hospitals have been identified as valuable sources for surveillance of child maltreatment (McKenzie & Scott, 2011) as standardized codes are used to describe diagnoses (Farst, Ambadwar, King, Bird, & Robbins, 2013). Utilized uniformly by hospitals and required for billing purposes, diagnoses are classified according to standardized codes in this system, the International Classification of Disease, Ninth Revision (ICD-9). The linkage of hospital records to CPS records provides information beyond the hospital and CPS administrative records alone to identify risk factors that may be used in developing interventions focused on prevention by utilizing all of the information collected by these systems and tracing children's interactions across them. The analysis of the CPS responses, namely reports to CPS by hospitals and the placement and substantiation decisions of the reported children by CPS, develops new knowledge regarding how systems respond to the identification of these children, informing policies and training needs. Based on this public health framework, this dissertation advances the child welfare field regarding child maltreatment hospitalizations using a population-based linked dataset of birth, CPS, and hospital records, a study, to my knowledge,

that has not yet been conducted, while complementing the burgeoning field of research on sentinel injuries.

This dissertation's utilization of a novel dataset that combines data on children from birth records, hospital records, and CPS moves the field forward by answering previously unexamined questions regarding the prevalence and responses to severe child maltreatment. The inclusion of child characteristics at birth provides the opportunity to identify risk factors that can be used in the development of prevention efforts, in line with the public health approach. Further, the linkage of data between hospitals and CPS allows for an examination of how children move (or do not move) between these critical systems. CPS agencies rely on mandated reporters to refer concerns of child maltreatment to them. Health professionals in hospitals are a critical component of this intervention, especially for young children who are not yet in school. Thus, while this study provides information about the counts and sociodemographic variables regarding children who experience child maltreatment-related hospitalizations, it also provides information about how health professionals respond to encountering these children in hospitals, providing valuable information on how the mandated reporting process works. Child maltreatment is a particularly salient social justice issue in the United States as it disproportionately affects children living in poverty (Pelton, 2015) and black children (Wildeman et al., 2014). The linked dataset allows examinations about how these subpopulations interact with the hospital and CPS systems, a component that is limited when using a single source of data.

Research Questions:

The research questions for this dissertation are:

1. What are the incidence and prevalence of child maltreatment-related hospital admissions for all children born in Washington State between 1999 and 2013 within their first three years of life?

The public health field of epidemiology, which focuses on the distribution and determinants of health outcomes with the goal of preventing disease, uses two different terms to measure the occurrence of morbidity (Weiss & Koepsell, 2014). Incidence refers to the counts of new *cases* of a disease in a population divided by the population at risk of experiencing the disease and prevalence is defined as the number of *persons* who are affected by the disease divided by the number of persons in the population in a specified time period (Gordis, 2014). Thus, I will use incidence to refer to the number of *hospitalizations* related to child maltreatment and prevalence in regards to the number of *children* experiencing child maltreatment-related hospitalizations in this dissertation. Both measures contribute to our knowledge of how many children experience child maltreatment.

This population-based study will contribute to the understanding of maltreatment that results in hospitalization for an entire state over more than a decade. Identifying the size of the child maltreatment problem is important for the allocation of resources for both responses to and prevention of child maltreatment. I expect to find variations in incidence by type of maltreatment – physical abuse, neglect, and sexual abuse. Official reports to child welfare agencies indicate that neglect is the most reported form of child maltreatment at about 75% of reports (USHHS, 2019). I do not expect to find a similar pattern using hospitalization data, as neglect frequently does not require hospitalizations, but I do expect to find that sexual abuse is the least frequent form of child maltreatment related hospitalizations, just as is found for child maltreatment reports. Importantly, my focus on young children is due to their increased vulnerability.

Additionally, the restriction on the first three years of life also reduces the concern that migration out of the state, and thus underestimates, may alter the analysis.

2. What sociodemographic factors at birth are related to subsequent child maltreatment related hospital admissions? Is report of maltreatment a risk factor for child maltreatment related hospital admissions?

Sociodemographic factors related to child maltreatment are important to identify for the development and implementation of prevention programming. I expect to find that some birth sociodemographic factors, such as public birth payment, low birth weight, and maternal age will be identified as risk factors for child maltreatment-related hospitalizations, based on the California findings of these being risk factors for injury mortality (Putnam-Hornstein, 2011) and prenatal substance exposure (Putnam-Hornstein, Prindle, & Leventhal, 2016; Rebbe, Mienko, Brown, & Rowhani-Rahbar, 2019a). Further, I will explore geographical differences as risk factors. I expect to find greater rates of child maltreatment related hospitalizations in communities with higher poverty/cumulative disadvantage due to the stress that these environmental factors have on parents and the lack of resources in these communities (Coulton, Theodos, & Turner, 2012; Drake & Pandey, 1996; Ernst, 2000; Freisthler, 2004; Freisthler, Midanik & Gruenewald, 2004). Also, congruent with the findings from California in regards to injury mortality (Putnam-Hornstein, 2011), I expect that prior reports to CPS will be a risk factor for child maltreatment-related hospitalizations.

3. What are the initial responses of hospitals and CPS to children with child maltreatment related diagnoses?

This question will identify which cases of child maltreatment-related hospitalizations health professionals decide to report to CPS and which children CPS remove from their caregivers. This will provide information about whether children move from the health system to CPS, providing important information about how mandatory reporting policies work. I expect to find differences in which diagnoses are reported to CPS and how CPS responds to those reports, in addition to variations in reports by birth characteristics and geographical categories. I expect to find higher rates of reports for the physical abuse categories than the neglect diagnoses because physical abuse is more straightforward than neglect, which lacks a standard definition (Proctor & Dubowitz, 2014). In terms of removals of children by CPS of the reports they receive in regards to child maltreatment-related hospitalizations, I expect to find differences by subtype of maltreatment and geographical variations. Specifically, I anticipate higher rates of removals for physical abuse than neglect, similar to reporting.

Aim 1: Incidence & Prevalence of Child Maltreatment

The first step of the public health approach is to define and measure the problem, which is commonly referred to as surveillance in the public health field. Surveillance has been defined as "the ongoing systematic collection, analysis and interpretation of outcome-specific data for use in the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know" (Thacker & Berkleman, 1988, pg. 164). This is a critical first step of a public health approach that involves gathering accurate and reliable data to ascertain trends and patterns (Rivara & Johnston, 2013). The three functions of child maltreatment surveillance are enumeration, monitoring, and evaluation (Leeb & Fluke, 2015). A critical component in the collection of child maltreatment surveillance data is

the measurement and definitions of child maltreatment (Leeb, Paulozzi, Melanson, Simon, & Arias, 2008).

Despite research confirming the deleterious effects that child maltreatment has on its victims, in the United States, we do not have a good understanding of child maltreatment prevalence, or, in other words, the number of children affected by child maltreatment (Drake & Jonson-Reid, 2018; Jud, Fegert, & Finkelhor, 2016). However, we do have accurate information on how many children are reported to and have allegations substantiated by the state child welfare agencies. The NCANDS collects reports from each state on an annual basis regarding the children and families reported and served by their state child welfare agencies. The most recent report for the year 2017 indicates that over 4.1 million children in the U.S. were the subject of a report of child maltreatment for a rate of 55.7 per 1,000 children and of those, over 674,000 were found to be victims of child maltreatment for a rate of 9.1 per 1,000 children (USHHS, 2019). This dissertation will address this limitation by measuring child maltreatment beyond children just reported to the state child welfare agency.

However, the problem with using the NCANDS data is that not all maltreated children are reported to child welfare agencies (Drake & Jonson-Reid, 2018; Sedlak et al., 2010) and there are vast differences between states in terms of their mandatory reporting laws (Mathews & Kenny, 2008) and other child welfare statutes (Vesneski, 2011), including definitions of neglect (Rebbe, 2018). Consequently, a situation deemed to be neglectful in one state could not meet the definition and standard in another state (Mennen, Kim, Sang, & Trickett, 2010). Washington state includes health providers in its mandated reporting laws. In 2016, 25.1 per 1,000 children in Washington received a CPS investigation/response with 2.7 per 1,000 children categorized as a victim of child maltreatment, both lower than the overall rate for the country (USHHS, 2019).

The National Incidence Survey (NIS-4) attempts to tackle the problem of state variability by operationalizing child maltreatment using a 60-form typology to classify alleged maltreatment, with subcategories of sexual abuse, physical abuse, emotional abuse, physical neglect, educational neglect, emotional neglect, and other maltreatment. A nationally representative sample of 122 counties is used to estimate the rate of maltreatment for the United States using standardized definitions. The NIS-4 gathers information from multiple sources beyond child welfare agencies to estimate the number of children who are maltreated, as well as the nature, the perpetrators, and severity of the maltreatment (Sedlak, et al., 2010). Additional sources of information on child maltreatment in these counties included schools, hospitals, law enforcement, social service agencies, and mental health providers. This approach of counting children beyond the official child reports is thought to provide a more accurate measure of child maltreatment incidence than using CPS reports alone.

The NIS-4, the most recent version of this study, estimated that more than 1.25 million children experienced maltreatment at a rate of 1 of every 58 children in the U.S, using their more stringent "harm" standard which requires demonstrated harm to the child as a result of maltreatment (Sedlak, et al., 2010). The study estimated that almost 3 million children were maltreated at a rate of one in every 25 children in the U.S. when applying the more inclusive definition of "endangerment" standard, where the child only needs to have experienced a threat of harm. The use of the NIS-4's broader sources of information regarding the prevalence of child maltreatment leads to much higher estimates of victimization in the U.S. (671,000 via official agencies vs. 1.25 million via the NIS-4 harm standard vs. 3 million via the NIS-4 endangerment standard).

General population surveys have also been used to determine the prevalence of child maltreatment in the population. These surveys usually ask adults or adolescents to self-report their experiences with child maltreatment and are limited by problems with definitions and the memory biases of respondents (Jud, Fegert, & Finkelhor, 2016). For example, the National Longitudinal Study of Adolescent Health (Add Health) followed a nationally representative sample of adolescents into adulthood and asked retrospective questions about child maltreatment (Hussey, Chang, & Kotch, 2006). This study found 41.5% (2 of 5) of youth reporting supervision neglect, 11.8% reporting physical neglect (1 in 10), 28.4% (1 in 4) endorsing experiencing physical assault, and 4.5% (1 in 25) reporting sexual abuse (Hussey, Chang, & Kotch, 2006). These rates are much higher than the official reports or from the NIS-4, highlighting how we still do not have good information on the true scope of the child maltreatment problem (and that it significantly varies by definition). To summarize, measures of child maltreatment incidence and prevalence that rely on CPS reports alone are in fact just capturing the count of CPS reports and not the actual number of children experiencing child maltreatment as not all maltreated children are reported to CPS. The NIS-4 addresses the issue of definitional concerns and includes information beyond CPS reports, but is limited by the fact it was completed more than a decade ago. As one of the goals of public health surveillance is monitoring the problem of child maltreatment, surveys like the NIS-4 appear to be unsustainable sources for child maltreatment prevalence. Retrospective surveys of young adults are limited by definitional issues and memory biases. Additionally, they are usually conducted years after the maltreatment occurred. However, linked administrative data is well-suited to address these limitations, including the timing and frequency of data collection, for child maltreatment surveillance (Putnam-Hornstein, Webster, Needell, & Magruder, 2011).

Medical Records

Health professionals are critical elements in regards to the intervention of child maltreatment (Jackson et al., 2015; Letson et al., 2016). Additionally, medical records avoid some of the pitfalls that beset other measures of child maltreatment prevalence. The standard diagnosis codes that are used universally reduces the problem of definitional inconsistencies across jurisdictions and do not suffer from recollection bias because they are included in the medical records at the time of patient discharge. Thus, hospital records can provide a better source of child maltreatment prevalence than just CPS records (Schnitzer, Slusher, Kruse, & Tarleton, 2011). Hospital discharge records, in particular, have been identified as useful sources to understand the incidence of forms of child maltreatment (Ellingson, Leventhal, & Weiss, 2008).

ICD codes have been used to identify various forms of maltreatment in the literature. ICD codes are developed by the World Health Organization as a standardized system for classifying diseases across the globe (World Health Organization, 1980). In the United States, ICD codes are required for reimbursement by health insurers including Medicare and Medicaid, resulting in their omnipresence in hospital records (Schnitzer, Slusher, Kruse, & Tarleton, 2011). Regardless of location, the ICD includes strict guidelines that coders must follow when applying ICD codes to medical records (McKenzie & Scott, 2011). The ubiquity and standardization of ICD codes makes them a good source of public health surveillance. Researchers have leveraged these codes to identify child maltreatment broadly as well as specific forms of child maltreatment to increase our knowledge regarding the prevalence of child maltreatment in the population.

ICD-10 codes. Countries outside of the United States adopted ICD-10 codes earlier than the U.S. These ICD-10 codes have been used to identify abusive head trauma in Canada

(Fujiwara, Barr, Brant, Rajabali, & Pike, 2012), maltreatment or violence-related injury in England and Scotland (Gonzalez-Izquierdo et al., 2014; Gonzalez-Izquierdo et al., 2009), definitive or indicative maltreatment in Australia (Guthridge, Ryan, Condon, Moss, & Lynch, 2014), and long bone fractures and intracranial injuries in New Zealand (Vaithianathan, Rouland, & Putnam-Hornstein, 2018). Child maltreatment hospital data was examined in Australia and found to have high reliability and specificity in regards to coding (McKenzie, Scott, Waller, & Campbell, 2011).

ICD-9 codes – uses and challenges for child maltreatment research. The U.S. did not adopt the ICD-10 until October of 2015 resulting in most published studies thus far focusing on ICD-9 codes, which is also the focus of this dissertation. ICD-9 codes have been used in studies to identify the incidence of child maltreatment in the U.S. using various approaches and different sources of data. I will first review studies that calculated child maltreatment incidence broadly and follow with a discussion of studies that focused on the incidence rates for specific subtypes of maltreatment.

Some studies have utilized the child maltreatment specific codes in the ICD-9. An examination of all the hospital discharges for minors (0-19) in the state of Pennsylvania in the year 1995 used ICD-9 codes specifically related to child maltreatment (Forjuoh, 2000). This study identified 348 child maltreatment-related hospitalization discharges for an incidence rate of 10.8 per 100,000 people. This study used the external cause-of-injury ("E") codes to identify cases, specifically using E967.0-E967.9, in conjunction with ICD-9 codes related to child maltreatment (995.50-995.54, 995.59, and V71.5). Additionally, this study included some codes in which their inclusion is less clear, with codes 995.80-995.85, which involves adult maltreatment, and codes V61.10-V61.2, V61.29 (counseling for marital and partner problems

and parent-child problems). This study did not include code 995.59 (shaken baby syndrome) and this was not addressed by the author. This study represents one of the first uses of state-wide hospital discharge records to identify child maltreatment incidence.

A study in the state of Missouri also used a single year (2000) to examine the rates of child maltreatment in that state (Schnitzer, Slusher, & Van Tuinen, 2004). This study linked hospital discharge and emergency department data with official CPS records. Both sets of records were used to establish the number of children under 10 years of age in the population that experienced maltreatment and the study identified 5657 children, or 7.4 per 1,000 children. For this study, children were identified as having experienced maltreatment if they were the associated with a substantiated CPS case or if they had an ICD-9 diagnosis (995.50-995.59, 994.2-994.3 (effects of hunger/thirst), E967.0-E967.9, E968.4 (criminal neglect), E904.1 (lack of food), E904.2 (lack of water), V15.41-V15.42 (history of physical abuse/emotional abuse), and V15.49 (history of abuse-other). The codes with definitions in parenthesis are codes that were not used by Forjuoh (2000). Also, in contrast to Forjuoh (2000), this study included shaken baby syndrome (995.55). The innovation of this study was the linkage of hospital records to CPS administrative records, an approach also taken by this dissertation.

Puls (2019) used the Kids' Inpatient Database for 2012, which included 80% of pediatric hospitalizations from 4100 hospitals across the country, to examine if there were differences in the incidence of physical abuse hospitalizations by the urbanity of the child's residence at the time of the hospitalizations. Using this database, the authors identified hospitalizations related to physical abuse if the child had an ICD-9 code that indicated one of the four following diagnoses: 1) an injury code co-diagnosed with a child maltreatment code; 2) an injury code co-diagnosed with an E assault code; 3) a code specifically related to physical abuse; or 4) a diagnosis of

shaken baby syndrome. The authors found no differences between the three urban/rural status categories examined with the incidence rates ranging between 16.5 and 17.5 per 100,000 children under the age of five.

Building on the work that identified multiple forms of child maltreatment, some studies have looked at specific types of diagnosed injuries to identify the incidence of child maltreatment. The proportion of fractures related to child maltreatment in children under three years of age was examined using the Kids' Inpatient Database, which includes 2521 hospitals in 22 states (Leventhal, Martin, & Asnes, 2008). This study used ICD-9 codes to identify diagnoses of fractures with child maltreatment indicated if either an E-code for assault (E960-E969) or a child maltreatment code (995.5) was also present for the child's hospitalization. Using the weights provided by this dataset, the authors concluded that the incidence of abusive fractures was 15.3 per 100,000 children under the age of three and 36.1 per 100,000 under the age of one. This study used more E-codes for assault than the previously discussed studies, in particular E960-E966 and E968-E969, which are various forms of assault without a specified perpetrator.

Head injuries have been of particular concern in a few studies. The Kids' Inpatient Database was utilized in two studies to examine abusive head trauma and inflicted traumatic brain injury (TBI). Niederkrotenthaler (2013) estimated the rates of abusive head trauma (AHT) in the United States using the ICD-9 codes identified to indicate AHT by the Centers for Disease Control (Parks, Annest, Hill, & Karch, 2012), finding the rate of AHT in children less than a year of age was 39.8 per 100,000 and 6.8 per 100,000 for children under the age of two. Ellingson, Leventhal, and Weiss (2008) estimated the incidence of inflicted TBI for children under the age of one to be 27.5 per 100,000 infants for the years 1997 and 2000 and 32.3 for the year 2003. A study that used a census approach for all hospitals in North Carolina with a Pediatric Intensive

Care Unit found an incidence of traumatic brain injury of 29.7 per 100,000 person-years for children under age one and 13.0 for children aged one year old (Keenan et al., 2003).

One study was interested in the incidence of TBI or fractures attributable to child maltreatment, which utilized the 2006 edition of the Kids' Inpatient Database (Leventhal, Martin, & Asnes, 2010). The estimate for either TBI or fractures was 21.9 per 100,000 children, but when limited to the first year of life, the authors round a much higher rate of 50.0 per 100,000 children.

The accuracy of ICD-9 codes to identify child maltreatment has been raised in the literature (Berger, Parks, Fromkin, Rubin, & Pecora, 2015) and is important to ensure that the use of ICD-9 codes is a correct measurement of child maltreatment. The accuracy of abusive head trauma ICD-9 codes have been found to be high through the assessment of sensitivity and specificity (Berger, Parks, Fromkin, Rubin, & Pecora, 2015). Assessing all possible child maltreatment-related hospitalizations, two studies retrospectively assessed the sensitivity and specificity of the ICD-9 codes assigned to hospitalized children who were evaluated by a child abuse pediatrician. One study evaluated 133 cases in one children's hospital (Hooft, Ronda, Schaeffer, Asnes, & Leventhal, 2013) and the second examined 936 cases at four hospitals with child maltreatment consultation programs (Hooft et al., 2015). While only the study with four hospitals found a specificity rate under 100% (with an eight percent rate of false positives), both studies had lower rates of sensitivity, at 74 and 76 percent, indicating that about 25% of child maltreatment cases are underestimated by ICD-9 codes. Further, in the study across four hospitals, while all of the hospitals had specificity of at least 85% and three with at least 96.9%, much greater ranges of sensitivity were found from a low of 53.8% to a high of 83.9%,

indicating that underestimation occurs more frequently and with greater variability across hospitals.

Beyond hospitals with dedicated child maltreatment physicians, concerns have been raised of the under ascertainment of child maltreatment in general hospitals, or non-children's hospitals, where many children are treated. General hospitals have been found to be less likely to detect and report child abuse in a study that used the Kids' Inpatient Database from 1997 and comparing the diagnoses of femur fractures and TBI in different types of hospitals (Trokel, Waddimba, Griffith, & Sege, 2006). The authors stated that their findings could not be explained by the child's age, the severity of the injury, or health insurance status, but could be attributed to the type of hospital the child was treated at. With 49% of cases identified in this multistate database treated in general hospitals, these findings raise the concern that child maltreatment specific ICD-9 codes are not being utilized at an accurate frequency in facilities that are not dedicated to pediatrics.

A major problem with the definitive child maltreatment ICD-9 codes is that there are none exclusively related to neglect (Schnitzer, Slusher, Kruse, & Tarleton, 2011). This is a stark contrast to the finding that three-quarters of children found by CPS agencies to be victims are neglected (USHHS, 2019). Thus, it is possible that while health professionals may identify a child has been hospitalized as a result of neglect, there may not be an ICD-9 code that accurately reflects the clinician's assessment of the child's diagnosis. Further, research has demonstrated that physicians are sometimes reluctant to report and identify child maltreatment (Flaherty et al., 2008; Sege et al., 2011) for reasons both concerned with prior experiences (Flaherty et al., 2008; Gunn, Hickson, & Cooper, 2005; Vulliamy & Sullivan, 2000) and for trepidations in regards to possible outcomes related to their identification of the maltreatment (Gunn, Hickson, & Cooper,

2005; Jones et al., 2008). Despite the utility of the child maltreatment ICD-9 codes and the research studies that have utilized them to measure child maltreatment, they are limited in that they do not reflect the breadth of child maltreatment and that health professionals may be reluctant to use them.

Suggestive ICD-9 codes – a strategy for addressing limitations. In response to this concern of under ascertainment of child maltreatment using explicit maltreatment ICD-9 codes, a set of codes suggestive of child maltreatment were developed (Schnitzer, Slusher, Kruse, & Tarleton, 2011). This innovation is critical to overcome some of the limitations of using specific child maltreatment codes alone. To establish the list of codes suggestive of maltreatment, the authors, in consultation with child maltreatment experts and the academic literature, first identified a broad list of ICD-9 codes that could be suspicious of child maltreatment, which also included criteria for inclusion and exclusion of maltreatment. The authors then examined the emergency room or hospital inpatient records in the year 2000 for children under the age of 10 that included a code for possible maltreatment, utilizing Missouri's population-based emergency room and statewide hospital discharge database, known as the Patient Abstract System. Over 28,000 visits were identified; for codes with less than 50 associated cases, all cases were examined, while codes with over 50 cases, a random sample of 50 cases was selected. A sample of 3,684 cases, with all available medical records including x-ray, laboratory, and social findings, were examined and coded as either probable, possible, or not likely child maltreatment, using operationalized definitions. If 66% or more of the cases were classified as probable or possible maltreatment, an *a priori* cutoff, the code was included in the set of codes suggestive of maltreatment. The codes suggestive of child maltreatment were classified into four categories: sexual maltreatment, physical maltreatment, neglect, and neglect or physical maltreatment.

To calculate the incidence of child maltreatment in Missouri, Schnitzer et al. (2011) first identified the children who either had a diagnosis with an explicit child maltreatment ICD-9 code or a substantiated CPS report, which were 6,109 children for a rate of 7.9 per 1,000 children. The authors then added children associated with a suggestive maltreatment code by applying the weights developed for each ICD-9 code. When using both the definitive and suggestive diagnoses, there were 20,554 children identified either through a CPS substantiation or a child maltreatment-related hospitalization bringing the child maltreatment rate to 26.7 per 1,000 children in Missouri in the year 2001.

The Nationwide Emergency Department Sample (NEDS) from 2012 was used to calculate national estimates of emergency department visits related to definitive and suggestive maltreatment (Wheeler, Shi, Xiang, Haley, & Groner, 2017). The NEDS is a stratified sample of 20% of non-rehabilitative hospitals in the U.S., for a total of 950 hospitals. The authors identified cases using definitive ICD-9 codes and the suggestive ICD-9 codes proposed by Schnizter et al. (2011), including the application of the co-occurring exclusion codes. In contrast to Schnitzer et al. (2011), the authors excluded dental caries, poisonings with intents other than undetermined, and solar dermatitis, while adding humerus and femur fractures for children under one year of age. The authors generated a national estimate of 117,849 definitive and suggestive maltreatment emergency department visits for children under the age of 10 in 2012. If we take the U.S. child population aged 0-11 from 2012 of 48,634,117 (datacenter.kidscount.org), this estimate yields an incidence rate of 2.42 maltreatment-related emergency department visitations per 1,000 children.

A population-based study of all the births in New York City (NYC) between 1995 and 2004 also used the Schnitzer et al. (2011) suggestive codes to identify hospitalizations for infants within the first 12 months of the child's life (Mason, Schnitzer, Danilack, Elston, & Savitz,

2018). This study linked birth records with hospital discharge records for NYC residents born in NYC hospitals (N = 912,826). The authors examined hospital discharge records for those related to suggestive ICD-9 codes only (in other words, they did not look at definitive child maltreatment ICD-9 codes (per personal correspondence, 2/2/19)). The incidence rate for suggestive maltreatment was 67.0 per 100,000. Despite not utilizing ICD-9 codes directly related to child maltreatment, this study identifies the children hospitalized for child maltreatment within an entire population, in this case, the city of New York, and uses sociodemographic variables from birth record to identify risk and protective factors. This dissertation takes a similar approach, but includes a larger catchment area (an entire U.S. state), more years of the child's life (up to age three), a more comprehensive list of ICD-9 codes, a longer time period for data collection, and includes linkages to the CPS agency to examine the system responses.

The incidence rates previously discussed are summarized in Table 1 below. This dissertation will use population-based data to provide rates of incidence using ICD-9 codes that are both specific to and suggestive of child maltreatment. When using the suggestive codes, I will follow the guidelines set forth by Schnitzer et al. (2011) including the exclusion and inclusion codes. This will provide child maltreatment incidence rates (broadly and for subcategories) before the age of three for children born in the state of Washington between 1999-2013.

Table 1. *Summary of Reported Child Maltreatment Incidence in Research*

Author	Data Year	Data Source/Codes	Focus	Study Type	Age Range	Incidence Rate
NDCANDS	2016	Official CPS Reports	national CPS records	census	0-18	55.1 per 1,000
NDCANDS	2016	Official CPS Substantiations	national CPS records	census	0-18	9.1 per 1,000
WA NDCANDS	2016	Official CPS Reports	WA CPS records	census	0-18	25.0 per 1,000
WA NDCANDS	2016	Official CPS Substantiations	WA CPS records	census	0-18	2.9 per 1,000
NIS-4	2005-2006	NIS-4	Endangerment Standard	sample	0-18	39.5 per 1,000
NIS-4	2005-2006	NIS-4	Harm Standard	sample	0-18	17.1 per 1,000
Add Health	2001-2002	survey questions	supervision neglect	self-report sample	< 6th grade	415 per 1,000
Add Health	2001-2002	survey questions	physical neglect	self-report sample	< 6th grade	118 per 1,000
Add Health	2001-2002	survey questions	physical assault	self-report sample	< 6th grade	284 per 1,000
Add Health	2001-2002	survey questions	sexual abuse	self-report sample	< 6th grade	45 per 1,000
Forjouh	1995	PA Hospital Discharge Data	specific CM ICD-9	census	0 - 19	10.8 per 100,000
Schnitzer	2000	MO CPS, hospital discharge, & ED data	CM specific ICD-9 codes	census	< 10 yo	7.4 per 1,000
Puls	2012	Kids' Inpatient Database	CM specific ICD-9 codes	sample	< 5 yo	16.5-17.5 per 100,000
Leventhal	2003	Kids Inpatient Database	CM fractures - ICD-9	sample	< 3 yo	15.3 per 100,000
Leventhal	2003	Kids Inpatient Database	CM fractures - ICD-9	sample	< 1 yo	36.1 per 100,000
Niederkrotenthaler	2013	Kids Inpatient Database	AHT vs non-abusive head trauma - ICD-9	sample	< 2 yo	6.8 per 100,000
Niederkrotenthaler	2013	Kids Inpatient Database	AHT vs non-abusive head trauma - ICD-9	sample	< 1 yo	39.8 per 100,000
Keenan	2003	NC hospitals with PICU	TBI incidence - ICD-9	census	< 1 yo	29.7 per 100,000
Keenan	2003	NC hospitals with PICU	TBI incidence - ICD-9	census	< 2 yo	3.8 per 100,000
Ellingson	1997	Kids Inpatient Database	Inflicted TBI incidence - ICD-9	sample	< 1 yo	27.5 per 100,000
Ellingson	2000	Kids Inpatient Database	Inflicted TBI incidence - ICD-9	sample	< 1 yo	27.5 per 100,000
Ellingson	2003	Kids Inpatient Database	Inflicted TBI incidence - ICD-9	sample	< 1 yo	32.2 per 100,000
Leventhal	2006	Kids Inpatient Database	TBI or fractures - ICD-9	sample	< 3 yo	21.9 per 100,000
Leventhal	2006	Kids Inpatient Database	TBI or fractures - ICD-9	sample	< 1 yo	50.0 per 100,000
Schnitzer	2000	MO CPS, hospital discharge, & ED data	CPS substantiation or ICD-9 (incl. suggestive)	census/weights	< 10 yo	26.7 per 1,000
Schnitzer	2000	MO CPS, hospital discharge, & ED data	definitive dx or CPS	census/weights	< 10 yo	7.9 per 1,000
Wheeler	2012	NEDS	definitive or suggestive ER or hospitalizations	sample	< 10 yo	2.42 per 1,000
Mason	1995-2004	NYC birth & hospital records	suggestive ICD-9 codes only	census	< 1 yo	67.0 per 100,000

Aim 2: Risk Factors for Child Maltreatment

The second step in a public health approach after determining the scope of the problem in a population is to identify risk factors, which is a critical component for prevention efforts (Rivara & Johnston, 2013). If the goal is ultimately prevention of child maltreatment, it is important to identify the patterns and trends in the distributions of child maltreatment. Reliable predictors that are identifiable earlier in a child's life may provide greater utility for prevention efforts through earlier intervention (Herrenkohl et al., 2015). An examination of risk factors beyond the family-level also provides a fuller context to which child maltreatment occurs in, which is in line with a social justice lens.

Sociodemographic Variables Identifiable at Birth

Previous research has identified a number of risk factors at birth of future child maltreatment. Low birth weight (defined as less than 2500 grams), independent of maternal age and socioeconomic status, was identified as a risk factor for future reports of child maltreatment in a population cohort study (Spencer, Wallace, Sundrum, Bacchus, & Logan, 2006). Low birth weight, in addition to public birth payment, late or no prenatal care, maternal age, maternal race, and parity (later born vs. first born) were found to be risk factors of child maltreatment within the first year of life in a population cohort study in Florida (Wu et al., 2004). These are risk factors that are routinely collected on birth records by state public health agencies enhancing their utility to be compared across populations. This makes these variables particularly useful for both the first step of a public health approach – surveillance – and the second step of identifying risk and protective factors.

Risk factors for CPS contact (intakes) were identified from birth records for a population-based cohort of children born in California (Putnam-Hornstein & Needell, 2011). The risk

factors indicated to be statistically significant were low birth weight, no or late prenatal care, birth abnormality, younger mothers, US-born (vs. foreign-born) mothers, maternal race, low maternal educational attainment, no paternity established, parity (or birth order), and public birth pay. These risk factors are similar to those identified by Spencer et al. (2006) and Wu et al (2004) and consistent across large populations, suggesting these are important measures to include in examinations of risk factors for child maltreatment. These variables have been used in other analyses in California for different child welfare related outcomes including injury related deaths (Putnam-Hornstein, 2011), teen birth rates (Putnam-Hornstein & King, 2014), and prenatal substance exposure (Putnam-Hornstein, Prindle, & Leventhal, 2016). These studies have advanced the field by providing population-based answers to child welfare related questions that were hard to answer as accurately without the linked population-based data. The inclusion of risk factors that are identified at birth provides opportunities for early interventions to prevent negative outcomes.

Sociodemographic risk factors that are identifiable at birth are advantageous in that they are variables collected routinely across the population allowing for comparisons between children who have experienced maltreatment with those who have not. Additionally, this information is collected early in a child's life enabling the targeting of interventions to high-risk populations prior to child maltreatment occurring (Putnam-Hornstein & Needell, 2011). While these sociodemographic risk factors have been studied in regards to CPS contacts, only one study to my knowledge (Mason, Schnitzer, Danilack, Elston, & Savitz, 2018) has tested their relationships with hospitalizations related to child maltreatment, which I will discuss later in this section. The results from this dissertation will inform the targeting of prevention strategies for child maltreatment.

Community-Level Risk Factors

Social work has a long tradition of recognizing the various factors influencing an individual, especially factors beyond the family, such as the social context and environmental factors (NASW, 2017). Similarly, the field of epidemiology considers all risk factors, including environmental exposures, when identifying risk factors (Gordis, 2014). This consideration has extended to the study of child maltreatment and specifically the interrogation of neighborhood contexts informed specifically by ecological theory. Congruent with this tradition, this dissertation examines the neighborhood context to identify if neighborhood concentrated disadvantage, a measure more comprehensive than poverty alone, at the neighborhood level is a risk factor for child maltreatment-related hospitalizations.

Ecological Theory. Bronfenbrenner's ecological theory (1979) identified that an individual is influenced by the multiple contexts that the individual lives within. Importantly, this theory recognized that an individual is simultaneously influenced by these multiple systems that also interact and influence each other. Examples of these contexts include the household that one lives in, the neighborhood one resides in, the peer network one socializes in, and the broader sociopolitical culture that one lives in.

Bronfenbrenner's ecological theory influenced the work of Belsky (1993), who identified "contexts of maltreatment" to understand the etiology of child maltreatment, including the "broader context" which is inclusive of the community and cultural contexts where child maltreatment occurs. In this broader context, Belsky argued, a lack of social support, smaller peer networks, and isolation from the community are associated with parental maltreating behaviors. Belsky also identified the high American tolerance for violence as a cultural context conducive for child maltreatment to occur in.

Neighborhood Influences on Child Maltreatment. To explain how neighborhoods (broadly) affect child maltreatment, Coulton et al. (2007) proposed a framework with neighborhood disadvantage as a key component, utilizing two traditions that have discussed the relationships between neighborhoods and child maltreatment. The first, which the authors attribute to sociology and social work, focuses on the social disorganization of neighborhoods, while the second tradition, traced to developmental psychologists, identifies the ecological-transactional development of children and parents. The authors employed elements from both sets of traditions to theorize that a neighborhood's structure (including neighborhood disadvantage, neighborhood demographics, and neighborhood stability) influences the neighborhood's processes (including collective efficacy, social organization, and community resources/deficits), which influences transactional processes (environmental stressors and social support) simultaneously as child maltreatment reporting processes, resulting in maltreatment behaviors and reports. This explicit examination of how neighborhood contexts relate to child maltreatment is a move away from the traditional "child protection" orientation that focuses on the individual actions of parents (Gilbert, 1997). Instead, this framework recognizes that the social context that a family is living in may contribute to child maltreatment behaviors. This dissertation examines an important component of this framework, neighborhood disadvantage, to test for its relationship with child maltreatment related hospitalizations.

Neighborhood Socioeconomic Disadvantage. Congruent with the Coulton et al. (2007) framework for neighborhood influences on child maltreatment (Figure 2), neighborhood characteristics and child maltreatment have been examined in a number of studies, often focusing on socio-economic characteristics of the neighborhood (Coulton, Richter, Korbin, Crampton, & Spilsbury, 2018). Neighborhoods with higher concentrations of female-headed households have

been found to have higher rates of child maltreatment (Gillham et al., 1998; Freisthler, Midanik, & Gruenewald, 2004). Similarly, neighborhoods with increased poverty rates (Coulton, Theodos, & Turner, 2012; Drake & Pandey, 1996; Ernst, 2000; Freisthler, 2004; Freisthler, Midanik & Gruenewald, 2004) and unemployment rates (Freisthler, 2004; Freisthler, Midanik & Gruenewald, 2004; Freisthler, Needell, & Gruenewald, 2005; Gillham et al., 1998) have been connected to higher child maltreatment rates. Neighborhoods with disadvantaged socio-economic contexts likely have decreased quantity and quality of resources, higher levels of crime, increased interactions with law enforcement, and increased stress. The characteristics create an environment that is less conducive for positive parenting and may be associated with increased rates of child maltreatment behaviors. This examination of the environmental context that child maltreatment occurs in is congruent with a social justice approach that strives for equity in society.

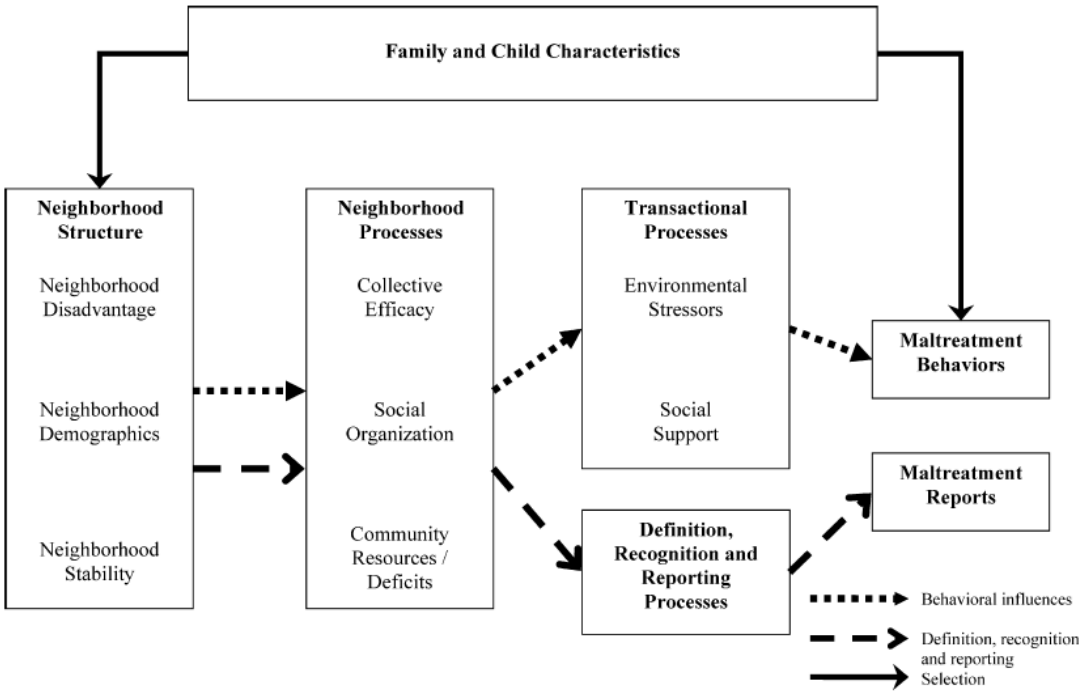

Figure 2. Framework for Neighborhood Influences on Child Maltreatment (Coulton et al., 2007).

While research has identified that poverty measured at the community-level has been associated with increased levels of child maltreatment, these studies have been limited by their measurement of child maltreatment. In a review of studies that examined the relationship between neighborhood characteristics and child maltreatment, 22 of the 25 identified studies used official reports to child welfare agencies as their measure of child maltreatment, while the other three studies relied on self-reports (Coulton, et al., 2007). The limitations with official reports to child welfare agencies are that bias may be involved with who is reported to government child welfare agencies and not all maltreated children are reported to child welfare agencies (Drake & Jonson-Reid, 2018; Sedlak et al., 2010). Surveys that rely on self-report are limited by problems with definitions and the memory biases of respondents (Jud, Fegert, & Finkelhor, 2016). Thus, while neighborhood-level poverty has been found to be associated with child maltreatment, there are questions about the validity of the child maltreatment measures, and it may be more accurate to state that neighborhood-level poverty is related to child maltreatment reports.

Additionally, measures of poverty have been criticized as the federal poverty line is not considered an accurate measure of poverty in the U.S. (Iceland, 2013). An improved approach is the construction of an index that incorporates multiple measures to identify areas with concentrated disadvantage. One approach developed by the Association of Maternal and Child Health Programs (2013) is concentrated disadvantage which is comprised of five variables collected through the U.S. Census American Community Survey (ACS): 1) percent of individuals below the poverty line, 2) percent of individuals on public assistance, 3) percent of female-headed households, 4) percent of population unemployed, and 5) the percent of population under the age of 18. The use of multiple variables addresses some of the data issues

that an individual measure might have. The recommended use of this measure is create an index with a cutoff at the 75th percentile. This use of an index makes this measure relative, allowing comparisons to occur within the population of interest.

Prior CPS Report as a Risk Factor

A prior CPS report was found to be an independent risk factor for injury mortality before the age of five in a population-based study in California (Putnam-Hornstein, 2011). When the study adjusted for sociodemographic variables, the prior CPS report was the strongest predictor for injury mortality. This finding was the most pronounced for the subset of injury deaths that were identified as having an intentional intent, where children with a prior CPS report died at a rate five times greater than children who were not previously reported to CPS. Overall, the study found 20% of children who died from an injury were previously reported to CPS. Among children whose injury death was considered to have been intentional, 33% had a previous CPS report. This dissertation will examine if a prior CPS report as a risk factor extends to child maltreatment-related hospitalizations.

Risk Factors of Child Maltreatment-Related Hospitalizations

Risk-factors specific to child maltreatment-related hospitalizations have been identified in three studies. Two studies specifically looked at the relationships between poverty measured at the community-level and child maltreatment-related hospitalizations. The relationship between macroeconomic indicators and admission rates of physical abuse were analyzed using a database of 38 children's hospitals between the years 2000 and 2009 (Wood et al., 2012). This study found that increases in the mortgage delinquency rate and foreclosure rate for the metropolitan statistical area associated with the hospital the child was admitted to were associated with increases in physical abuse and TBI admission rates. No statistically significant association was found between the unemployment rate and abuse or TBI admission rates. Ultimately, the results

of this study indicate a relationship between macro housing stability indicators and child maltreatment-related hospital admissions.

The relationship between the median household income of the zip code that the child resided in at the time of hospitalization was assessed using a nationwide sample of hospitalizations between 2013 and 2014 for children under 18 years of age (Imran, Cross, & Das, 2019). The results of this study indicated a stepwise relationship between the quartiles of median household income with zip codes with the lowest median incomes having the highest incidence rates of child maltreatment-related hospitalizations. This pattern continued for child maltreatment-related in-hospital mortality reinforcing that lower median household income at the zip code level is an increased risk factor for hospitalizations with child maltreatment diagnoses.

The third study to examine risk factors associated with child maltreatment-related hospitalizations looked at risk factors broader than economic factors. The study in NYC that utilized linked birth and hospitalization records previously discussed in this chapter (Mason et al., 2018), utilized the sociodemographic variables from the birth records to identify risk factors associated with child maltreatment hospitalizations. Public insurance used for the birth payment, teenaged mothers at the time of birth, infant male sex, and maternal race/ethnicity of black, Hispanic, or unknown were all found to be risk factors for child maltreatment related hospitalizations before the age of one. This dissertation takes an approach that incorporates these two sets of foci, by examining community-level poverty in addition to sociodemographic variables available from the birth record.

Aim 3: Health Professionals' Reporting of Child Maltreatment

The third aim of this dissertation examines how health professionals (including all professionals who may encounter children in a health setting) and CPS respond to child

maltreatment. This is an element in the child welfare that has not been examined in as much detail, primarily due to a lack of data enabling such analyses to occur. The majority of current data only identifies children who have been reported to CPS. However, how professionals and agencies respond to identified maltreatment has been cited as the most useful research for policy-makers because these professionals and agencies have great capacity to change (Jud, Fegert, & Finkelhor, 2016). Yet, we have limited research that has focused on this important component of U.S. child welfare systems.

In particular, medical professionals are considered to be valuable identifiers of suspicious injuries and clinical presentations, yet despite mandates to report suspected abuse and neglect in every state, research, primarily utilizing retrospective survey data of physicians, has demonstrated that physicians do not always do so (Flaherty, et al., 2008; Sege, et al., 2011). Reasons for not reporting include a lack of understanding of mandated reporting laws (Gunn, Hickson, & Cooper, 2005), previous poor experiences with child protective services (CPS) (Flaherty, et al., 2008; Gunn, Hickson, & Cooper, 2005; Vulliamy & Sullivan, 2000), apprehensions about damaging the relationship with the child's family (Gunn, Hickson, & Cooper, 2005), previous experience testifying or being deposed in a maltreatment case (Gunn, Hickson, & Cooper, 2005), and reservations regarding outcomes after reporting to CPS (Jones et al., 2008). In two population-based studies that did utilize linked administrative datasets regarding infants diagnosed with prenatal substance exposure, results indicated that health professionals reported children to CPS at relatively low rates. In California, 53.4% of infants diagnosed with prenatal substance exposure were reported to CPS (Putnam-Hornstein, Prindle, & Leventhal, 2016) while 42.4% of infants diagnosed with prenatal substance exposure were reported to CPS in Washington State (Rebbe, Mienko, Brown, & Rowhani-Rahbar, 2019a).

Thus, while U.S. child protection systems are dependent on members of the public and especially mandated reporters to refer concerns of child maltreatment to CPS, the limited evidence that exists on this subject suggests that these reports do not occur at the rate policies state that they should. And when some reports occur there are problems in how the information is passed along from medical to CPS agencies. "Sentinel injury" teams in hospitals in Ohio, Pennsylvania and Los Angeles are building on a large amount of prior medical research about the proper ways of doing case and information "handoffs" so that crucial information about a child's condition and risk levels is communicated promptly and with minimal loss of essential information.[1] This is an important area for increased research and evidence in order to improve child protection systems.

Summary

The public health framework is a useful guide for future research and the development of prevention programs in regards to child maltreatment. Additionally, it highlights two key limitations regarding the current knowledge of child maltreatment. First, the incidence and prevalence of child maltreatment continues to be elusive because child maltreatment is difficult to measure, as definitional differences exist between jurisdictions, and the prevailing notion that not all maltreated children are reported to CPS. As a result, there is great variation in the published incidence and prevalence rates. Second, the data from official reports lacks critical sociodemographic information that is needed to develop a deep understanding of the risk factors of child maltreatment. Additionally, the public health framework identifies that early risk factors

[1] See for example: Institute of Medicine. Crossing the quality chasm: A new health system for the 21st century. Washington, DC: National Academy Press; 2001; Patterson ES, Roth EM, Woods DD, et al. Handoff strategies in settings with high consequences for failure: Lessons for health care operations. *Int J Qual Health Care*. 2004; 16(2):125–132. Sheets, L.K., Leach, M.E., Koszewski, I.J., Lessmeier, A.M., Nugent, M., & Simpson, P. (2013). Sentinel injuries in infants evaluated for child physical abuse. *Pediatrics.* 131(4):701-7. doi: 10.1542/peds.2012-2780.

are helpful to develop early interventions and prevention services. With these in mind, the public health framework illustrates the gaps in the field and where advances are needed to better understand the problem of child maltreatment. This dissertation is situated to address some of these gaps in the field and will contribute new knowledge that can be applied to the public health framework of child maltreatment.

In addition to understanding the prevalence and risk factors of child maltreatment, this dissertation addresses a critical gap in the child maltreatment literature. Child protection systems in the U.S. rely on reports to come to CPS agencies regarding concerns of child maltreatment. It is from these reports that interventions by the state can then occur. Mandated reporters, which includes all health professionals, are a particularly important component of this systemic feature given their exposure to children and their expertise. The state of Washington has recognized the particular important role that physicians play and has codified in policy that all CPS reports by physicians be screened in for investigation (DCYF Policy 2200.1.c.ii.C [2]). The medical field itself has identified the critical role medical professionals, and pediatricians in particular, have in regards to child maltreatment intervention both historically, including Kempe's identification of the battered child syndrome, and with the recent literature on sentinel injuries. Yet despite widespread recognition of how important medical professionals are in terms of child maltreatment intervention, there is limited evidence in regard to how they respond when they do encounter cases of suspected maltreatment, the majority of which has relied on retrospective surveys. This dissertation addresses this gap in the literature, utilizing the linked administrative dataset that enables this analysis to occur.

This dissertation has major implications in terms of policy. First, the contribution to our understanding of the incidence and prevalence of child maltreatment can be used in regard to

allocating resources related to child maltreatment prevention and intervention. If we do not have a good understanding of how many children and families are impacted by child maltreatment, it is difficult to accurately disperse the appropriate level of resources in response. Results from this dissertation can be used to better understand this concern. Second, the identification of risk and protective factors can be used to target and develop prevention programs. Frequently, research on risk and protective factors in regard to child maltreatment are variables identified using cross-sectional research. This limits the utility of these variables for prevention programs because they are identified after (or when) child maltreatment has occurred. The identification of sociodemographic variables from the birth records maximize the usefulness of these risk and protective factors because they are identifiable at birth. Thus, prevention programming can be targeted to children and their families just after birth, enhancing their effectiveness by intervening as early as possible. Additionally, the examination of neighborhood characteristics accounts for the multiple levels that may be influencing child maltreatment behaviors. If neighborhood-level risk factors are identified, then community-level prevention programs and interventions can be implemented in the communities identified as being high at risk for increased rates of child maltreatment related hospitalizations. Finally, the examination of system responses to child maltreatment-related hospitalizations will inform whether modifications to the current mandated reporter policies, especially in regard to health professionals needs to be modified. In particular, it is possible that additional training may be necessary for health professionals on mandated reporting laws and/or identifying child maltreatment.

[2]https://www.dcyf.wa.gov/practices-and-procedures/2200-intake-process-and-response

CHAPTER 2:
METHODS

Data

This dissertation utilizes a unique population-based dataset of linked birth record, hospital discharge, and child protective services (CPS) administrative data for all children born in Washington State between 1999 and 2013 (N = 1,271,416). It is part of a larger parent study at Partners for Our Children, "Child Welfare System Involvement and Risk for Injury" (PI: Joseph Mienko), that has approval through the Washington State Institutional Review Board (IRB). The dataset incorporates administrative records from different state agencies; the birth and hospital discharge records are from the Washington Department of Health which have been linked to each other and to the administrative records from the Washington State CPS agency. Per the IRB agreement, the linkage was completed outside of Partners for Our Children at the University of Washington School of Public Health using deterministic and probabilistic methods. The dataset includes information from the children's birth record, any hospital admissions they have had within Washington State, and any involvement with the Washington State CPS agency. The dataset includes 332,676 unique hospitalizations between 1999 and 2013.

Data Preparation

As part of the preparation for this dissertation, extensive data preparation was required. The following procedures were used to prepare the dataset for analysis. The variables needed were contained in different tables within a SQL database at Partners for Our Children. Using the unique identifier that was assigned to each individual during the linkage process, a dataset was assembled in SQL. Specifically, the data needed to be combined into a single table where each row represented a single hospitalization (for incidence) or a single child (represented by the first

child maltreatment-related hospitalization for children who experienced more than one hospitalization for prevalence).

As described in the first chapter, a set of codes suggestive of child maltreatment was developed to address the concerns of under counting child maltreatment using only ICD-9 codes specifically related to child maltreatment (Schnitzer, Slusher, Kruse, & Tarleton, 2011). The process, which involved consulting numerous child maltreatment experts and the academic literature, consisted of four major components: 1) compiled a broad list of ICD-9 codes to study, 2) examined the medical records for a sample of hospitalizations associated with the codes, 3) identified if the hospitalization was probable, possible, or not likely child maltreatment using operationalized definitions, and 4) created a list of codes suggestive of maltreatment when 66% or more of the cases were identified as probable or possible maltreatment. These suggestive codes were classified into four subtypes of maltreatment (physical abuse, neglect, sexual maltreatment, physical maltreatment or neglect), which are utilized in this dissertation.

To prepare the dataset for analysis, first, a table was created that included all of the ICD-9 codes found to be suggestive of maltreatment by Schnitzer et al. (2011) and the specific maltreatment codes (995.50-995.59, E967, V7181, V715) with corresponding maltreatment flags for the type maltreatment. This table was joined (or matched) with the hospitalization table adding maltreatment flags for each diagnosis in the dataset. The diagnoses in the original format were "long," meaning that each diagnosis had its own row. Each hospitalization could have up to 25 diagnoses. Therefore, the next step was to rearrange the data so that it was "wide," or that each row represented one hospitalization. As each hospitalization now had up to 25 diagnoses and each diagnosis had its own set of maltreatment flags, additional variables were created to identify the number of diagnoses in each maltreatment category present for each hospitalization.

The Schnitzer et al. (2011) article also included co-occurring exclusion codes for many of the ICD-9 codes identified as suggestive of maltreatment. The codes suggestive of maltreatment with their corresponding exclusion codes are presented in Table 2. For example, these exclusions included external causes of injury codes such as E810-19 involving a motor vehicle accident and codes E890-E897 involving accidents caused by fire. These exclusion codes do no indicate that child maltreatment could not have occurred, but that it was more likely to not have been associated with maltreatment. An exclusion flag was created indicating if any of the co-occurring exclusion diagnosis codes were present for a hospitalization with a suggestive maltreatment diagnosis. For two diagnoses, severe malnutrition (262) and second-hand tobacco smoke (E869.4), there were inclusion co-occurring codes as opposed to exclusion co-occurring codes. In other words, there were co-occurring codes necessary to be present for maltreatment to be suggested. For these two codes, neglect was only indicated if the codes required by Schnitzer et al. (2011) were present and the flags were created in such a manner to reflect this requirement. The variables of interest from the birth record were then added (joined) to the dataset by matching the unique child identifiers from both tables. The sociodemographic variables from the birth record were the same as those used in the California linked administrative dataset study of injury mortality (Putnam-Hornstein, 2011) except where there was too much missing data to include them in this study (such as maternal education which had more than 70% missing). The included variables are discussed at more length in the measures subsection of this chapter.

Table 2. *ICD-9 Codes Suggestive of Maltreatment from Schnitzer et al., 2011.*

ICD-9 Code	Code Description	Age Included	Co-Occurring Exclusion
Suggestive of sexual maltreatment			
054.1	Genital herpes	< 10	771.2
098	Gonococcal infection	< 10	098.4, 771.6
614.9	Pelvic inflammatory disease, unspecified	< 10	
922.4	Contusion of genital organs	< 10	E800-E819, 286-287
V71.5	Observation after alleged rape	< 10	
V71.81	Observation for abuse/neglect	< 10	
Suggestive of physical maltreatment			
362.81	Retinal hemorrhage	< 3	E810-E813 or E815-E819 (unless .6 or .7), 286-287
807.0	Rib fracture	< 5	E810-E813 or E815-E819 (unless .6 or .7), 756.51, 767, 733.10-733.19, 765
807.1	Rib fracture	< 5	
811	Scapula fracture	< 5	
852.2	Traumatic subdural hemorrhage	< 5	E810-E813 or E815-E819 (unless .6 or .7), 286-287
853.0	Other/unspecified intracranial hemorrhage	< 5	
863.1	Stomach injury	< 10	E810-E813 or E815-E819 (unless .6 or .7)
E965	Assault	< 4	E960.1, E968.4
E966	Assault	< 4	
E968.2	Assault	< 4	
E968.9	Assault NOS	< 4	
E988	Undetermined intent, other means	< 10	
Suggestive of neglect or physical maltreatment			
800	Skull vault fracture	< 5	E810-E813 or E815-E819 (unless .6 or .7), 756.51, 767, 733.10-733.19, 765
805	Vertebral fracture	< 5	
852.0	Traumatic subarachnoid hemorrhage	< 5	E810-E813 or E815-E819 (unless .6 or .7), 286-287
862	Intrathoracic injury, NEC	< 5	
863.2	Small intestine injury	< 5	

863.3	Small intestine injury	< 5	E810-E813 or E815-E819 (unless .6 or .7)
865	Spleen injury	< 5	
952	Spinal cord injury	< 3	E800-E819
Suggestive of neglect			
262	Other severe malnutrition	< 10	Table A3
521.0	Dental caries	< 10	
692.7	Solar radiation dermatitis	< 2	
808	Pelvic fracture	< 5	E810-E813 or E815-E819 (unless .6 or .7), 756.51, 767, 733.10-733.19, 765
860	Traumatic pneumohemothorax	< 5	E810-E813 or E815-E819 (unless .6 or .7)
861	Heart or lung injury	< 5	
863.8	GI injury, NEC	< 5	
864	Liver injury	< 5	
866	Kidney injury	< 5	
941	Burn of head	< 5	E890-E897
942	Burn of trunk	< 5	
945	Burn of leg	< 5	
946	Burn of multiple sites	< 5	
960-979	Poisoning by drugs/medicinals	< 5	E870-E876
994.1	Drowning, non-fatal submersion	< 4	
E869.4	Second-hand tobacco smoke	< 10	Only with 480.0–487.8; 490.0–491.9; 466.0–466.19; 493.0–493.9; or 381.0–381.4
E910.2	Swimming accident	< 4	
E910.4	Bathtub (near) drowning, NOS	< 4	
E910.8	Other (near) drowning	< 4	
E910.9	Accidental (near) drowning, NOS	< 4	
E960.0	Unarmed fight, brawl	< 4	E960.1; E968.4
E980	Undetermined intent, poisoning	< 5	
E985	Undetermined intent, firearm	< 10	
V60	Household circumstances	< 10	

Sample Description

With all the necessary variables in the dataset, the population was then restricted based on the criteria for this dissertation which are hospitalizations, between the years of 1999 and 2013, related to child maltreatment for children born in the state of Washington who were under the age of three years at the time of hospital admission. The hospitalizations were restricted to those that occurred within a child's first three years of life (n = 186,839), for children who were born in Washington State (n = 181,564), that had a diagnosis suggestive of maltreatment (n = 7,160), and without a co-occurring exception diagnosis for a final dataset of 6,992 hospitalizations. The first three years of life were chosen because the youngest children have been found to be the most vulnerable to child maltreatment as assessed nationally as confirmed victims of child maltreatment and child maltreatment fatalities (USHHS, 2019). Additionally, all of the age restrictions for the suggestive maltreatment codes are at age three or above (except for solar radiation dermatitis which is restricted to age two or younger). The restriction to children born in the state of Washington is to ensure that comparisons can be made between children who experience child maltreatment related hospitalizations and those who do not using the sociodemographic variables from the birth record. The years of the data are the most recent years of data available. This breakdown is presented in Table 3.

Some children had multiple child maltreatment-related hospitalizations during the observation time period. The multiple hospitalizations were included in the calculations of incidence as this measure was concerned with the number of hospitalizations related to child maltreatment. For the calculation of prevalence and subsequent analysis, only the first child maltreatment-related hospitalization was included in the analysis because the interest was on the children who had experienced hospitalizations related to child maltreatment. Some children, 14, had multiple hospitalizations on the same date, indicating a likely transfer from one hospital to

another for the same concerns. For these cases, the hospitalization that resulted in a transfer was removed from the dataset for analysis, in the same fashion as a child's subsequent hospitalizations (i.e. included for incidence analysis and removed for prevalence and child-level analyses).

Table 3. *Frequency of Hospitalizations, by year and study restriction*

Hospitalization Year	Hospitalizations	Within 3 years of life	Born in WA	Child Maltreatment Diagnosis	Without Exception
1999	16368	9084	5529	75	74
2000	16857	10976	9630	371	362
2001	16764	11902	11530	436	427
2002	17028	11938	11938	505	489
2003	16832	11356	11356	405	399
2004	17396	11400	11399	552	548
2005	19656	12530	12530	553	544
2006	20257	12231	12231	651	642
2007	21958	13043	13042	553	536
2008	24044	13532	13532	544	531
2009	28355	14665	14665	477	461
2010	29238	14653	14653	514	497
2011	29760	14384	14384	572	562
2012	29104	12718	12718	474	463
2013	29059	12427	12427	478	457
Total:	**332676**	**186839**	**181564**	**7160**	**6992**

Note: Within three years of life is after birth and before third birthday

Measures

Maltreatment Category. A categorical variable was constructed based on the type of maltreatment the hospitalization diagnosis (ICD-code) was associated with according to Schnitzer et al. (2011). For hospitalizations that had diagnoses from multiple categories of maltreatment, these were labeled as "poly-type." The specific codes for maltreatment were also included in these categories. The ICD-9 specific codes that did not specify a type (995.5, 995.59, E967, and V71.81) were included in the "unspecified maltreatment" category. The code for shaken baby syndrome (995.55) was included in the physical abuse category. The

emotional/psychological abuse codes were included with the neglect category. The categories included were: abuse, neglect, sexual abuse, unspecified maltreatment, and poly-type.

Age Category. A categorical variable was constructed to indicate if the hospitalization occurred before the child's first, second, or third birthday based on the child's birth date (from the birth records) and the hospitalization admission date.

Prior CPS Report. Using the CPS records, this was modeled as a time-varying covariate to indicate if CPS received any report (whether screened in or not) regarding the child prior to the hospitalization admission date. This is the same construction of this variable as in the California injury mortality study (Putnam-Hornstein, 2011).

Child Sex. Based on the child's birth record, the child's sex was constructed as a binary variable as either male or female. Female was treated as the referent category as previous research has indicated the male children are at higher risk for maltreatment-related hospitalizations (Mason et al., 2018).

Maternal County of Residence. A categorical variable based on the county that the mother resided in at the time of the child's birth, one of the 39 counties in Washington State, from the birth records.

Maternal Zip Code of Residence. The zip code the mother resided in at the time of the child's birth, from the birth records.

Length of Hospitalization Stay. This discrete variable was constructed using the hospital admission date and the discharge date and is presented in days, from the hospitalization record.

Hospitalization Cost. A continuous variable representing the total cost for the hospitalization for the child in dollars, from the hospitalization records.

Maternal Race/Ethnicity. This categorical variable was constructed from two variables from the birth record, a race variable and an ethnicity variable. Multiple racial categories could not be captured by the race variable. If the race variable indicated Asian Indian, Chinese, Filipino, Guamanian, Hawaiian, Japanese, Korean, Other Asian, Samoan, or Vietnamese, it was coded as Asian/Pacific Islander. If the race variable indicated black, Hispanic, or Native American, this variable was coded the same. If the race variable indicated white, other non-white, or unknown, the ethnicity variable was referred to, and if it indicated Central or South American, Cuban, Mexican, or Puerto Rican, it was coded as Hispanic. If none of these were indicated, for the instances where it was indicated white, they were coded as white. All others were coded as other/unknown. The final categories for this variable were: white, black, Hispanic, Native American, Asian/Pacific Islander, and other/unknown. White was used as the reference category as it was the largest race/ethnicity category for the study.

Maternal Age. A categorical variable based on the mother's age at the time of birth. Age was broken up into four categories: 19 years and younger, 20-24, 25-29, and 30 or more years. For the inferential statistical models, a binary variable indicating that the mother was either a teenager at time of birth or not was used to use the same type of variable throughout the model, which improves the interpretation of the results.

Birth Payment Category. The health insurance type used to pay for the birth, according to the birth records. Two categories were utilized. The first, private insurance, was if the insurance was labeled as "private insurance" or "self-pay." The second, public insurance, included public forms of health insurance, most prominently, Medicaid. Private insurance was treated as the referent category as it was the largest category.

Prenatal Care Start Trimester. A categorical variable indicating the trimester prenatal care was started by the mother, from the birth records. As a result, there were four categories: first trimester, second trimester, third trimester, and no prenatal care recorded. For the inferential statistical models, prenatal care was modeled as a binary variable with 1st and 2nd trimester prenatal care starts as the referent category and no or late (3rd trimester) prenatal care as the second category as the majority of births in this time period had prenatal care starts in the first or second trimester.

Parity. The number of live births the mother experienced prior to the current birth on the birth record was constructed as a binary variable as either the mother's first born child or a subsequent birth. This is the same construction as the California injury mortality study (Putnam-Hornstein, 2011).

Infant Birth Weight. The infant's birth weight was converted to a binary variable as either low birth weight, as indicated below 2500 grams, or normal birth weight, those of at least 2500 grams, a typical construction for this variable (Mason, 2018; Putnam-Hornstein & Needell, 2011; Spencer, Wallace, Sundrum, Bacchus, & Logan, 2006; Wu et al., 2004).

Concentrated Disadvantage. Following the guidelines set for by the Association of Maternal and Child Health Programs (2013), concentrated disadvantage was comprised of five variables through the U.S. Census American Community Survey (ACS): 1) percent of individuals below the poverty line, 2) percent of individuals on public assistance, 3) percent of female-headed households, 4) percent of population unemployed, and 5) the percent of population under the age of 18. These variables were downloaded from the U.S. Census's American Fact Finder website at the Zip Code Tabulation Areas for Washington State using estimates from the 2011 ACS 5-year estimates, which spanned the largest portion of the years in

this study. Zip codes were chosen because they provide more nuance and replicate neighborhoods better than counties as they are smaller, but due to the relatively rarity of child maltreatment-related hospitalizations, maltreatment occurs with more frequency than in census block groups. The five variables were z-score transformed for each zip code where:

$$\text{z-score} = (\text{score} - \text{mean})/\text{standard deviation}$$

After all the z-scores were calculated for each zip code, a cut off was calculated at the 75th percentile, consistent with the Association of Maternal and Child Health Programs (2013) recommendations. Then a binary indicator was created for those zip codes who were above the 75th percentile as high concentrated disadvantage and those who were not above the threshold. The distribution of concentrated disadvantage in the state of Washington is presented in Figure 3.

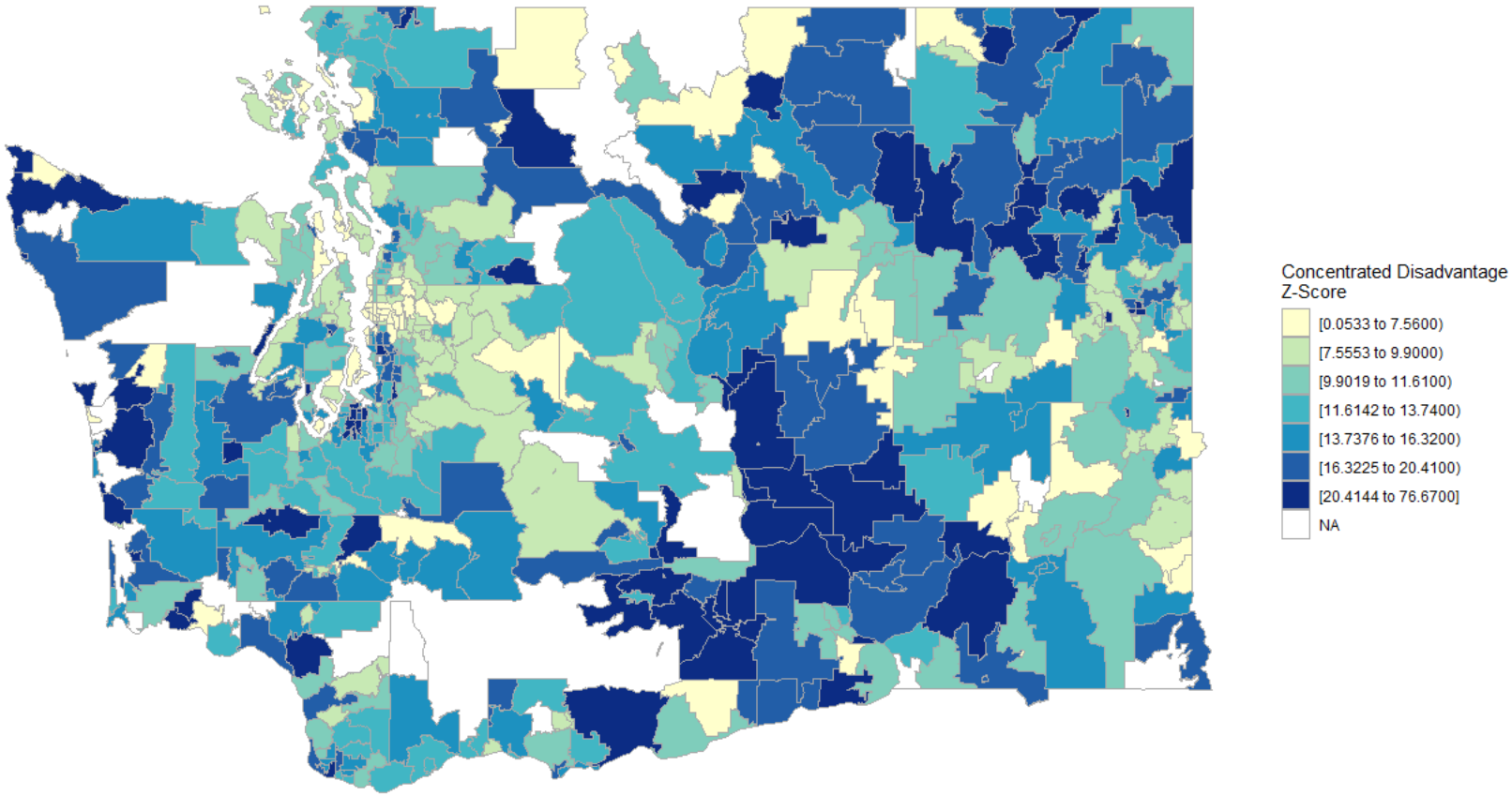

Figure 3. Distribution of Concentrated Disadvantage by Zip Code, Washington State, 2011 5-Year Estimate

Analytic Methods

Aim 1 - Prevalence

All data analysis was conducted using R version 3.5.0 (R Core Team, 2018). The frequency of child maltreatment-related hospitalizations was calculated by maltreatment type and the year of the child's life. Additionally, the incidence rate per 1,000 births by maltreatment and the year of the child's life was calculated based on the entire population of 1,271,426 births in Washington State during this time frame. The use of the entire population means that weights or other methods are not needed to calculate the incidence rates. The formula to calculate the incidence rates was:

$$Incidence\ rate\ per\ 1{,}000 = \frac{Number\ of\ hospitalizations}{Number\ of\ births\ in\ population}\ x\ 1{,}000$$

The frequency of the use of child maltreatment specific codes was calculated among all of the hospitalizations in the dataset.

The frequency and incidence rates per 1,000 births were calculated by the child's birth year and the type of maltreatment. Similarly, the frequency and incidence rates per 1,000 births were calculated by the type of maltreatment and the child's sex. The incidence rates per 1,000 births were calculated by maternal residence county at birth. The incidence rates per 1,000 births were calculated based on the number of births by each birth year, by child sex, and by maternal residence at birth, respectively, from the birth record data.

A sensitivity analysis was conducted specifically taking the same approach as Leventhal et al. (2008) to identify any type of fracture that had a co-occurring child maltreatment code (E960-E969 or 995.5) to identify how a different approach would impact the results regarding incidence.

Aim 2 – Risk Factors

The second aim utilized sociodemographic context variables to address what are risk factors at birth for child maltreatment-related hospitalizations. The methods to address this second aim were conducted in three parts. The first part of the examination of risk factors was chosen to provide descriptive statistics about the distribution of the sociodemographic risk factors among the entire population, children who experienced child maltreatment-related hospitalizations, and the children who did not experience one of these hospitalizations. The second part specifically examined the role of concentrated disadvantage at the community level, as measured by zip codes. Multilevel, also known as hierarchical, models were chosen to test this community-level variable simultaneously with the individual-level sociodemographic risk factors (Maguire-Jack, 2014). The third part assessed whether a prior CPS report was a risk factor. As a prior CPS report is not a static risk factor, meaning that unlike the sociodemographic variables from the birth record, a child's status could change from one day to the next, survival models were employed to take this timing of the status into consideration.

Part 1 – Sociodemographic Risk Factor Distribution. First, the proportions of maltreatment hospitalizations by maternal race and maltreatment type were calculated per 1,000 births. Second, the distributions of the sociodemographic factors were examined among the entire population of children born in Washington State between 1999 and 2013 (N = 1,271,416) and then between the children who had a child maltreatment-related hospitalization (n = 6,958) and those who did not (n = 2,264,458). The sociodemographic variables examined were maternal race/ethnicity, child sex, maternal age, birth payment, prenatal care start, parity, and infant birth weight. The frequency and percentages by variable were calculated and then chi-square tests were used to test for differences in the expected and observed frequencies for each sociodemographic variable.

Part 2 – Community-level analysis. I use multilevel regression models in this part of the analysis to examine whether community-level concentrated disadvantage was a risk factor for child maltreatment-related hospitalizations. A dataset with all the births in Washington between 1999-2013 was created with the sociodemographic variables, a binary indicator for a child maltreatment-related hospitalization, the maternal zip code of residence at the time of birth, and the binary high concentrated disadvantage variable. A hierarchical logistic regression model was run in addition to a standard logistic regression model for comparison. The varying-intercept logistic regression model is (Gelman & Hill, 2007):

$$\text{logit}(P[y_i = 1]) = \alpha_{j[i]} + \beta x_i, i = 1, \dots n$$
$$\alpha_j \overset{i.i.d.}{\sim} N(\mu_\alpha, \sigma_\alpha^2), j = 1, \dots n$$

Where y_i is experiencing a child maltreatment hospitalization before the age of three, i represents an individual, j represents each zip code, $\alpha_{j[i]}$ is the varying intercept, and βx_i is the vector of sociodemographic variables for individual i.

The Bayesian Information Criterions (BIC) of the hierarchical and standard logistic regression models were compared and the hierarchical model was indicated to be a better fit as indicated by its lower BIC score (Raftery, 1995), where BIC is:

$$\text{BIC} = -2 \text{ log-likelihood} + (p + 2)\log(n)$$

The random effects for each zip code were plotted. The hierarchical regression model results were presented as odds ratios.

Part 3 – Survival Models. This analysis specifically examined the associations between a prior CPS report and child maltreatment-related hospitalizations using survival models: the nonparametric Kaplan-Meier survival curve estimator and the Cox proportional hazards models. The formula for the Kaplan-Meier estimator is:

$$\hat{S}(t) = \prod_{t_i \le t} (1 - \hat{q}_i) = \prod_{t_i \le t} \left(1 - \frac{d_i}{n_i}\right)$$

where n_i is the number of children at risk for hospitalization at time t_i, and d_i is the number of children who had a hospitalization at that time. The Kaplan-Meier survival curve was plotted.

The Cox proportional hazard models were fit as both unadjusted, with just the prior CPS report variable, and adjusted models that included the prior CPS report variable and all of the covariates. The prior CPS report variable was modeled as a time-varying covariate. The adjusted models equations are:

$$\begin{aligned}\lambda\big(t\big|\mathrm{cps}(t)\big) = \lambda_0(t)\exp\,[&\beta_1 \mathrm{cps}(t) + \beta_2 \mathrm{maternal\ race} + \beta_3 \mathrm{male} \\ &+ \beta_4 \mathrm{low\ birth\ weight} + \beta_5 \mathrm{first\ born} + \beta_6 \mathrm{public\ birth\ payment} \\ &+ \beta_7 \mathrm{no/late\ prenatal\ care} + \beta_8 \mathrm{teenaged\ mother}]\end{aligned}$$

where:

$$\mathrm{cps}(t) = \begin{cases} 0\text{: if no prior CPS report} \\ 1\text{: if CPS report prior to time } t \end{cases}$$

The models were run for all hospitalizations and for each of the subtypes of maltreatment hospitalizations, except for sexual maltreatment because of the low incident rate. The results are presented in hazard ratios.

Aim 3 – Initial Responses

The hospitalization data was joined to the CPS report data. A flag was created to indicate whether an intake was made during the period of time the child was hospitalized. The time period indicating a report related to the hospitalization started four days prior to the admission date to the discharge date. The decision to choose four days prior to admission was to allow for the possibility of a child being in an emergency department prior to the hospital admission because emergency rooms were a typical entry point to the hospitalization for the children in this study. Further, the intakes were restricted to reporters who were categorized as medical

professionals, mental health professionals, social service professionals, a CPS worker, and law enforcement to ensure that the report was by a professional related to the hospitalization.

A second flag was constructed to indicate a hospital admission related removal. This type of removal was indicated if a removal occurred related to the hospitalization. Specifically, a removal was indicated when a removal occurred between four days prior to the admission date and five days after the discharge date from the hospitalization to allow for the court procedures necessary related to removals to occur.

The proportions of initial responses were calculated for each of maltreatment type, specific maltreatment code status, maternal race, and child age category. To do this, I use multinomial logistic regression models.

Multinomial logistic models extend logistic regression models where they include three or more outcome options and this approach is conceptualized as a series of logistic regressions (Gelman & Hill, 2007). In this case, the possible outcomes were "No CPS Report", "CPS Report" without a removal, and "Removal" which also implies a CPS report. Multinomial logistic regression was run with "No CPS Report" as the outcome reference using the multinom() function in the R 'nnet' package (Venables & Ripley, 2003). Multinomial logistic regression was chosen over ordinal logistic multinomial models because these models require an order or ranking to the outcomes (Gelman & Hill, 2007). Without the additional information that clinicians use to make their determination of how to respond to these types of hospitalizations, the decision was made not to impose an order onto the outcomes. The model included the maltreatment type categories, specific maltreatment code status, maternal race white (compared to other racial categories), child sex, low birth weight, first born status, public birth payment, no

or late prenatal care, and if the mother was a teenager at the time of birth. The equations for the multinomial model are as follows:

$$\ln\left(\frac{\Pr(response = CPS\ Report)}{\Pr(reponse = No\ CPS\ Report)}\right) = \beta X$$

$$\ln\left(\frac{\Pr(response = Removal)}{\Pr(reponse = No\ CPS\ Report)}\right) = \beta X$$

where βX is the vector of coefficients:

$$\beta_0 + \beta_1 \text{maltreatment type} + \beta_2 \text{ specific maltreatment code} + \beta_3 \text{maternal race} + \beta_4 \text{male} + \beta_5 \text{low birth weight} + \beta_6 \text{first born} + \beta_7 \text{public birth payment} + \beta_8 \text{no/late prenatal care} + \beta_9 \text{teenaged mother}$$

The binary maternal race category was used as it was found to be a better fit than a model with each of the maternal race categories as indicated by BIC scores (6598.657 (all races) vs 6543.185 for white binary). Results are presented as odds ratios in both tables and figures in Chapter 3.

In order to enhance interpretability (King, Tomz, & Wittenberg, 2000), the predicted probabilities and confidence intervals of the model were simulated using the R package "simcf" (Adolph, 2013). Using the parameters from the predictive distributions of the model defined by the variance-covariance matrix, specifically allowing the maltreatment types and the specific maltreatment code status to vary while holding the covariates at the mean, I drew 1,000 simulations and plotted them by maltreatment type and specific maltreatment code status.

CHAPTER 3:
RESULTS

Aim 1 – Incidence and Prevalence

Incidence

A total of 6,992 child maltreatment-related hospitalizations were identified for children under the age of three and born between 1999 and 2013, for an incidence rate of 5.50 hospitalizations per 1,000 births (after removing the secondary admissions on the same day for 14 children, likely the result of the child transferring to another hospital). The most frequent type of child maltreatment-related hospitalization was for neglect at 5,272 (incidence rate of 4.15 per 1,000 births), which is 75.6% of all these hospitalizations. The ICD-9 codes indicating neglect included burns, drownings, poisonings, and kidney injuries. Many of these codes appear to be likely related to supervisory neglect. The most frequent time period was before the child's first birthday with 3,186 hospitalizations, accounting for 45.7% of the total. The first year of a child's life continued to be the most frequent time for all of the subcategories, with the exception of neglect, which had the highest frequency during a child's second year (2,265) compared to 1,937 (1st year) and 1,070 in the third year.

Hospitalizations with multiple types ("poly-type") of suggested child maltreatment diagnoses were indicated for 397 children (incidence rate of 0.31 per 1,000 births), with the most frequent time period during the first year. The unspecified category of maltreatment-related diagnoses had a total of 821 hospitalizations (incidence rate of 0.65 per 1,000 births), with a large decline from the first year (577) to the second year (141). Sexual abuse-related hospitalizations were the least frequent with a total of 10 and an incidence rate of 0.01 per 1,000 births. However, there were more diagnoses indicating sexual abuse used in this population, as 34 of the hospitalizations under the poly-type category had a sexual abuse diagnosis, bringing the

total to 44 sexual abuse related hospitalizations, or an incidence rate of 0.03 per 1,000 births. Full results of the frequencies and incidence rates are presented in Table 4.

Table 4. *Frequencies and Incidence Rates per 1,000 Births of All Child Maltreatment-Related Hospitalizations by Subtype and Age*

	All		< 1 year		1-2 years		2-3 years	
	n	Rate	n	Rate	n	Rate	n	Rate
Neglect	5272	4.15	1937	1.52	2265	1.78	1070	0.84
Unspecified	821	0.65	577	0.45	141	0.11	103	0.08
Abuse	478	0.38	386	0.30	61	0.05	31	0.02
Poly-Type	397	0.31	283	0.22	60	0.05	54	0.04
Sexual Abuse	10	0.01	3	0.00	5	0.00	2	0.00
All Types	6978	5.49	3186	2.51	2526	1.99	1260	0.99

Table 5 presents the frequency of the use of child maltreatment specific codes. The most frequently used specific code was the external causes of injury (E-code) indicating child maltreatment (E967) present 421 times, or 6.02% of all of the child maltreatment-related hospitalizations. This external code was followed closely by code 995.54 indicating child physical abuse with 363 uses. The ICD-9 code diagnosing shaken baby syndrome, also known as abusive head trauma (995.55), was used 78 times. In sum, child maltreatment specific codes were used 1,048 times, for 607 hospitalizations, which is 8.68% of the total hospitalizations.

Table 5. *Frequency of Child Maltreated Specific Codes Used for Hospitalizations*

ICD-9 Code	Code Description	Count
995.5	Child abuse, unspecified	47
995.51	Child emotional/psychological abuse	1
995.52	Child neglect (nutritional)	79
995.53	Child sexual abuse	6
995.54	Child physical abuse	363
995.55	Shaken baby syndrome	78
995.59	Other child abuse and neglect	31
E967	Child abuse – injury purposely inflicted by other persons	421
V71.5	Rape	0
V71.81	Evaluation for abuse and neglect	22

Some children, 209, had multiple child maltreatment-related hospitalizations before their third birthday. A total of 192 children had two maltreatment-related hospitalizations, while 14 had three maltreatment-related admissions, two children had four admissions, and one child had five hospital admissions. All subsequent results will discuss the first hospitalizations, or prevalence, of children in the dataset.

Prevalence

The birth year with the highest prevalence rate of child maltreatment-related hospitalizations was 2005 with a rate of 6.83 per 1,000 births, excluding consideration of birth years 2011-2013 because of incomplete hospital records. Children born in 2009 had the highest prevalence rate of abuse-related hospitalizations at a rate of 0.56 per 1,000 births while children born in 2004 had the highest prevalence rate of neglect-related hospitalizations (5.73 per 1,000 births). Children born in 2010 had the highest prevalence rates of both unspecified maltreatment-related hospitalizations (0.91 per 1,000 births) and poly-type-related hospitalizations (0.41 per 1,000 births).

The lowest prevalence rate for all types of child maltreatment-related hospitalizations was for children born in 2008 at 4.99 per 1,000 births. Children born in 2003 had the lowest prevalence rates for abuse-related, unspecified maltreatment-related, and poly-type hospitalizations. The lowest prevalence rate for neglect-related hospitalizations at 3.34 per 1,000 births was children born in 2009. Full results of hospitalization prevalence rates by birth year and maltreatment type are found in table 6.

Table 6. *Prevalence Rate per 1,000 Births of All Child Maltreatment-Related Hospitalizations by Subtype and Birth Year*

	All Types		Abuse		Neglect		Sexual Abuse		Unspecified		Poly-Type	
Birth Year	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate
1999	497	6.43	21	0.26	433	5.56	1	0.01	33	0.41	14	0.18
2000	490	6.20	26	0.32	424	5.24	2	0.02	36	0.44	14	0.17
2001	451	5.87	20	0.25	393	4.94	1	0.01	37	0.46	16	0.20
2002	488	6.31	35	0.44	399	5.05	0	0.00	37	0.47	28	0.35
2003	497	6.33	15	0.19	449	5.57	0	0.00	32	0.40	14	0.17
2004	556	7.02	26	0.32	484	5.91	0	0.00	40	0.49	25	0.31
2005	566	7.01	34	0.41	476	5.74	0	0.00	53	0.64	18	0.22
2006	535	6.29	31	0.35	442	5.06	2	0.02	48	0.55	26	0.30
2007	505	5.84	33	0.37	374	4.18	0	0.00	82	0.92	34	0.38
2008	454	5.11	52	0.57	327	3.60	0	0.00	55	0.60	31	0.34
2009	456	5.26	55	0.61	307	3.42	2	0.02	76	0.85	32	0.36
2010	450	5.47	37	0.43	317	3.64	1	0.01	83	0.95	38	0.44
2011[a]	422	5.05	37	0.42	269	3.07	0	0.00	106	1.21	30	0.34
2012[a]	257	3.03	33	0.38	134	1.52	0	0.00	70	0.80	29	0.33
2013[a]	119	1.37	27	0.31	40	0.46	1	0.01	34	0.39	17	0.20
Total	6743	5.30	439	0.35	5118	4.03	10	0.01	810	0.64	366	0.29

[a] Birth years without hospitalization records for three years

Table 7. *Prevalence Rates per 1,000 Births of First Child Maltreatment Related Hospitalizations by Type and Sex*

	All Types		Abuse		Neglect		Sexual Abuse		Unspecified		Poly-Type	
	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate
Female	2930	4.73	172	0.28	2245	3.62	4	0.01	359	0.58	150	0.24
Male	3813	5.85	267	0.41	2873	4.41	6	0.01	451	0.69	216	0.33
Total	6743	5.30	438	0.35	5118	4.03	10	0.01	810	0.64	366	0.29

Male children had higher overall prevalence rates of child maltreatment-related hospitalizations than female children at 5.85 per 1,000 births compared to 4.73 per 1,000 births for females. This pattern held across all maltreatment subtypes with male children having higher prevalence rates per 1,000 births than females for abuse (0.41 vs. 0.28), neglect (4.41 vs. 3.62), unspecified maltreatment (0.69 vs. 0.58), and poly-type (0.33 vs. 0.24) diagnoses. Full results by sex and maltreatment subtype are presented in Table 7.

The average length of stay in the hospital was the longest for children who experienced poly-type maltreatment. These children averaged 7.44 days in the hospital. This was followed by children who experienced abuse-related hospitalizations at an average of 5.12 days in the hospital. Full results are presented in Table 8.

Table 8. *Average Lengths of Stays of All Child Maltreatment Related Hospitalizations by Subtype*

Subtype	n	Average Hospital Length of Stay
Neglect	5278	3.61
Unspecified	822	2.29
Abuse	482	5.12
Poly-Type	366	7.44
Sexual Abuse	10	2.50
All Types	6958	3.76

Variation of prevalence rates was found among maternal residence counties at the time of the child's birth. Lincoln, Benton, and Ferry counties had the highest overall prevalence rates of child maltreatment related hospitalizations at 11.60, 11.10, and 9.51 hospitalizations per 1,000 births, respectively. Lincoln and Ferry counties are located in the northeast part of the state, while Benton is located on the south-central border. Skamania (1.02), Klickitat (1.36), and Columbia (1.91) counties had the lowest prevalence rates of child-maltreatment related hospitalizations per 1,000 births. Skamania and Klickitat counties are located on the south border

in the west while Garfield is also on the Southern border to the east. Garfield County had a total of 59 births between 1999 and 2013 and had no child maltreatment-related hospitalizations for these children during their first three years of life. A map displaying the child maltreatment-related hospitalization prevalence rates for each county in Washington State is presented in Figure 4.

The neglect-related hospitalization prevalence rates by county followed a similar pattern as the overall maltreatment-related hospitalization prevalence rates. Lincoln (10.20), Benton (9.86), and Ferry (8.56) counties had the highest prevalence rates of neglect-related hospitalizations, while Skamania (1.02), Klickitat (1.36), and Columbia (1.91) counties had the lowest prevalence rates of neglect related hospitalizations per 1,000 births. The neglect-related hospitalization prevalence rates are presented in a map by county in Figure 5.

The physical abuse-related hospitalization prevalence rates varied in its distribution from the overall and neglect prevalence rates of hospitalizations. San Juan, Stevens, and Okanogan counties had the highest prevalence rates of physical-abuse related hospitalizations at 1.40, 1.03, and 0.94 per 1,000 births. Stevens and Okanogan counties are located in the northeastern part of the state while San Juan is comprised of islands in the northwest region of the state. Additionally, Asotin, Columbia, Ferry, Garfield, Klickitat, Pend Oreille, Skamania, Wahkiakum, and Whitman counties had no physical abuse-related hospitalizations for this cohort. The county physical abuse-related hospitalization prevalence rates are presented in a map in Figure 6.

The prevalence rate of hospitalizations related to unspecified maltreatment diagnoses had the highest prevalence rates in rural counties. Grant (1.68), Walla Walla (1.54), and San Juan (1.40) counties had the highest prevalence rates per 1,000 births. Grant and Walla Walla are located in the eastern part of Washington while San Juan is an island county in the northwest.

Seven states had no hospitalizations associated with the unspecified maltreatment diagnoses: Asotin, Columbia, Garfield, Klickitat, Pacific, Skamania, and Wahkiakum. The map in Figure 7 presents the unspecified maltreatment diagnosis-related hospitalization prevalence rates by county.

Sexual abuse-related hospitalizations were not as frequent as the other types of child maltreatment. Douglas County, located centrally in the state, had the highest prevalence rate per 1,000 births of sexual abuse-related hospitalizations at 0.40. Island and Spokane counties were the next highest at 0.14 and 0.12, respectively. A total of 23 counties had no sexual abuse-related hospitalizations for children born within this time period by their third birthday. Figure 8 presents the county prevalence rates of sexual abuse-related hospitalizations per 1,000 births.

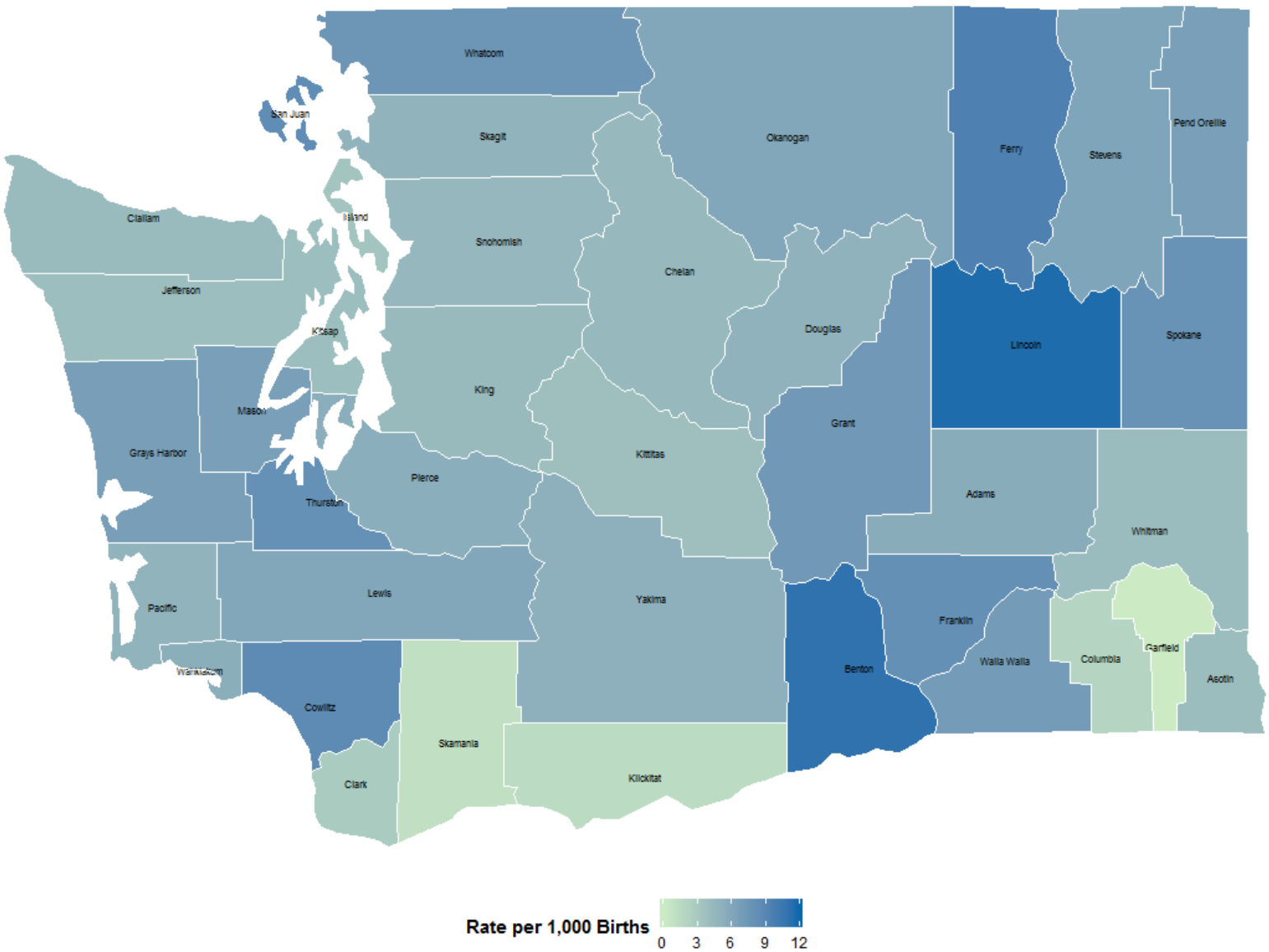

Figure 4. Map of Prevalence Rate of First Child Maltreatment-Related Hospitalizations Before Age 3 by County

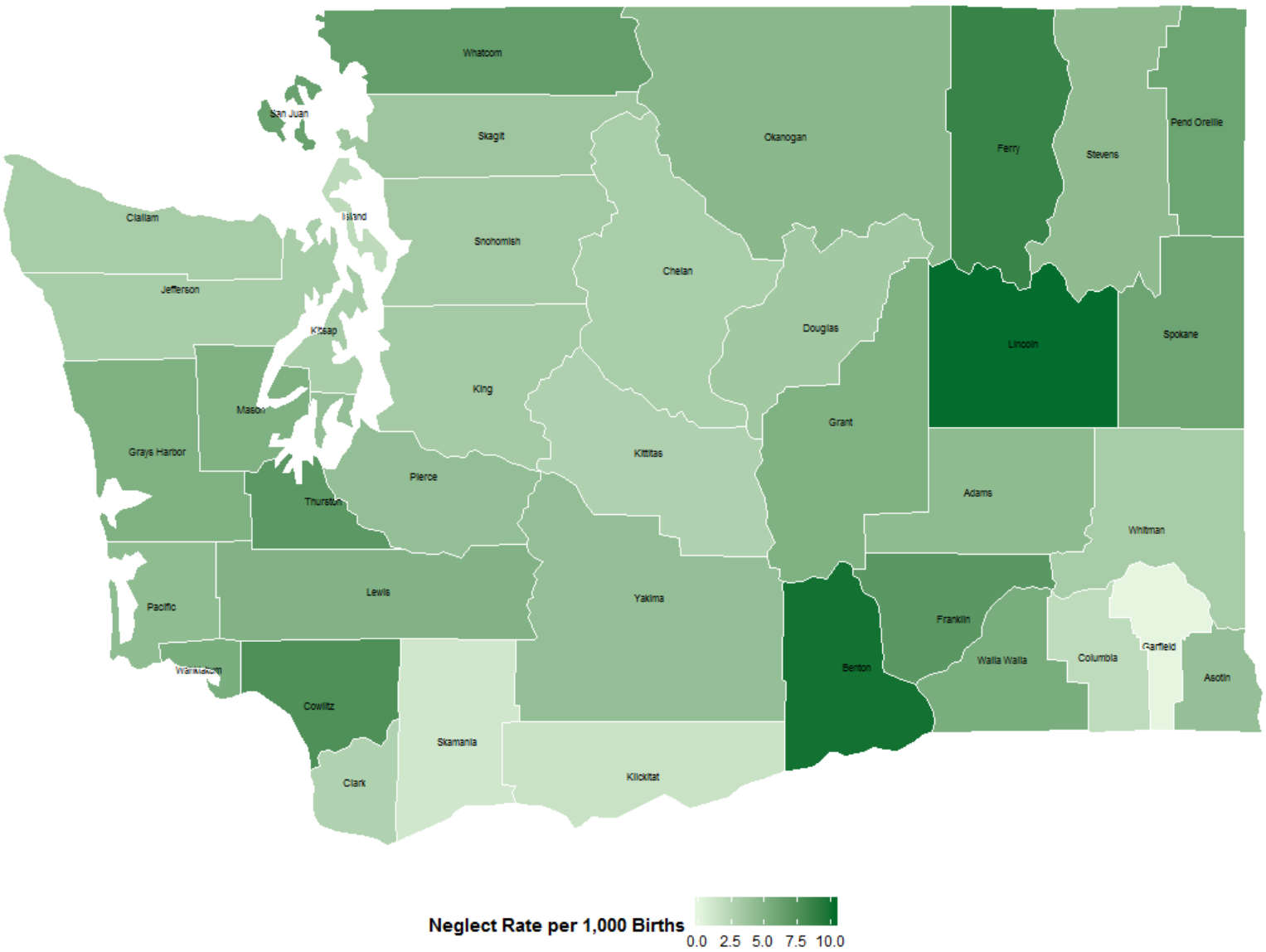

Figure 5. Prevalence Rate of First Neglect-Related Hospitalizations Before Age 3 by County

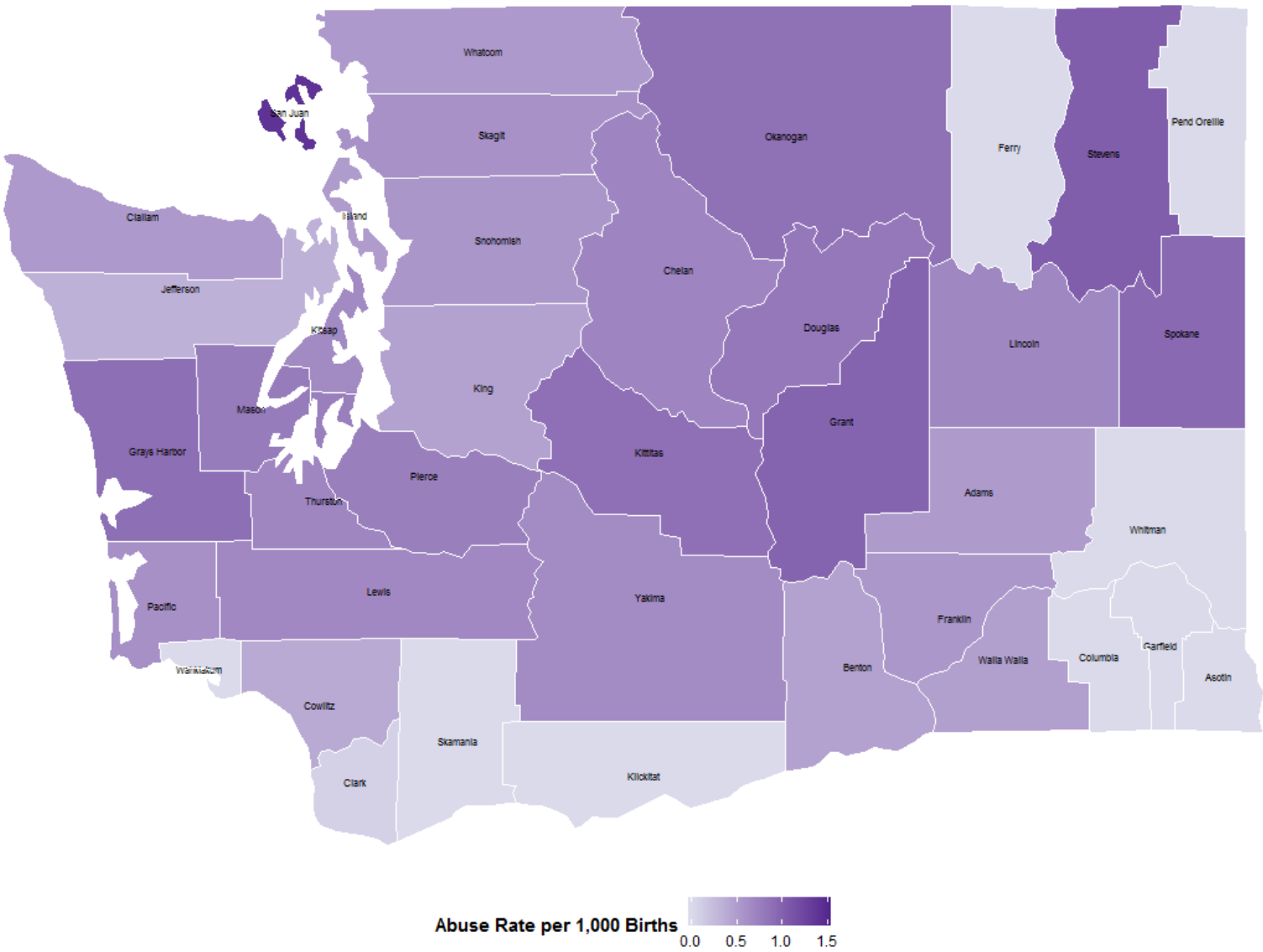

Figure 6. Prevalence Rate of First Abuse-Related Hospitalizations Before Age 3 by County

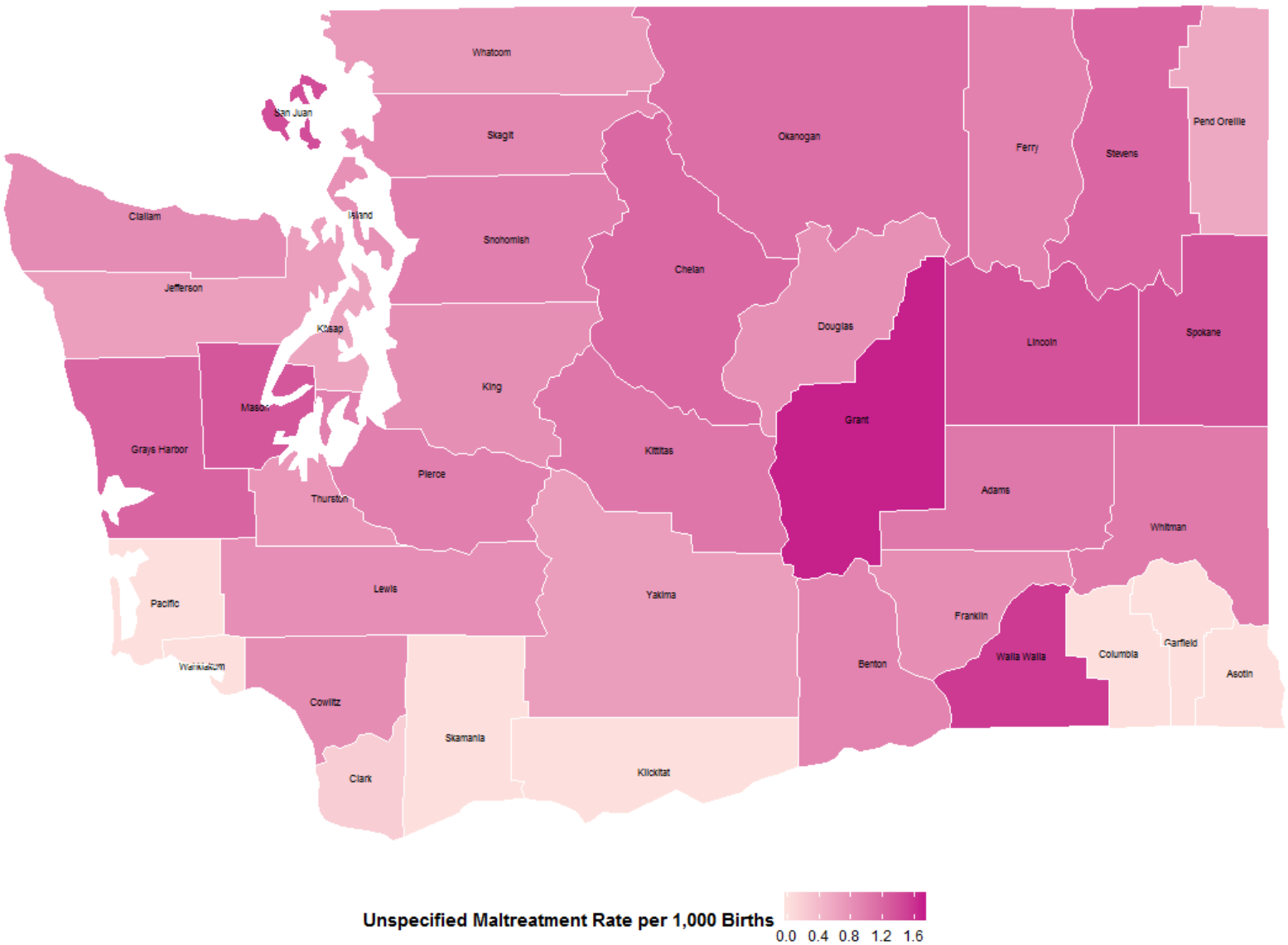

Figure 7. Prevalence Rate of First Unspecified Maltreatment-Related Hospitalizations Before Age 3 by County

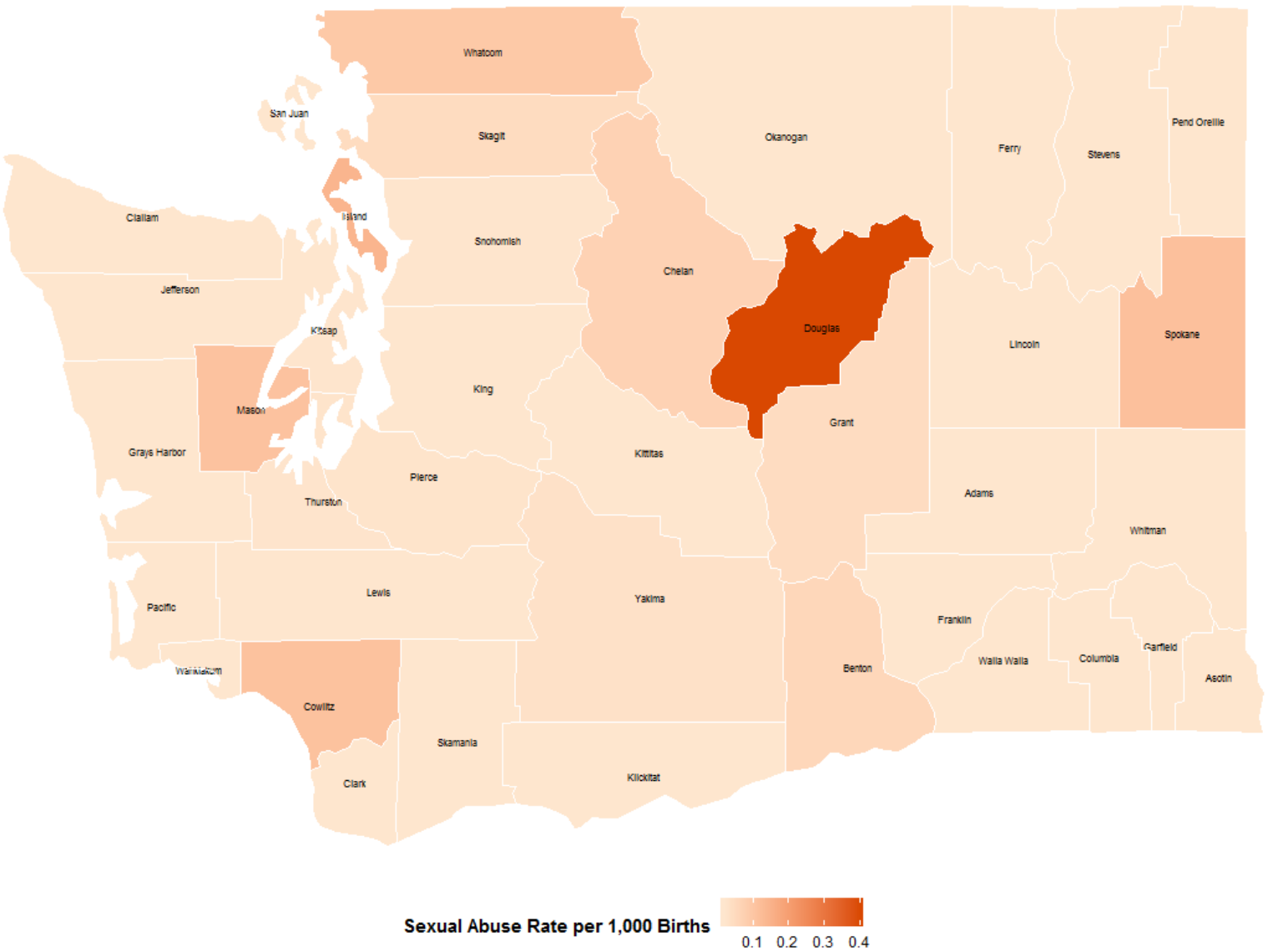

Figure 8. Prevalence Rate of First Sexual Abuse-Related Hospitalizations Before Age 3 by County

Aim 2 – Risk Factors

The proportions per 1,000 births by maternal race and maltreatment type are presented in Figure 9. For each maternal race category, the highest proportion of maltreatment type was neglect. Infants born to Native American mothers had the highest proportions per 1,000 births at 6.95 while Asian/Pacific Islanders had the lowest at 2.76. The race/ethnicity categories between these two extremes also saw differences of the proportions per 1,000 births with black (5.04), Hispanic (4.61), and white (3.99). Infants born to Asian/Pacific Islander mothers had the lowest proportions across all maltreatment types. For abuse-related hospitalizations, infants born to Native American mothers had almost triple the proportions (1.01) compared to all the other race/ethnicity categories, while black (0.35), Hispanic (0.32), and white (0.35) had similar proportions. Infants born to Native American (0.83) and black (0.47) mothers had the highest proportions per 1,000 births for poly-type-related hospitalizations. Little variance between the race/ethnicity categories for the unspecified type of maltreatment-related hospitalizations with a range of 0.65 for infants born to white and black mothers to 0.59 for infants born to Native American mothers.

Sociodemographic Variable Distribution

The birth characteristics by maltreatment hospitalization status are presented in Table 9. Each of the categories was found to have differences between the observed and frequencies using chi-square tests. While 11.1% of the population of children born in Washington State between 1999-2013 were the subject of an official maltreatment report, 23.7% of children with a child maltreatment-related hospitalization had a CPS report prior to their hospitalization.

Children born to black and Native American mothers were overrepresented in the population of children experiencing a maltreatment-related hospitalization compared to the

overall population born in Washington State, while children born to Asian/Pacific Islander mothers were underrepresented.

Male children had higher proportions of experiencing maltreatment-related hospitalizations comprising 56.5% of the hospitalizations, while just 51.3% of the births. Similarly, children born to teenaged mothers comprised 13.2% of the maltreatment-related hospitalizations, while only accounting for 8.1% of births. Children whose births were paid for with public insurance represented 41.7% of the maltreatment-related hospitalizations despite being just 35.0% of births. Children born with low birth weights were also overrepresented in hospitalizations; 6.5% of all births were considered having low birth weight, but 9.7% of maltreatment-related hospitalizations were children born weighing less than 2500 grams.

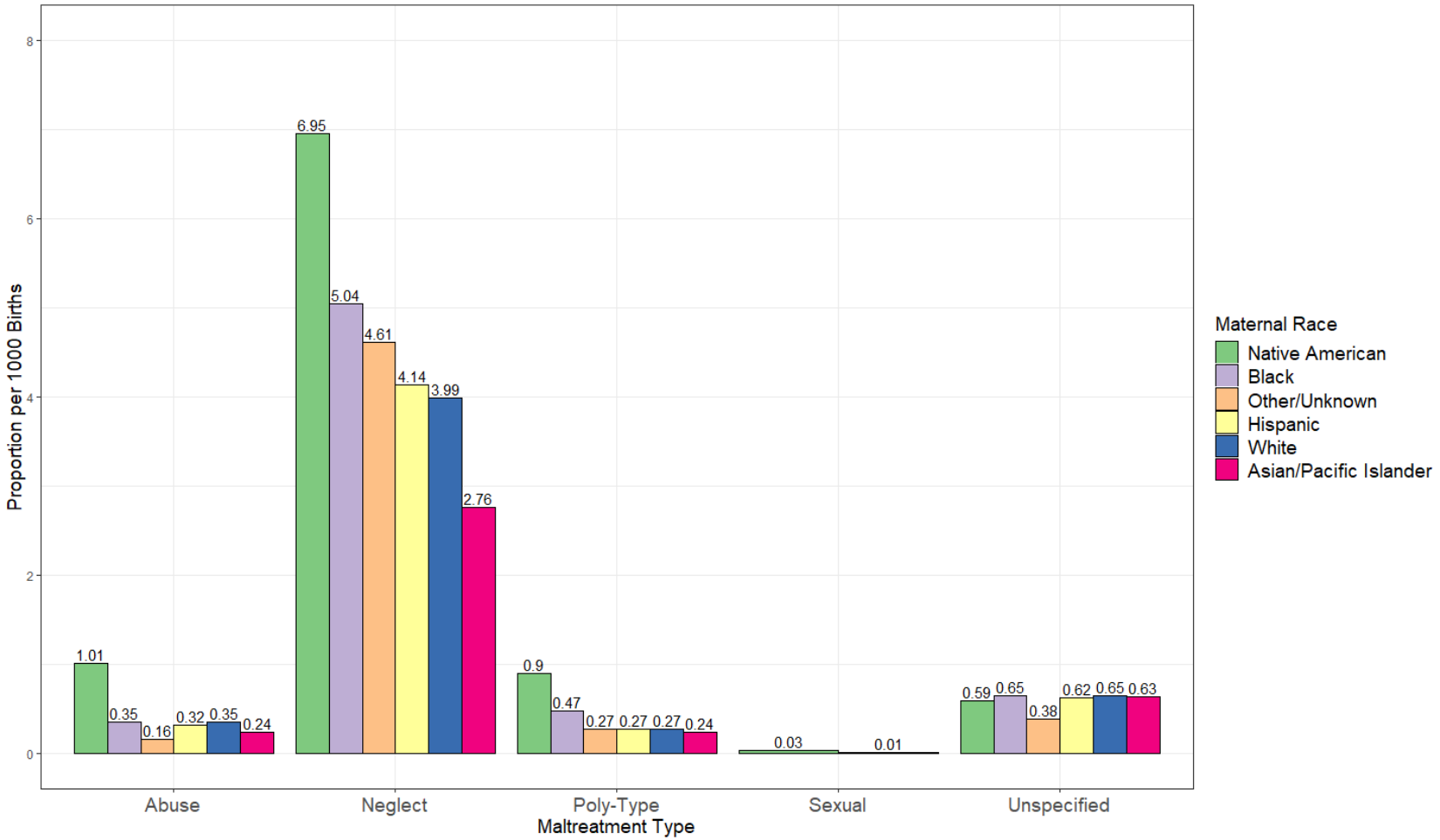

Figure 9. Proportion of Maltreatment Hospitalizations by Maternal Race and Maltreatment Type.

Table 9. *Distribution of Sociodemographic Characteristics of Children Born in Washington State by Hospitalization Status*.

Sociodemographic Characteristic	All Births 1,271,416		No Maltreatment Hospitalization 1,264,458		Maltreatment Hospitalization 6,743		
	N	%	n	%	n	%	X^2
CPS Intake							1079.10***
Not Occurred	1129825	88.9	1124679	88.9	5146	76.3	
Present	141591	11.1	139994	11.1	1597	23.7	
Race/Ethnicity							158.77***
White	840355	66.1	835932	66.1	4423	65.6	
Black	59,762	4.7	59373	4.7	389	5.8	
Hispanic	203,383	16.0	202293	16.0	1090	16.2	
Native American	28,787	2.3	28514	2.3	273	4.0	
Asian/Pacific Islander	120,485	9.5	120018	9.5	467	6.9	
Other/Unknown	18,644	1.5	18543	1.5	101	1.5	
Child Sex							73.95***
Female	619,570	48.7	616640	48.8	2,930	43.5	
Male	651,846	51.3	648033	51.2	3,813	56.5	
Maternal Age							496.63***
<= 19 y	102,940	8.1	102052	8.1	888	13.2	
20-24 y	295,316	23.2	293339	23.2	1977	29.3	
25-29 y	361,060	28.4	359217	28.4	1843	27.3	
30+ y	511,561	40.2	509526	40.3	2035	30.2	
Birth Payment							291.23***
Public	444,913	35.0	442101	35.0	2812	41.7	
Private	474,995	37.4	473145	37.4	1850	27.4	
Not Recorded	351,508	27.6	349427	27.6	2081	30.9	
Prenatal Care							43.91***
1st trimester	666,767	52.4	663443	52.5	3324	49.3	
2nd trimester	403,984	31.8	401805	31.8	2179	32.3	
3rd trimester	70,231	5.5	69821	5.5	410	6.1	
None	130,434	10.3	129604	10.2	830	12.3	
Parity							19.90***
First birth	519,095	40.8	516516	40.8	2579	38.2	
Non-first birth	752,321	59.2	748157	59.2	4164	61.8	
Infant Birth Weight							112.96***
Low (<2500 g)	82714	6.5	82059	6.5	655	9.7	
Normal (2500+)	1,188,702	93.5	1182614	93.5	6088	90.3	

Note: *** $p < .001$

Community-level Analysis

For the multilevel modeling, this model was preferred by its lower BIC by more than a few points of 78126.14 compared to the logistic regression model's higher BIC of 78348.22. The random effects of the model are displayed in Figure 10. Maternal residence in a zip code with high concentrated disadvantage was found to be a predictor of child maltreatment-related hospitalizations with an odds ratio of 1.22 (95% Confidence Interval 1.10-1.36). Additional predictors included low birth weight (OR: 1.63, CI: 1.50-1.77), mother being a teenager at birth (OR: 1.61, CI: 1.49-1.74), Native American maternal race (OR: 1.46, CI: 1.28-1.67), male infants (OR: 1.25, CI: 1.19-1.32), public birth payment (OR: 1.22, CI: 1.16-1.29), and no or late prenatal care (OR: 1.14, CI: 1.07-1.22). Protective factors included being the first born child to the mother (OR: 0.84, CI: 0.79-0.88), Hispanic maternal race/ethnicity (OR: 0.83, CI: 0.77-0.90), and Asian/Pacific Islander maternal race ethnicity (OR: 0.79, CI: 0.72-0.88). Full results are presented in Table 10 and graphically in Figure 11.

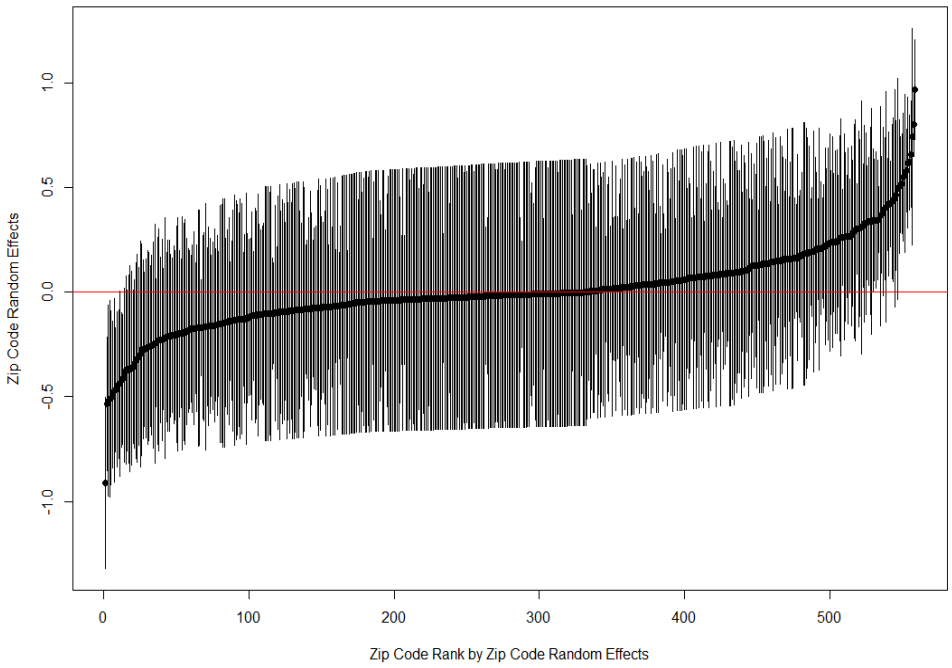

Figure 10. Zip Code Random Effects

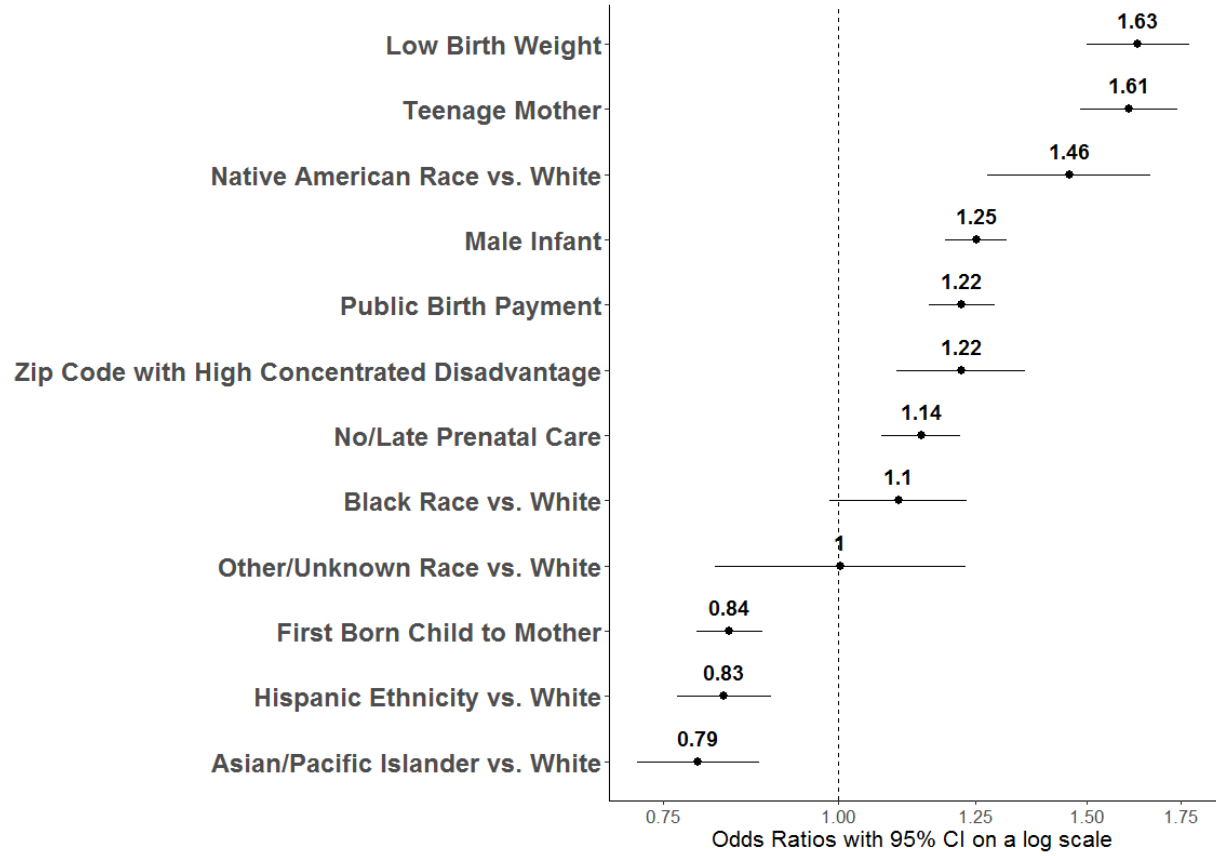

Figure 11. Odds Ratios from Mulitlevel Model for Child Maltreatment Hospitalizations

Table 10. *Odds Ratios from Multilevel Regression Models for Child-Maltreatment Hospitalizations*

	OR	95% CI
Zip Code Concentrated Disadvantage		
High CD Indicated	1.22	[1.10 - 1.36]
Not Indicated	Ref.	--
Race/Ethnicity		
White	Ref.	--
Black	1.10	[0.99 - 1.23]
Hispanic	0.83	[0.77 - 0.90]
Native American	1.46	[1.28 - 1.67]
Asian/Pacific Islander	0.79	[0.72 - 0.88]
Other/Unknown	1.00	[0.82 - 1.23]
Child Sex		
Female	Ref.	--
Male	1.25	[1.19 - 1.32]
Maternal Age		
20 + years	Ref.	--
< 20 years	1.61	[1.49 - 1.74]
Birth Payment		
Public	1.22	[1.16 - 1.29]
Private	Ref.	--
Prenatal Care		
1st /2nd trimester	Ref.	--
3rd trimester/ No Prenatal Care	1.14	[1.07 - 1.22]
Parity		
First birth	0.84	[0.79 - 0.88]
Non-first birth	Ref.	--
Infant Birth Weight		
Low (<2500 g)	1.63	[1.50 - 1.77]
Normal (2500+)	Ref.	--

Survival Models

The Kaplan-Meier survival curve estimator demonstrates the timing of hospitalizationa and the relative rarity of a child maltreatment hospitalization. The curve is presented in Figure 12.

In the Cox proportional hazards model, the time-varying covariate, a prior CPS report, was a significant predictor of child maltreatment-related hospitalizations consistently across all models. The first set of models included all of the child maltreatment-related hospitalizations. In both the unadjusted and adjusted models, children with a prior CPS report had 2.9 and 2.2 times the rate, respectively, of child maltreatment-related hospitalizations compared to children who were not previously reported. The highest hazard ratios for children previously reported to CPS were in regards to abuse-related hospitalizations (7.2 in the unadjusted model and 4.9 in the unadjusted model), followed by poly-type hospitalizations (6.7 unadjusted and 4.1 in the adjusted model), unspecified maltreatment hospitalizations (2.5 unadjusted and 2.1 adjusted). The lowest hazard ratios, but continuing the pattern of children previously reported to CPS having higher rates of hospitalizations, was for the neglect-related hospitalizations where children previously reported to CPS were 2.5 and 1.9 times the rate, for the unadjusted and adjusted models respectively, compared to children not reported to CPS. Full results of the Cox proportional hazards model are presented in Table 11. The results are also presented graphically in Figure 13. The hazard ratio results for each maltreatment subtype are presented in Figure 14.

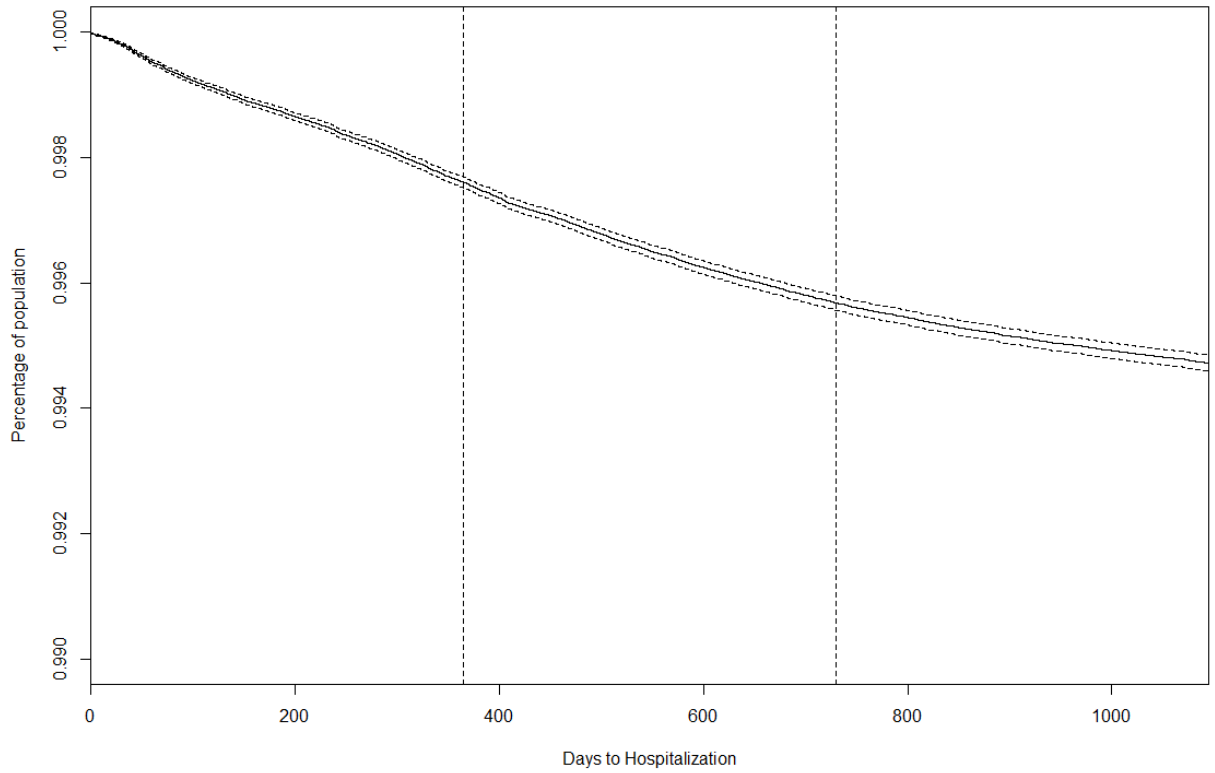

Figure 12. Survival Curve of Maltreatment-Related Hospitalization in Days

Table 11. *Hazard Ratios from Cox Proportional Hazards Models by Maltreatment Subtype*

	All (N = 6743)		Abuse (n = 482)		Neglect (n = 5278)		Poly-Type (n = 415)		Unspecified (n = 887)	
Variable	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Prior CPS Report	2.24***	[2.08, 2.41]	4.92***	[3.91, 6.20]	1.95***	[1.79, 2.12]	4.12***	[3.22, 5.28]	2.06***	[1.62, 2.60]
Asian/Pacific Islander	0.76***	[0.69, 0.83]	0.76	[0.54, 1.09]	0.70***	[0.62, 0.78]	1.03	[0.72, 1.47]	1.01	[0.80, 1.28]
Black	1.03	[0.94, 1.14]	0.77	[0.52, 1.14]	1.08	[0.97, 1.20]	1.23	[0.86, 1.76]	0.86	[0.63, 1.17]
Hispanic	0.85***	[0.80, 0.91]	0.76*	[0.60, 0.99]	0.88***	[0.81, 0.94]	0.76*	[0.58, 0.99]	0.82*	[0.68, 0.99]
Native American	1.44***	[1.29, 1.61]	1.81***	[1.29, 2.55]	1.46***	[1.29, 1.66]	1.86***	[1.29, 2.69]	0.76	[0.49, 1.18]
Other/Unknown Race	0.90	[0.74, 1.08]	0.37	[0.11, 1.16]	1.01	[0.82, 1.23]	0.79	[0.33, 1.93]	0.51	[0.24, 1.08]
Male	1.24***	[1.18, 1.29]	1.53***	[1.29, 1.82]	1.21***	[1.15, 1.27]	1.37**	[1.13, 1.65]	1.21**	[1.06, 1.38]
Low Birth Weight	1.55***	[1.43, 1.67]	2.21***	[1.74, 2.81]	1.53***	[1.40, 1.67]	1.23	[0.89, 1.69]	1.43**	[1.14, 1.79]
First Born	0.84***	[0.80, 0.88]	1.12	[0.93, 1.34]	0.80***	[0.76, 0.85]	0.83	[0.68, 1.02]	0.92	[0.80, 1.06]
Public Birth Payment	1.42***	[1.35, 1.49]	1.67***	[1.40, 2.01]	1.35***	[1.28, 1.43]	1.77***	[1.45, 2.15]	1.53***	[1.33, 1.76]
No/Late Prenatal Care	1.13***	[1.06, 1.19]	1.11	[0.90, 1.38]	1.14***	[1.07, 1.22]	1.16	[0.92, 1.46]	1.00	[0.83, 1.19]
Teenaged Mother	1.54***	[1.43, 1.65]	1.74***	[1.37, 2.22]	1.40***	[1.29, 1.53]	3.71***	[2.93, 4.69]	1.39**	[1.12, 1.72]

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

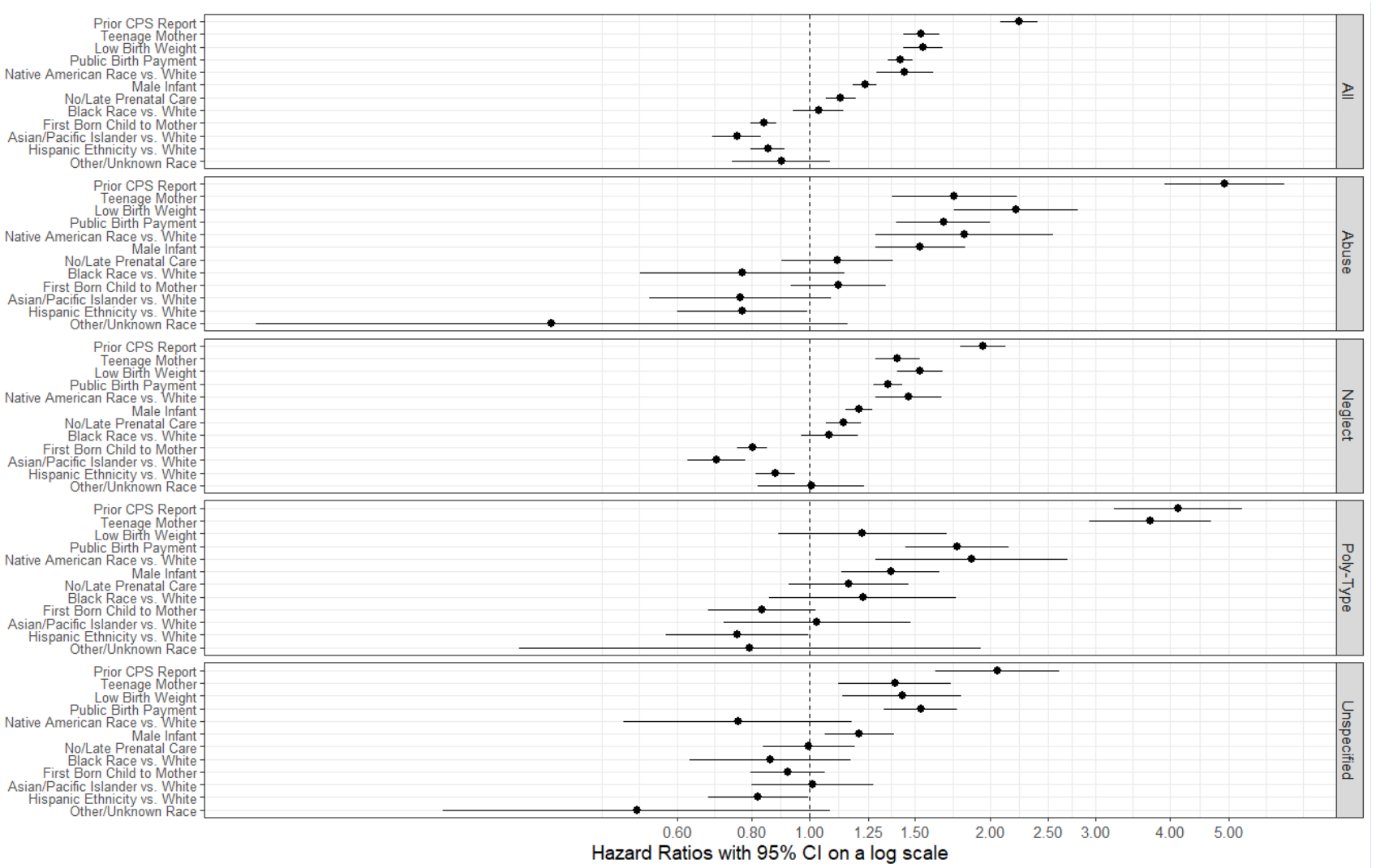

Figure 13. Hazard Ratios from Cox Proportional Hazard models by Maltreatment Subtype.

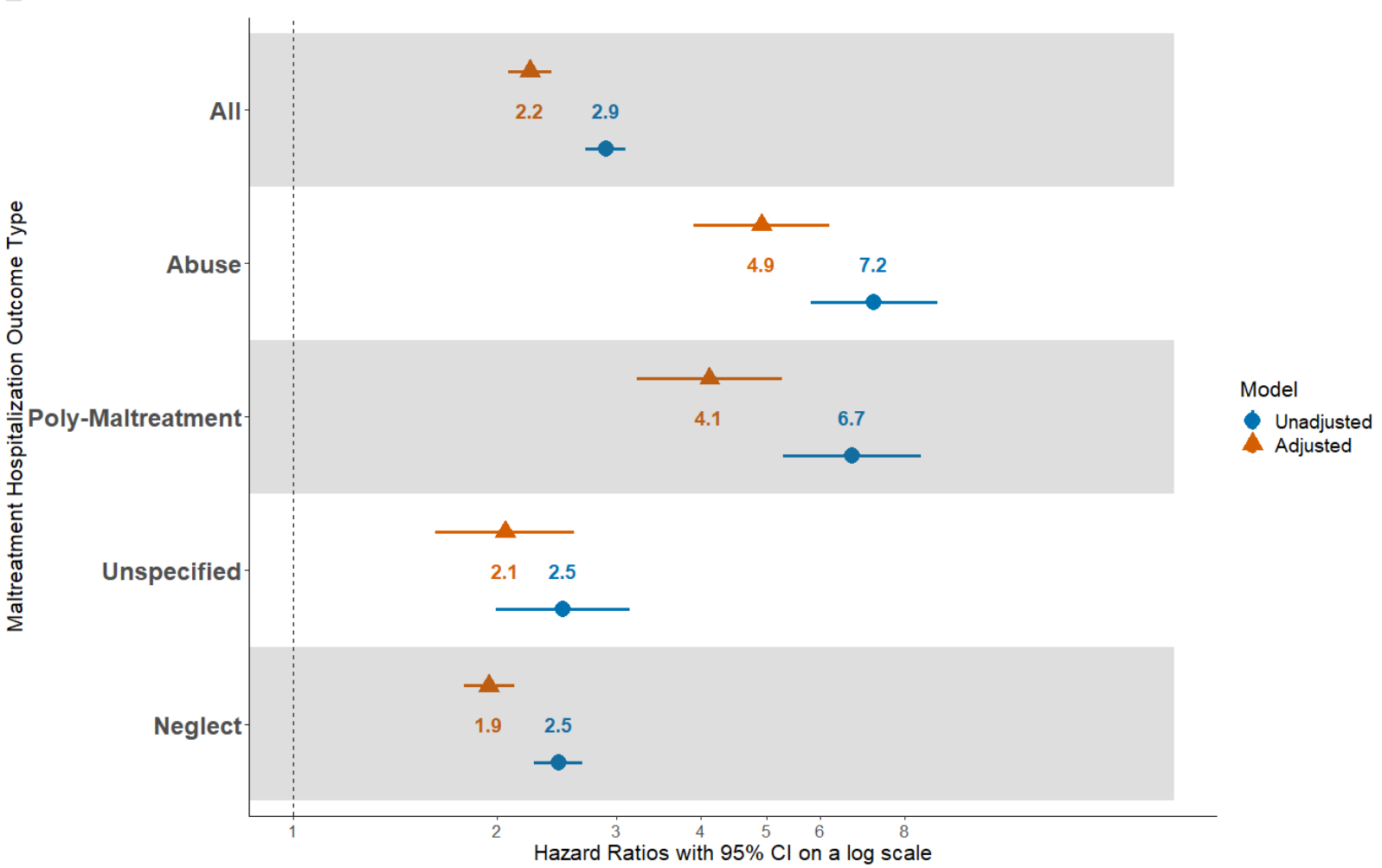

Figure 14. Hazard Ratios from Cox Proportional Hazard models by Maltreatment Subtype and Model Type.

Aim 3 – Initial Responses

The flow of the initial system responses is presented Figure 15 through the use of a Sankey diagram, moving from left to right. This displays, first, the proportion of the hospitalizations by maltreatment type. The second step is the proportion with either a specific or non-specific maltreatment code from the maltreatment types in the first step. The final two steps are CPS reports and removals, respectively, moving from the previous steps.

Figure 16 presents the proportions of initial system responses by maltreatment type. Hospitalizations related to neglect had the highest proportions of not being reported to CPS at 90.54%. The second highest maltreatment type to not receive a CPS report is the unspecified category (68.89%). The lowest was the poly-maltreatment group at 25.14%. The proportion of removals was highest for hospitalizations related to abuse (43.96%) and poly-maltreatment (43.17%). Removals were lowest for neglect (2.44%). Half of the hospitalizations related to sexual maltreatment were not being reported to CPS and while 40% had a CPS report and 10% were removed.

The proportions of system responses by specific maltreatment code status are presented in Figure 17. For hospitalizations that did not have a specific maltreatment code, the largest proportion were not reported to CPS (86.20%), while 10.54% were reported and 3.26% were removed. For hospitalizations that did include a specific maltreatment code, the largest proportion was removed (56.16%), followed by a CPS report without removal (28.52%), and no CPS report (15.32%).

Figure 18 presents the proportion of system responses by maternal race. The highest proportions of reports to CPS and removals were for children whose mothers were Native American and black. In terms of removals, these were experienced by 14.29% and 10.80% of

children whose mothers were Native American and black, respectively. CPS reports only (without removals) were experienced by 16.85% of children with Native American mothers and 14.65% of children with black mothers. The maternal race categories with the lowest proportions of a system response were Hispanic (CPS report: 11.28%; removal: 7.25%) and Asian/Pacific Islander (CPS report: 10.28%; removal: 5.78%).

The proportions of system responses by child age at the time of hospitalization are presented in 19. The proportion of removals was highest for children under the age of one at 13.56%, followed by children between two and three years of age (3.20%) and children between one and two years of age (2.65%). The proportions of CPS reports followed the same pattern with children under the age of one having the highest proportion (14.83%), followed by children between two and three years of age (12.07%) and children between the ages of one and two (8.59%).

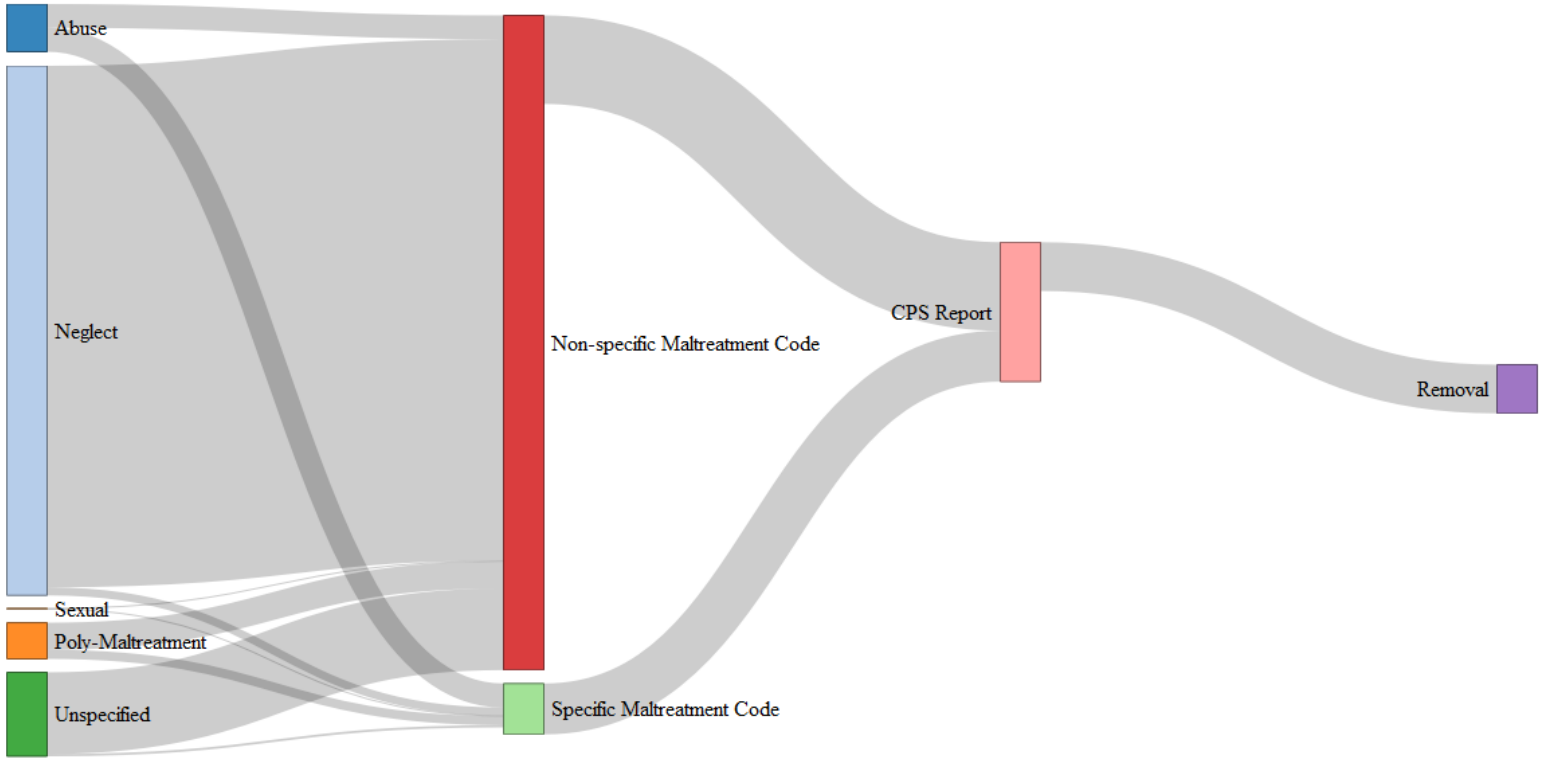

Figure 15. Flow of Responses to Child Maltreatment-Related Hospitalizations

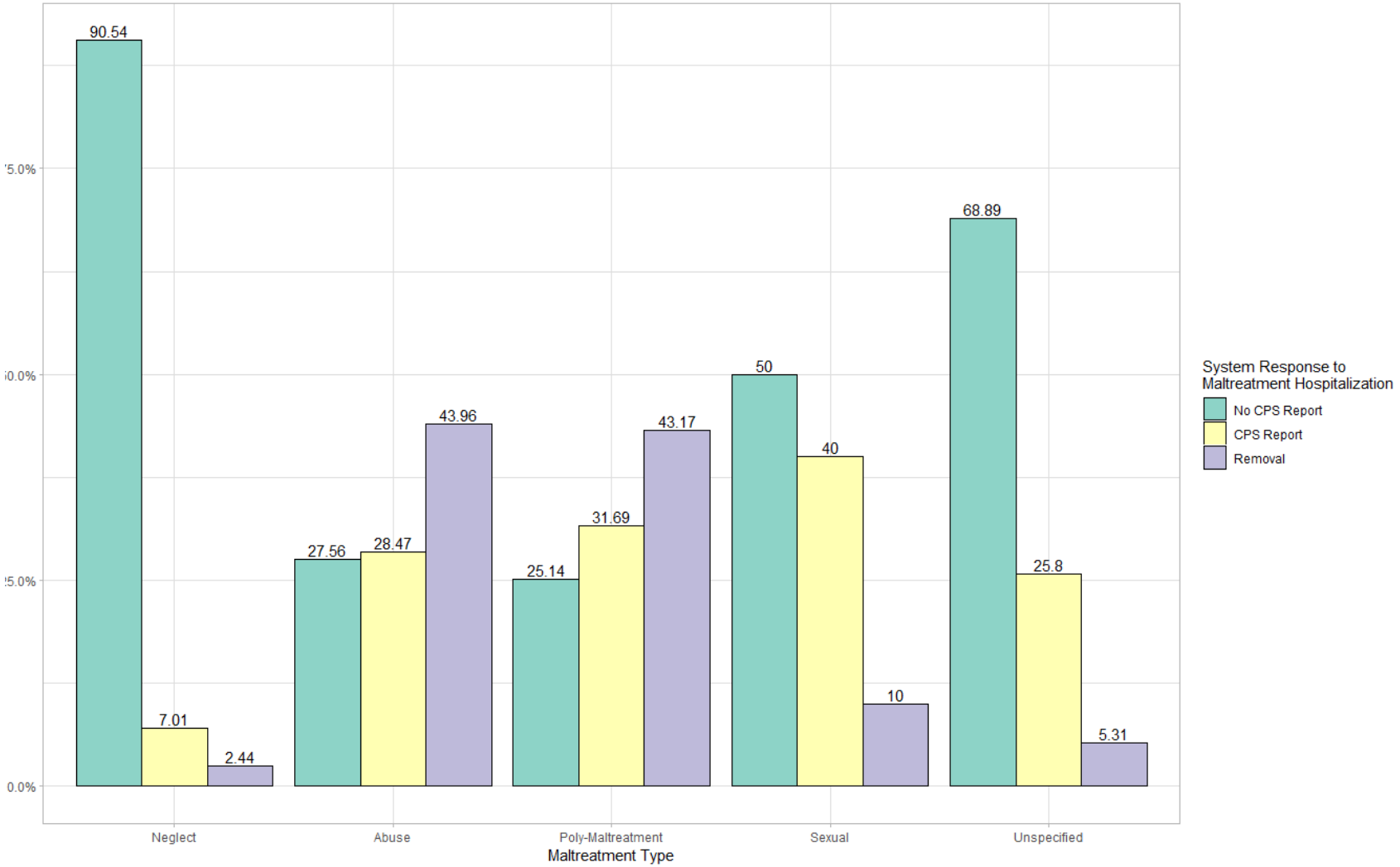

Figure 16. Proportions of System Responses by Maltreatment Type

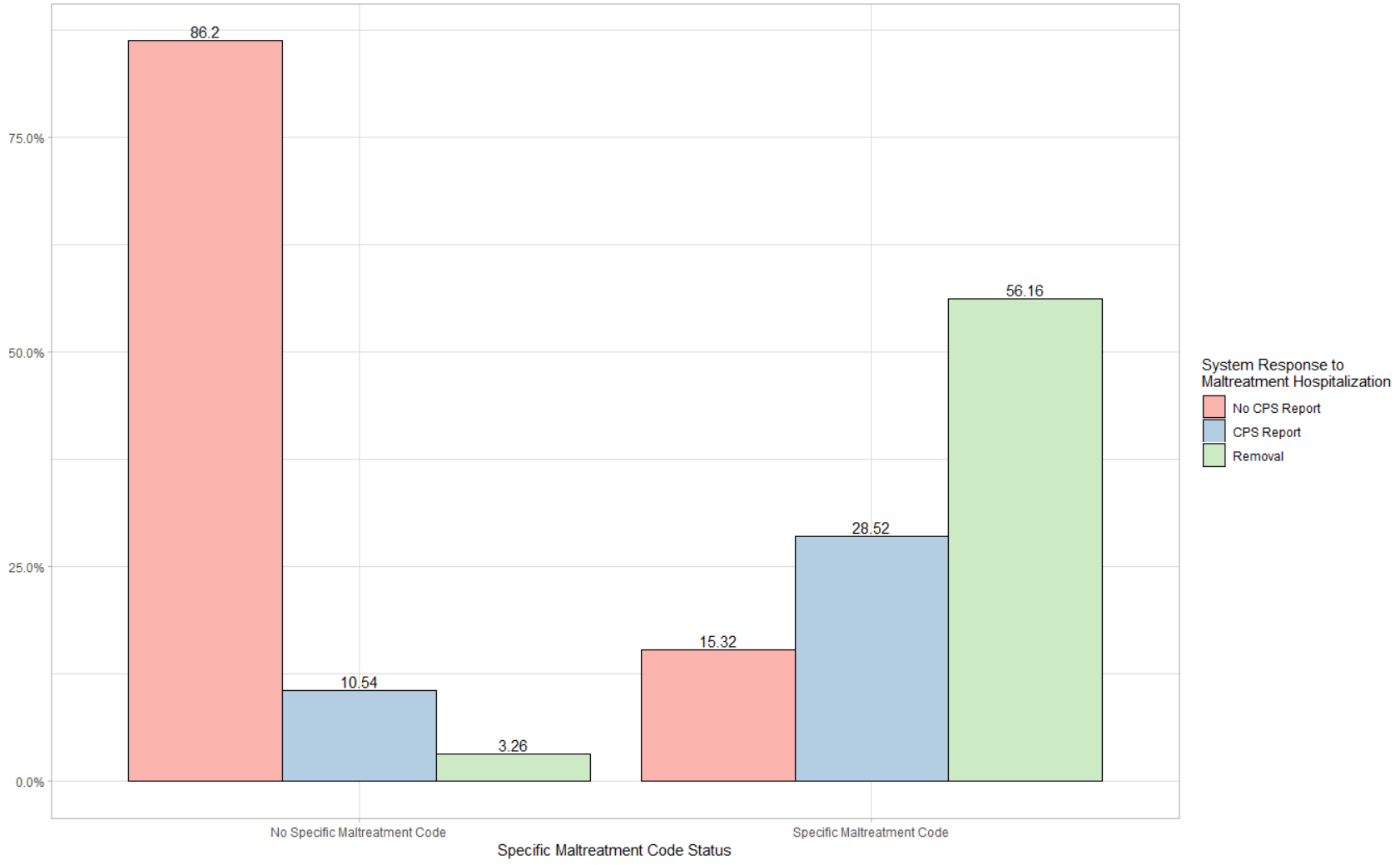

Figure 17. Proportions of System Responses by Specific Maltreatment Code Status

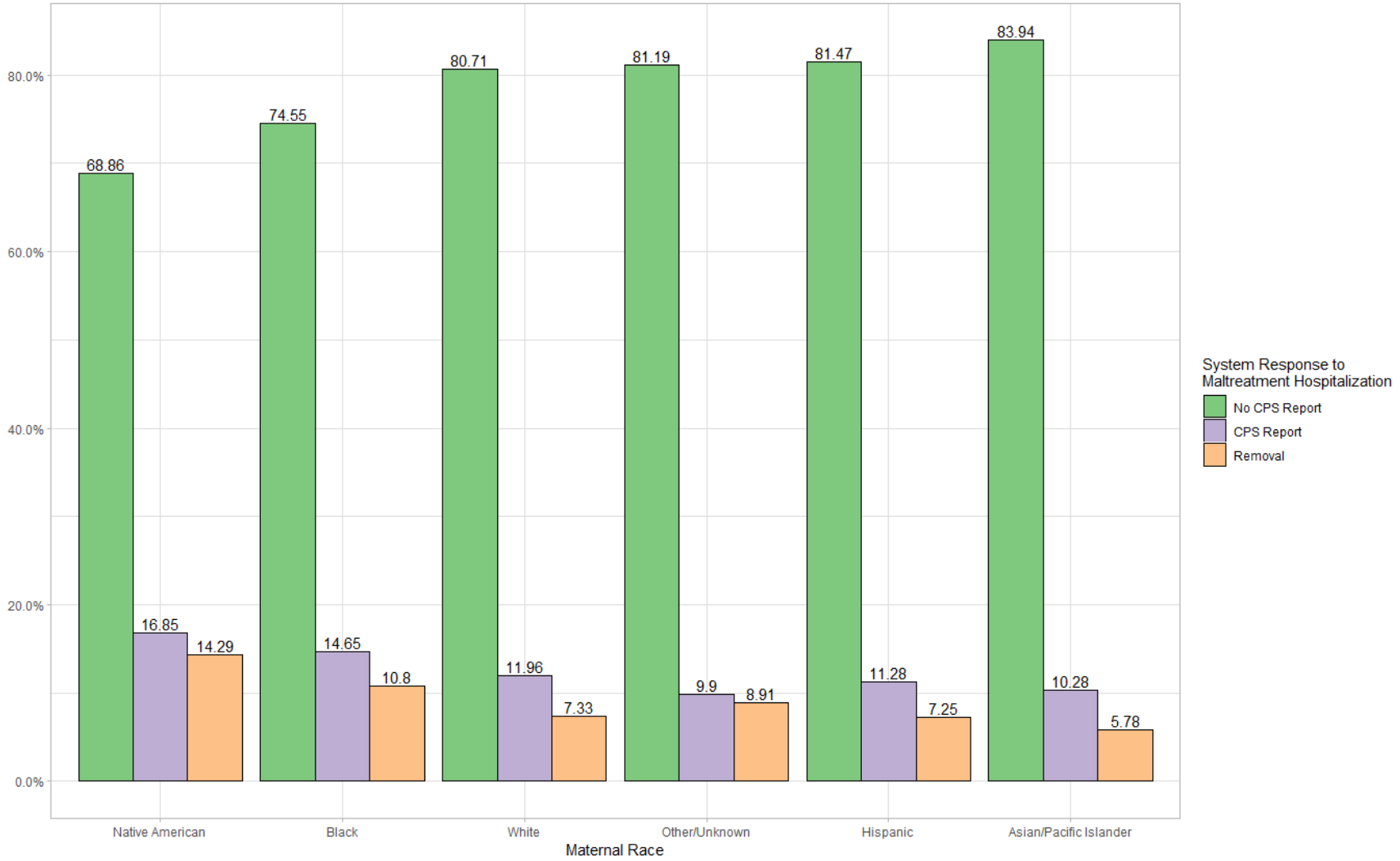

Figure 18. Proportion of System Responses by Maternal Race

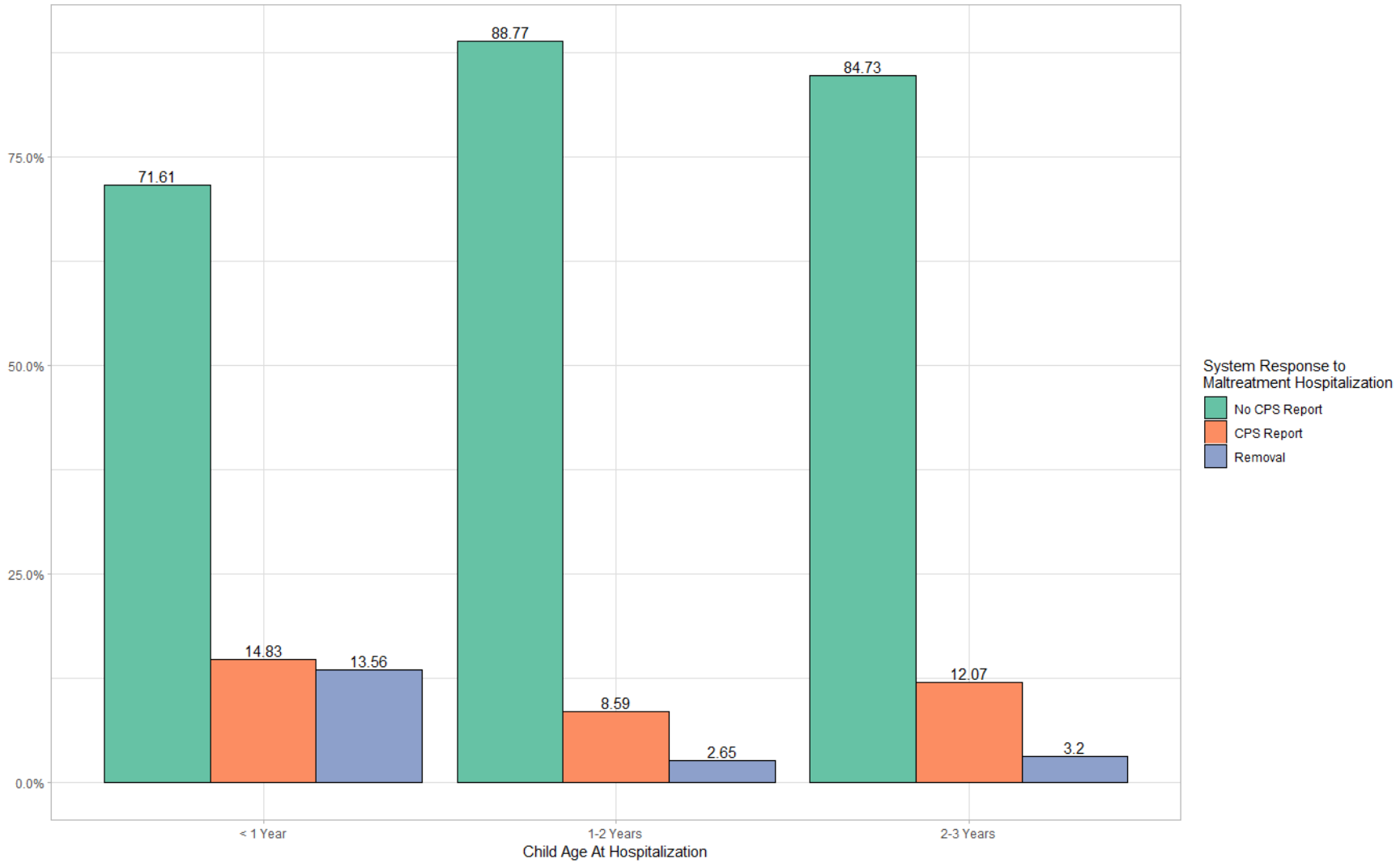

Figure 19. Proportion of System Responses by Child Age

Multinomial Logistic Regression

The odds ratios of the multinomial logistic regression are presented in Table 12 and presented graphically in Figure 20. Compared to neglect, all of the other types of maltreatment had increased odds of both reports to CPS and reports and removals. In terms of reports to CPS only, the odds of being reported to CPS only were 9.5 times higher for children with abuse-related diagnoses, 6.3 times higher for sexual maltreatment related diagnoses, 7.6 times higher for poly-maltreatment related diagnoses, and 5.1 times higher for unspecified maltreatment type diagnoses compared to children with neglect related diagnoses. The pattern continues with the odds for being removed higher for children with abuse (OR: 17.1; 95% CI: 11.98, 24.40), sexual (OR: 2.13, CI: 2.11, 2.16), poly-maltreatment (OR: 9.31; CI: 6.19, 13.98), and unspecified (OR: 2.48; CI: 1.70, 3.61) related diagnoses compared to children with neglect related diagnoses.

The use of a specific maltreatment diagnosis increased the odds that a CPS report would be made and that the child would be removed by CPS. Specifically, children who had a specific maltreatment diagnosis had odds 4.9 times higher for being reported to CPS and odds 18.6 times higher of being removed by CPS than children whose diagnoses did not specifically indicate maltreatment.

Risk factors identifiable on the birth record also had increased odds of CPS interventions. Children whose births were paid for using public insurance, like Medicaid, had increased odds for CPS reports (OR: 2.37; 95% CI: 2.01, 2.80) and removals (OR: 2.90; CI: 2.28, 3.69) than children whose births were paid for using private insurance. Children whose mothers were teenagers at the time of their births had increased odds of both CPS reports (OR: 1.37; CI: 1.08, 1.73) and removals (OR: 1.43, CI: 1.03, 1.97) than children whose mothers were at least 20 years old at the time of their birth. Children born to mothers who started prenatal care late or did not

receive any at all had prenatal care had increased odds for a CPS report (OR: 1.23; CI: 1.01, 1.50) and removals (OR: 1.38, CI: 1.04, 1.84). Child low birth weight resulted in increased odds for one outcome only. Specifically, a child with low birth weight had increased odds for being removed (OR: 1.73; CI: 1.24, 2.43). Maternal race, the child's age in days at the time of hospitalization, the child's sex, and parity were not found to have statistically significant impacts on the odds of reports or removals.

The simulation of the multinomial logistic regression model is presented in Figure 21. The first column presents the probability of not being reported to CPS, the second the probability of a CPS report only, while the third column contains the probability of being reported and removed. The rows are for the absence (top) and presence (bottom) of a specific maltreatment code. Colors distinguish the different maltreatment types. Each circle represents the predicted probability for a single of the 1,000 simulations. The point estimates, or the mean of the simulations, is presented for each cell.

Children with neglect-related hospitalizations have higher predicted probabilities for not being reported to CPS for both maltreatment code statuses: nonspecific (point estimate: 0.92) and specific (PE: 0.59). For all maltreatment types, the predicted probability of being not reported to CPS was higher for those without a specific maltreatment diagnosis. Conversely, those with specific maltreatment diagnoses had higher predicted probabilities of being removed by CPS across all maltreatment types.

Table 12. *Odds Ratios of Multinomial Logistic Regression System Responses.*

	CPS Report		Removal	
	OR	95% CI	OR	95% CI
Abuse (vs. Neglect)	9.45	[6.97, 12.81]	15.74	[11.07, 22.40]
Poly-Maltreatment (vs. Neglect)	7.60	[5.35, 10.80]	9.31	[6.19, 13.98]
Sexual (vs. Neglect)	6.25	[6.15, 6.34]	2.13	[2.11, 2.16]
Undetermined (vs. Neglect)	5.09	[4.15, 6.24]	2.48	[1.70, 3.61]
Specific Maltreatment Code	4.88	[3.50, 6.81]	18.59	[13.20, 26.18]
Age in Days	1.00	[1.00, 1.00]	1.00	[1.00, 1.00]
White Maternal Race (vs. Other Racial Groups)	1.11	[0.93, 1.31]	1.01	[0.79, 1.29]
Male Child (vs. Female)	0.86	[0.74, 1.02]	0.99	[0.78, 1.25]
Low Birth Weight	1.03	[0.78, 1.35]	1.73	[1.24, 2.43]
First Born Child to Mother	0.94	[0.79, 1.13]	0.91	[0.71, 1.18]
Public Birth Payment	2.37	[2.01, 2.80]	2.90	[2.28, 3.69]
No or Late Prenatal Care	1.23	[1.01, 1.50]	1.38	[1.04, 1.84]
Teenaged Mother	1.37	[1.08, 1.73]	1.43	[1.03, 1.97]
(Intercept)	0.04	[0.03, 0.06]	0.02	[0.01, 0.03]

Note: OR = Odds Ratio; CI = Confidence Interval

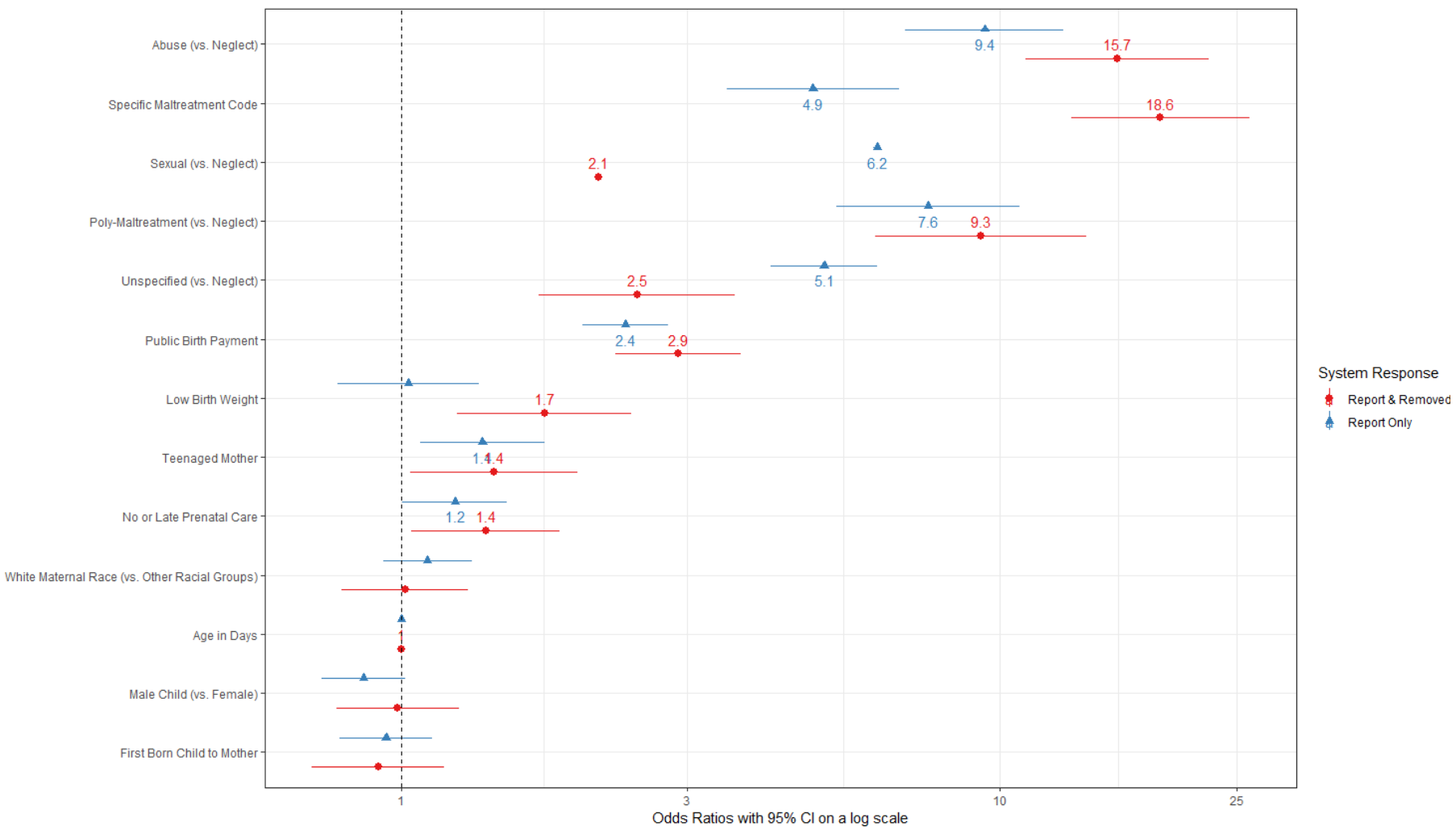

Figure 20. Odds Ratios from Multinomial Model for System Responses.

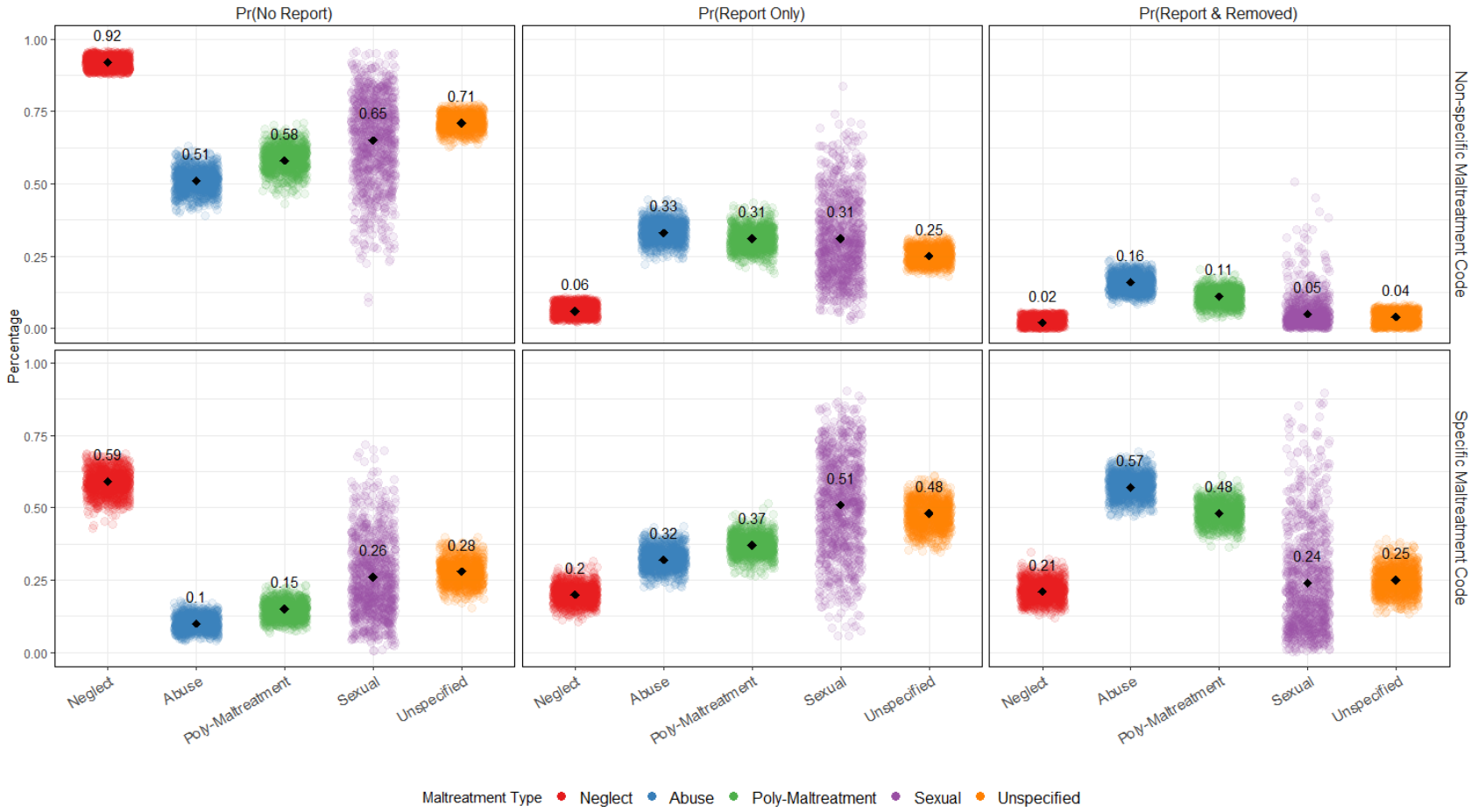

Figure 21. Simulation of Multinomial Regression by Maltreatment Type and Specific Code Status with Point Estimates

CHAPTER 4:
DISCUSSION

This dissertation adds new knowledge regarding the number of children who are hospitalized as a result of child maltreatment, the risk factors for experiencing this type of hospitalization, and how systems respond to these children, as measured by reports to CPS by health professionals and removals by CPS. This is the first study, to my knowledge, to integrate all of these pieces of information together in one study for the population of an entire state over an extended duration. This provides new knowledge regarding not only the scope of child maltreatment, but also how the child protection system responds, with important implications for policy and practice. This chapter provides a discussion of this study including the public health approach for the prevention of child maltreatment, the incidence of child maltreatment, risk factors, and system responses.

The Public Health Approach for Child Maltreatment Prevention

The results from this dissertation provide meaningful results that contribute to a public health approach towards the prevention of child maltreatment. It directly addresses the first two, foundational elements of a public health approach by providing a more comprehensive understanding of the number of children who are the victims of child maltreatment before the age of three. Surveillance, or identifying the size of the problem, is a critical component of approaches to prevent child maltreatment and is addressed by aim 1, but has been limited because child maltreatment usually occurs within the confines of the private family, a sphere where parents are considered to have great discretion by the U.S. government (Levesque, 2008). That has limited our measurement of the child maltreatment problem by relying primarily on either official reports to the CPS agencies or retrospective self-reports from victims (Drake &

Jonson-Reid, 2018). By moving beyond official reports to CPS, which are widely considered as only capturing a fraction of the true numbers of children who are maltreated (Sedlak et al., 2010), the Aim 1 results help move us closer to capturing the elusive actual numbers of maltreated children. Indeed, the findings here indicate that there are many children who have likely been maltreated that are not reported to CPS, capturing a portion of the true count of maltreated children that are not recorded in official CPS reports. Ultimately, these results identifies the number of children, 6,958, who were hospitalized for child maltreatment-related injuries in the entire state of Washington between 1999 and 2013.

The second component of child maltreatment prevention, risk factors, is also informed by the results of this dissertation. The strength and unique contribution of these results is the use of an entire population of children born in a state over more than a decade so that we are able to identify not only the children who did experience a child maltreatment-related hospitalization, but also to compare them to their peers who were not hospitalized. This provides an understanding of not just the shared characteristics of children experiencing a child maltreatment-related hospitalization, but direct comparisons between children who did and who did not experience these injuries. These results are thus more useful in secondary prevention responses targeting families at risk of experiencing a child maltreatment incident instead of the business-as-usual approach of responding to child maltreatment after it has occurred (Higgins, 2015). Further, there is great utility in the use of birth records, as many of the risk and protective factors identified are identifiable at birth, allowing for prevention programs to be targeted at the earliest time points (Putnam-Hornstein & Needell, 2011), with the goal of reducing the risk to the children before they are maltreated (Herrenkohl et al., 2015). Indeed, the risk factors

identified in this dissertation can be used to target child maltreatment prevention programs, a topic that will be discussed at greater length later in this chapter.

Finally, it has been noted that in regards to child maltreatment, "the most useful studies for policy-makers are the ones with information about the agencies and officials who are in positions to help and respond" (pg. 17, Jud, Fegert, & Finkelhor, 2016). The children identified here as maltreated are not hidden, but are being presented to health care professionals for treatment of their injuries. Thus, this dissertation's findings, particularly those from Aim 3, also provide great insights not only about the quantity and characteristics of these children, but of how and when a critical system for child maltreatment intervention – hospitals – is responding to the presentation of these children to their inpatient wards. This compliments the growing work in regards to sentinel injuries (Sheets et al., 2015) and the calls for health professionals, and pediatricians in particular, to take a more robust role in the intervention of child maltreatment (Jackson et al., 2015; Letson et al., 2016). The Aim 3 results provide insights into how medical professionals are responding to these calls for them to be active participants in the intervention of child maltreatment.

Aim 1: Child Maltreatment Incidence & Prevalence

Aim 1 provides important new knowledge in regards to the incidence and prevalence of child maltreatment. The four primary takeaways are 1) that the use of population-based dataset and suggestive ICD-9 codes in addition to specific codes provide a more comprehensive understanding of child maltreatment incidence; 2) that the incidence rates in regards to physical abuse in WA state are in line with previous studies of hospitalizations related to physical abuse; 3) that the use of suggestive codes enables an understanding of neglect, which is not adequately

captured in ICD-9 codes; and 4) that these hospitalizations require multiple day stays in the hospital for the children. These findings are discussed in greater depth in the rest of this section.

Incidence Rates

The results from this dissertation add to our knowledge about the incidence of child maltreatment in the population. The use of population-based data provides a more precise measurement of incidence through the inclusion of the entire population at risk for experiencing hospitalizations related to child maltreatment. The inclusion of diagnostic codes suggestive of maltreatment in addition to definitive codes likely identifies an incidence rate closer to the actual rate as it is not hindered by the reluctance of some health professionals to identify child maltreatment (Schnitzer et al., 2011).

It is possible that these incidence rates are including some hospitalizations that were not related to child maltreatment, despite the use of the exclusion codes to reduce overestimation. Thus, in regards to the *actual* child maltreatment hospitalization incidence rate, a calculation that is likely impossible to determine due to child maltreatment occurring within the confines of the private family, these rates could be considered the upper bound while the rates using just the definitive codes could be considered the lower bound, with the actual, unascertainable rate somewhere between. If we just used the definitive codes, we would have just the lower limit, so the inclusion of the suggestive codes and this upper bound of the actual incidence rate, adds new knowledge regarding the incidence of child maltreatment.

Washington State. The incidence rates of maltreatment are lower when comparing hospitalizations related to child maltreatment with the official reports to the Washington state child welfare agency. This is an unsurprising finding given that injuries need to be quite severe to require hospital admission. However, similar to the national (25.3 per 1,000 children) and Washington State (4.8 per 1,000 children) rates of substantiations (confirmed victimization by

CPS), the incidence rates of child maltreatment-related hospitalizations were highest for children under the age of one (2.5 per 1,000 children). This finding supports previous findings that the youngest children are the most vulnerable to child maltreatment (Flaherty et al., 2014; USHHS, 2019; Sharkey et al., 2018; Wood et al., 2014). A notable exception to this trend is the NIS-4 which found that older children are at higher risk of maltreatment than younger children. This may be related to about eight percent (912 out of 11,321) of the sentinels, or mandated reporters regularly coming into contact with children surveyed in the NIS-4, being staff from hospitals, none of which were physicians (Sedlak et al., 2010). In comparison, more than two-thirds (7,684 out of 11,321) of the sentinels came from elementary and secondary public schools (Sedlak et al., 2010). The discrepancies in the sources of information, and the ages of the children they came into contact with, likely explains this difference in findings.

Congruent with the findings of Schnitzer et al. (2011), the combination of both substantiations and maltreatment-related hospitalizations for children under one year of age resulted in a higher incidence rate of child maltreatment than with just one source alone. For children under the age of one, the combined maltreatment rate was 8.3 per 1,000 children, which was just 4.8 per 1,000 children when just using the substantiation rate. Combining these two sources of information provides a more robust understanding of the child maltreatment incidence in a population. Unfortunately, the two articles published using the combination method in Missouri either only provide maltreatment rates for children under the age of 10 or only include definitive, and not suggestive, diagnostic codes related to hospitalizations, preventing direct comparisons to be made (Schnitzer et al., 2011; Schnitzer et al., 2004). However, the combination of these two sources of information have the potential to provide better comparisons between states than one source alone.

These population-based results were higher in comparison to a study that examined the incidence of child maltreatment for infants born in New York City (NYC) between 1995 and 2004 (Mason et al., 2018). Child maltreatment was identified using suggestive codes only (no definitive codes) for hospitalizations that occurred in NYC hospitals within the first year of life. Compared to this dissertation's finding of 2.49 child maltreatment-related hospitalizations per 1,000 children under the age of one in Washington State, the NYC census-based study found a lower incidence rate at 0.670 per 1,000 children. While both studies utilized census approaches, including all children born in the geographical region, the lower rate found in NYC raises the question of whether a city is too small of a geographical location to use as infants may be hospitalized in areas beyond their city of birth. Further, the exclusion of the specific child maltreatment codes is likely reducing the overall incidence rate.

My study in Washington State found a higher incidence rate of child maltreatment compared to the Wheeler et al. (2017) study of emergency room visits that utilized definitive and suggestive child maltreatment codes for children under the age of 10 (unless otherwise restricted by Schnitzer et al., 2011) (Wheeler, Shi, Xiang, Haley, & Groner, 2017). The estimated child maltreatment incidence rate of 2.42 per 1,000 children in the emergency room visit study is lower than this study's finding of 5.46, despite my study's reliance on admissions to the hospital, which presumably has a higher threshold for admission than emergency room visits. However, the inclusion of kids older than age three in the emergency room study, would increase the number of non-maltreatment children, given that younger children are the most vulnerable to child maltreatment (Flaherty et al., 2014; USHHS, 201; Sharkey et al., 2018, Wood et al., 2014). This increase in the population denominator is likely to decrease the incidence rate. Further, the authors of this study excluded the majority of poisonings from inclusion of child maltreatment,

another likely reason for the lower incidence rate (Wheeler et al., 2017). The emergency department records for the Wheeler et al. (2017) study also was a 20% stratified sample from U.S. hospitals and it is unclear of whether the use of a sample, in contrast to a census approach, is affecting the overall incidence rates.

Physical abuse. The incidence rates of physical abuse found in this population of children born in the state of Washington and described in this dissertation are in line with findings in previous studies (Ellingson et al., 2008; Keenan et al., 2003; Leventhal et al., 2008; Leventhal et al., 2010; Niederkrotenthaler et al., 2013). However, there are some key differences in the classification of ICD-9 codes that prevent direct comparisons to be made. One, is the inclusion of the unspecified category, termed neglect or physical maltreatment, by Schnitzer et al. (2011). This ambiguous category had higher incidence rates across each age category than the physical abuse category. Additionally, there are differences between studies in which ICD-9 codes are used. For example, studies using the Kids' Inpatient Database (Ellingson, Leventhal, & Weiss, 2008; Leventhal, Martin, & Asnes, 2008; Leventhal, Martin, & Asnes, 2010) included a broader spectrum of assault E-codes (the external cause of injury codes) than included by Schnitzer et al. (2008). Specifically, these studies included all of the E-codes between E960 and E969, while Schnitzer et al., (2008) found that just E965, E966, E968.2 and E968.9 (with E960.1 and E968.4 as co-occurring exclusion codes) were suggestive of maltreatment. The result is that some studies are including assault by fight/brawl/rape (E960), by corrosive or caustic substance (E961), by poisoning (E962), by hanging and strangulation (E963), by submersion/drowning (E964), perpetrator of child and adult abuse (E967), and late effects of injury purposely inflicted by other person (E969) while this study and others have not. These differences demonstrate that there is still not a precise consensus on which ICD-9 codes are indicative of child maltreatment.

Direct comparisons between studies warrant close examination of the codes used and caution with the interpretation of results, especially when drawing comparisons between studies.

Other studies examining physical child maltreatment incidence have usually taken a narrow approach, focusing on a subtype of physical maltreatment, such as fractures (Leventhal, Martin, & Asnes, 2008; Sharkey et al., 2018) or head injuries like abusive head trauma (Berger, Parks, Fromkin, Rubin, & Pecora, 2015; Niederkrotenthaler, Xu, Parks, & Sugerman, 2013) and inflicted traumatic brain injury (Ellingson, Leventhal, & Weiss, 2008; Keenan et al., 2003). Despite the differences in the populations studied and the variance in the measurement of child maltreatment, the incidence rates were all very similar for children under the age of one year old across studies, with a high of 0.398 per 1,000 children with abusive head trauma (Niederkrotenthaler, Xu, Parks, & Sugerman, 2013) to a low of 0.275 per 1,000 children with traumatic brain injury (Ellingson, Leventhal, & Weiss, 2008). The result in this dissertation of physical abuse at an incidence rate of 0.30 per 1,000 fits squarely in this range.

Of note, however, is that by following the guidelines of Schnitzer et al. (2011), my study again did not include some of the ICD-9 codes included by other studies. In particular, in regards to fractures, only rib (807.0 and 807.1) and scapula (811) fractures are included in physical maltreatment, while skull vault (800) and vertebral (805) fractures are in the unspecified category and pelvic (808) fractures are in the neglect category because of Schnitzer et al. (2001)'s categorization. While other types of fractures were analyzed by Schnitzer et al. (2011), including other skull (801-804), humerus (812), phalanges (816), and femur (820-821) fractures, these were not indicated to be suggestive of maltreatment in their study of Missouri hospitalizations. In contrast, Leventhal et al. (2008) included all fractures (800-829) when it was accompanied by any E-code associated with assault (E960-E969) or a child abuse code (995.5).

And in a study that also specifically followed the suggestive codes established by Schnitzer et al. (2011), Wheeler (2011) included humerus and femur fractures for children under the age of one, citing recent research on sentinel injuries (Lindberg, Beaty, Juarez-Colunga, Wood, & Runyan, 2015). These differences in codes indicates that further research should use the same codes as previous studies in order that direct comparisons may be made between populations and settings.

A sensitivity analysis was conducted specifically taking the same approach as Leventhal et al. (2008) to identify any type of fracture that had a co-occurring child maltreatment code (E960-E969 or 995.5). This analysis identified 718 hospitalizations that met this criteria, but this number was reduced to 299 children when restricted to children who were under the age of one and were born in Washington State. Based on the 1,271,426 children born in the state during this time frame (1999-2013), this results in a fracture maltreatment rate of 0.235, under the incidence rate found by Leventhal et al. (2008) using the Kids' Inpatient Database. The differences in the incidence rates could reflect issues with the weights used in the Leventhal et al. study, actual differences between the population in Washington State and the full U.S. population, or differences with the sample used for the Kids' Inpatient Database and the full population.

The sensitivity analysis also indicates that the inclusion criteria also seems to indicate that there may be some hospitalizations missed when strictly following the Schnitzer et al. (2011) ICD-9 codes for inclusion. The Schnitzer et al. (2011) maltreatment E-codes related to maltreatment (E960.0, E965, E966, E967, E968.2, E968.9, E988) were narrower than the Leventhal et al. (2011) list of co-occurring maltreatment codes which included all E-codes between E960 and E969. In the sensitivity analysis, the number of cases identified as meeting the study requirements (age, birth year, born in Washington) and the Leventhal et al. (2011) criteria

of having a diagnosis fracture with a co-occurring maltreatment code *not* used by Schnitzer et al. (2011) are presented in Table 13.

Table 13: *Count of E-codes from Sensitivity Analysis*

E-code	**Count**	**No child maltreatment code (995.5)**
E962.0 – Assault by drugs and medicinal substances	2	1
E962.1 – Assault by other solid and liquid substances	1	0
E968.7 – Assault by human bite	1	0
E968.8 – Assault by other specified means	26	0

These results in the count column represent 30 of the 299 total hospitalizations that met the Leventhal et al. (2011) criteria, but it is not clear whether these are child maltreatment-related. Child maltreatment requires that a caregiver be the perpetrator of child maltreatment (Drake & Jonson-Reid, 2018), but the identity of the perpetrator in these assault codes is unclear, leaving the certainty of these assaults being related to child maltreatment in doubt. The hospitalization records from Washington only include one E-code, however upon examination of each hospitalization record for another co-occurring maltreatment code (995.5), all but one of these hospitalizations had a co-occurring diagnosis of child maltreatment, highlighting the importance of not relying on a single diagnosis.

Neglect. This dissertation found that approximately three-quarters of child maltreatment-related hospitalizations were attributable to neglect. This percentage mirrors that found in the official reports to child protection agencies across the U.S. (USHHS, 2019). This is a compelling finding especially given that the only definitive ICD-9 codes in regards to neglect are "child emotional/psychological abuse" (995.51), "child neglect (nutritional)" (995.52), "other child abuse and neglect" (995.59), and "evaluation for abuse and neglect" (V71.81). These codes were used infrequently in this study, with the highest being child neglect (nutritional) with 79 cases

identified. Thus, many of the hospitalizations related to neglect are the result of the use of the codes suggestive of maltreatment.

Many of the hospitalizations suggestive of neglect are related to supervisory neglect and preventable injuries (Schnitzer et al., 2011). Encompassed in supervisory neglect is inadequate supervision, which can result in serious consequences (Pecora, Whitaker, Barth, Borja, & Vesneski, 2018). While there is no consensus on the definition of neglect, one of the most common elements included in state legal definitions of neglect is supervisory neglect (Rebbe, 2018). This codification of supervisory neglect in legal definitions by the majority of state legislatures in addition to the large number of children hospitalized with injuries likely related to supervisory neglect demonstrates the importance and frequency of this form of maltreatment. While the ICD-9 does not have a code specifically related to supervisory neglect, the ICD-10 addresses this shortcoming by including a code, Z62.0, which is "inadequate parental supervision and control" (McKenzie & Scott, 2011). Additional ICD-10 codes related to neglect are T74.0 ("maltreatment syndromes: neglect or abandonment"), Y06 ("neglect and abandonment"), Z62.4 ("emotional neglect of child"), and Z62.5 ("other problems related to neglect in upbringing") (McKenzie & Scott, 2011). With the implementation of the ICD-10 codes in the U.S. starting on October 1, 2015, future identification of neglect through diagnostic codes may be achieved through definitive ICD-10 codes more than they have been attainable through ICD-9 codes. It is possible that the availability of this code may also encourage health professionals to consider and document supervisory neglect as a diagnosis, as appropriate.

The implication that many of the neglect hospitalizations were related to supervisory neglect is supported by the finding that neglect-related hospitalization occurred most frequently during a child's second year, in contrast to all of the other subtypes of maltreatment. This is the

time frame in a child's development when they are becoming more ambulatory and independent, including walking. This skill development requires a change in the supervision that a parent provides, which may change in a short amount of time as a child's skills progress and increase. Services and education dealing with these changes may assist parents in responding to these developmental changes in order to keep children safe and free from injury.

Length of Stays

Children under the age of three with hospitalizations related to child maltreatment averaged 3.76 days in the hospital. The variation by maltreatment subtype occurred as expected, with the longest stays for children with poly-maltreatment type hospitalizations at 7.44 days. The complexity of the diagnoses for the child, spanning multiple types of child maltreatment, appears to coincide with the amount of time the child is hospitalized to treat those injuries, with an average of over a week as an inpatient the hospital. The next longest average stay in the hospital was for children hospitalized for physical abuse related diagnoses at 5.12 days. These results support previous findings that multiple day stays in the hospital are common for children hospitalized for child maltreatment (Forjuoh, 2000). Further, this highlights the important role hospitals and their staffs play in the investigation, treatment, and intervention for child maltreatment (Christian & Committee on Child Abuse & Neglect, 2015; Wood, French, Song, & Feudtner, 2015). Prior research has indicated that systematic screening of child maltreatment in medical settings resulted in increased detection of child maltreatment (Louwers et al., 2012). With the recent studies on sentinel injuries and the opportunities for health professionals to prevent future maltreatment (Harper, Feldman, Sugar, Anderst, & Lindberg, 2014; Lindberg et al., 2015; Petska & Sheets, 2014; Sheets et al., 2013), this finding is even more pertinent.

Aim 2: Risk Factors

The results from Aim 2 directly address the second step of the public health approach and generate new population-based knowledge about which risks are associated with hospitalizations related to child maltreatment. The major findings from this section include the identification of important risk factors at birth, including 1) the new finding that concentrated disadvantage at the neighborhood is related to child maltreatment-related hospitalizations, and 2) individual-level factors such as low birth weight, male child sex, child birth order, and public birth payment. A third major finding for Aim 2 is that, similar to the California study of injury mortality, a prior CPS report is associated with increased risk of hospitalizations related to child maltreatment. These findings are discussed in greater depth in the rest of this section.

Sociodemographic Variables from Birth Record

A number of sociodemographic variables were identified in this dissertation as risk factors for child maltreatment-related hospitalizations. This is a critical second part of the public health approach. It is from the understanding of these risk factors that prevention programming can be developed. The identification of risk factors from the birth records carry particular utility because 1) they provide comparisons across the entire population (Putnam-Hornstein & Needell, 2011) and 2) allow for early intervention (Herrenkohl et al., 2015). The sociodemographic variables identified in this dissertation can be used to develop and target early prevention efforts.

Low birth weight. Children whose birth weight was lower than 2500 grams was identified as a risk factor in both the hierarchical linear models and the Cox regression models. This is consistent with the population-based findings in California (Putnam-Hornstein & Needell, 2011), England (Spencer et al., 2006), and Florida (Wu et al., 2004). While the relationship between low birth weight and child maltreatment is not absolutely clear, some possibilities include the child's increased health concerns provoke reactions by parents or that the aspects of

social determinants of health that contribute to low birth weight are also associated with child maltreatment (Gavin, Grote, Conner, & Fentress, 2018; Spencer et al., 2006). Ultimately, identifying the mechanism of the relationship is beyond the scope of this dissertation but should be explored in future research. Low birthweight has lifelong implications for wellbeing and health, and the maltreatment implications suggest that these children are particularly vulnerable.

Teenaged mothers. Children who were born to mothers who were teenagers at the time of the child's birth also had elevated risk to experiencing a child maltreatment-related hospitalization. The birth rate to teenagers has steadily decreased during this dissertation's time frame, from 40.7 per 1,000 female teenagers in 1999 to 20.2 per 1,000 in 2013 (Center for Health Statistics, Washington State Department of Health, 2017). The results here suggest that the teenagers that do have children may not have the support and resources that they need, especially in light of many of the hospitalizations here identified as being related to supervisory neglect. Given that previous research has identified that a maternal history of child maltreatment was a strong predictor of offspring maltreatment among teenaged mothers (Putnam-Hornstein, Cederbaum, King, Eastman, & Trickett, 2015), this heightens the need for more supports to be targeted to this subpopulation.

Male infants. Male infants had increased risk of experiencing a child maltreatment-related hospitalization compared to female infants. This finding is consistent with the NYC population-based study of hospitalizations (Mason et al., 2018) and the California study of injury mortality (Putnam-Hornstein, 2011), but studies of general CPS contact (Putnam-Hornstein & Needell, 2011; Wu et al., 2004) and official reports to child protection agencies (USHHS, 2019) have not found differences based on the child's sex. The findings that male children are injured and killed as a result of child maltreatment at higher rates than female children but not in regards

to general reports of child maltreatment suggest that there may be differences in parenting behaviors that are resulting in serious injuries for male children. Given that large portions of the child maltreatment-related hospitalizations were related to supervisory neglect and about 75% of the injury mortality was classified as unintentional (Putnam-Hornstein, 2011), parents are likely behaving in accordance with the belief that male children require less supervision than female children, which is insufficient and resulting in serious injuries or death.

Public birth payment. Children whose births were paid for using public health insurance, like Medicaid, had increased odds of experiencing a child maltreatment-related hospitalization compared to children whose births were paid for using private insurance. Here, as in other studies, this measure is used as a proxy for individual-level poverty. Consistent with other studies (Putnam-Hornstein, 2011; Putnam-Hornstein & Needell, 2011; Mason et al., 2018; Wu et al., 2004), individual-level poverty is associated with child maltreatment outcomes, indicating that the eradication of poverty would likely alleviate the prevalence of child maltreatment.

Child birth order. Parity was found to be a risk factor for a child maltreatment-related hospitalization, where children who were not their mother's first born child found to have higher risk. In particular, the sub-analyses of the Cox proportional hazards models indicate that while later born children have higher risk for all types of hospitalizations, this finding only remains when looking at neglect-related hospitalizations in isolation. Again, as improper supervision is a likely cause of these hospitalizations, there is a need to assist parents to develop strategies to prevent these injuries from occurring. Further, many child maltreatment prevention programs are targeted to first-time parents (Duffy, Hughes, Asnes, & Leventhal, 2015; Easterbrooks, Kotake, & Fauth, 2019; Olds et al., 1997; Zielinski, Eckenrode, & Olds, 2009). This finding of later-born

children being at higher risk of child maltreatment-related hospitalizations indicate that it may not be that parents lack the knowledge of how to keep their children safe, but that they may not have the resources to adapt their strategies to incorporate more than one child in their supervision. Therefore, parents bringing home subsequent children may likely benefit from home-visiting and other maltreatment prevention programs that focus on the adjustment to raising and splitting their attention among multiple children. With the passage of the federal Maternal, Infant, and Early Childhood Home Visiting (MIECHV) program (42 U.S. § 711), which contains a stated goal to prevent child abuse and neglect, $400 million dollars have been allocated yearly to the implementation of home visiting programs (Campos, Kapp, Simoes, 2018; Labiner-Wolfe, Vladutiu, Peplinski, Cano, & Willis, 2018). Based on these results, home visiting programs should be targeted to families who have more than one child to assist them with preventing child maltreatment that results in hospitalization including supervision strategies.

Maternal race. In both the multilevel regression and the Cox proportional hazard models, when controlling for the other sociodemographic variables and compared with the largest maternal race category of white, only children born to Native American mothers were found to have increased risk of experiencing a child maltreatment-related hospitalization. In the same models, children born to Hispanic and Asian/Pacific Islander mothers had lower risks and no difference was found for children born to black mothers. However, when looking at the raw distribution numbers, black and Native American infants were overrepresented in comparison to the number of births in the state. These findings indicate that black and Native American racial disproportionality in the Washington State child welfare system, defined as differences between the general population and child welfare population by race (Hill, 2006), may, at least partially, be attributable to differences in the need for child protection intervention. This finding supports

the conceptual framework proposed by Boyd (2014) that disproportionate need is one of the contributors to disproportionality in child welfare systems. These results regarding overrepresentation in the counts of maltreatment are also similar to findings in the three most recent versions of the National Incidence Studies (NIS-2, NIS-3, and NIS-4) which found that black children were maltreated at higher rates than white children (Drake & Jonson-Reid, 2011). Yet, the finding of no increased risk of experiencing a child maltreatment-hospitalization for children born to black mothers compared to children born to white mothers after controlling for sociodemographic factors is in line with previous work that has identified that controlling for these factors, especially socio-economic ones, diminishes the maltreatment differences between black and white children (Ards et al., 2003a; Ards et al., 2003b; Dettlaff et al., 2011; Kim & Drake, 2018; Putnam-Hornstein, Needell, King, & Johnson-Motoyama, 2013). These results highlight the complexity regarding disproportionality in the child welfare system and that the root causes are likely multifaceted.

In regards to the findings regarding children born to Native American mothers, no other study of child maltreatment-related hospitalizations or death included Native Americans as a subgroup so it is not possible to compare studies regarding Native Americans. However, a population-based study of diagnosed prenatal substance exposure in Washington State did identify that the prevalence was the highest for children born to Native American mothers across all racial groups and all substance types (Rebbe, Mienko, Brown, & Rowhani-Rahbar, 2019a). The results of that study and this dissertation indicate that, at least in Washington State, Native American children are at higher risk for the adverse outcomes in early childhood of prenatal substance exposure and child maltreatment-related hospitalization. Further, in regards to child maltreatment-related hospitalizations, those risks are elevated even in models with

sociodemographic controls indicating that this risk is independent of poverty. These results indicate that Native American families in Washington State may not have access to quantity and quality of services. Additionally, these findings may be directly connected to the historical context of Native Americans in the U.S. Specifically, Walters and Simoni (2011) state "many of the behavioral health problems (e.g., diabetes, alcoholism) of Native women are directly connected to their colonized status and to associated forms of environmental, institutional, and interpersonal discrimination" (p. 522). Thus, an aspect of child maltreatment prevention must also include the eradication of marginalization that Native Americans face.

An important consideration of the race and ethnicity variables is that the birth records do not allow for multiracial identities, which is the fastest growing racial group in the U.S. (Subica & Wu, 2018). As a result, these results may not be capturing the actual identity of some of the children and their families in this study as they may identify with one of more races. Further, this limitation of the data extends to the lack of incorporation of an intersectional framework, a deficit identified in population health research (Richman & Zucker, 2019). This is a limitation that future data collection, especially at the population level, needs to consider, especially as methods are being developed to incorporate intersectionality in quantitative research (Bauer & Scheim, 2019).

The analysis in this dissertation did not include an examination of discrepancies in terms of race/ethnicity in the application of certain diagnoses. In particular, future research should explore whether there are disparities in how the specific child maltreatment codes are applied, especially in cases where bias may occur such as for racial minorities and families in poverty.

Community-level Disadvantage

The finding that community-level concentrated disadvantage is a risk factor for child maltreatment-related hospitalizations is consistent with previous work that identified

communities with higher levels of poor socioeconomic characteristics (Coulton, Theodos, & Turner, 2012; Drake & Pandey, 1996; Ernst, 2000; Freisthler, 2004; Freisthler, Midanik, & Gruenewald, 2004; Freisthler, Needell, & Gruenewald, 2005; Gillham et al., 1998). The strength of the results from this dissertation is that the outcome of interest is a measurement of child maltreatment (hospitalizations), not just reports to CPS. Thus, these results account for the possibility of class bias or concerns of increased scrutiny of residents of poor neighborhoods that abate studies that rely on official reports because this dissertation measures child maltreatment outcomes, not simply concerns of maltreatment. The population-based nature of the measure of community level disadvantage used in this dissertation also increases the utility of these results by providing state legislators with discrete information regarding where community-level resources and interventions can be targeted.

The multilevel model included both the individual-level measure of poverty, public birth payment, and the community-level measure of concentrated disadvantage. The effect sizes for both variables are very similar indicating that both measures of poverty are important indicators of child maltreatment-related hospitalizations and both should be included in future research. These results indicate that the community context that families live in plays a larger role than current child protection systems account for, as they treat child maltreatment primarily as an issue whose etiology is within the family. These results indicate that context the families live in also should be taken into consideration. Thus, programs and policies targeting reductions of both levels of poverty could prevent and reduce the incidence rates of hospitalizations related to child maltreatment.

Prior CPS Report

Children who were previously related to a CPS report had a higher risk of experiencing a child maltreatment-related hospitalization, just as was found in the California study of injury

mortality (Putnam-Hornstein, 2011). Additionally, consistent with the California injury mortality study, a prior CPS report was the strongest predictor of a child maltreatment-related hospitalization across all sub-types of maltreatment. The effect size was the strongest for the abuse and poly-type subtypes of hospitalizations, with children having a prior CPS report hospitalized at almost five times and over four times, respectively, more than children not previously reported to CPS. This suggests a stronger connection between a prior CPS report with the more violent types of maltreatment resulting in hospitalization. The California study found similar results with the intentional injury deaths having the strongest relationship with a prior CPS report than the unintentional and undetermined injury deaths.

These results support the argument that a prior CPS report is "an independent signal of risk" (Putnam-Hornstein, 2011, pg. 172). That argument was made on the basis of injury mortality, a much rarer event than child maltreatment-related hospitalizations. However, there are still significant consequences and costs associated with child maltreatment-related hospitalizations. The fact that a prior CPS report has been a consistently strong predictor between both of these severe outcomes indicates that children reported to CPS have a distinct risk profile and that reports to CPS are not random events (Putnam-Hornstein, 2011). Instead, children who are reported to CPS are more likely than their peers to be injured in a manner, likely related to child maltreatment that results in hospitalization or death.

Consequently, families that are referred to CPS should have more robust supports afforded to them in order to prevent future child maltreatment. These services do not need to be delivered through the child protection system, as these systems are already under-resourced and overwhelmed (Berrick, 2009). Further, the delivery by CPS in a voluntary manner may not be

embraced by families. But it is clear that these families are in need of additional supports to ensure that their children live healthy and safe childhoods.

Aim 3: System Responses

This dissertation's results of the system responses to child maltreatment-related hospitalizations fill an important gap in our understanding in regards to how health professionals report child maltreatment to CPS. Further, the results provide crucial information concerning if CPS removes children from their parents upon receipt of these reports. This information is the result of using a novel population-based linked administrative database that enables this dissertation to track children across the various systems they interact with, specifically here, from birth to hospital to CPS. Databases, such as this, have previously been identified an important source of evidence to inform policy and practice that provides a more comprehensive understanding of child maltreatment and its related systems (Jonson-Reid & Drake, 2008). The results of this dissertation realize this potential and provide new knowledge at the system level so that we can understand how these responses occur across the entire state of Washington, providing more information about how these systems interact than a sample could provide.

The main takeaways from this aim, providing new knowledge about the system responses to child maltreatment hospitalizations, are 1) that few of these children are removed from their parents immediately, and 2) that these responses are primarily a function of the type of ICD-9 code used and the subtype of maltreatment the child was diagnosed with.

Data linkages like the ones conducted as part of this dissertation are a growing part of the child welfare field, but only exist in a limited number of jurisdictions and vary by which systems they are able to link. The only other U.S. study, to my knowledge, that utilized administrative data that linked hospital and CPS data, as done here for this dissertation, did not examine this

critical question about health professionals reporting hospitalizations related to child maltreatment to CPS and then if CPS removes these children (Schnitzer, Slusher, & Van Tuinen, 2004). Instead, this study focused on the ascertainment of the number of children who experienced maltreatment, as measured by hospitalization or CPS maltreatment substantiation. This dissertation provides information beyond the identification of affected to children to data on which children are reported to CPS and then which children are removed from their parents. This research fills this important gap in our understanding of how mandating reporters respond to concerns of child maltreatment.

Understanding these decision points is critically important in regards to child protection and the safety of children. CPS agencies in the U.S. are reliant on mandated reporters and members of the public to alert them to concerns of child maltreatment. Without these reports to CPS agencies, these agencies cannot intervene and offer families services. Health professionals, inclusive of a variety of professions, are particularly important in this structure of child protection systems, especially in light of recent research identifying that sentinel injuries are being missed by health professionals prior to more serious injuries (Berger & Lindberg, 2019). Indeed, these hospitalizations are critical opportunities for intervention and health professionals, especially pediatricians, are integral to this (Jackson et al., 2015; Letson et al., 2016). Multidisciplinary child protection teams have been formed in many hospitals in recognition of the important opportunity that exists when children are presented for treatment and the benefit of interdisciplinary collaboration (Kistin, Tien, Bauchner, Parker, & Leventhal, 2010). Future research should examine if and how the presence of a child protection team at the hospital impacts the reporting of child maltreatment-related hospitalizations to CPS.

The Sankey diagram in Figure 15 (pg. 81), a flow diagram, visually displays some of the critical decision points regarding children who experienced child maltreatment-related hospitalizations. This figure demonstrates that neglect was the most common maltreatment subtype and that non-specific maltreatment codes were utilized for the majority of the hospitalizations. This finding is not necessarily surprising given the limited ICD-9 codes that are related to neglect (Schnitzer, Slusher, Kruse, & Tarleton, 2011). Thus, if a medical provider had identified that the child's injury was related to neglect, in particular a consequence of inadequate supervision, there is not a clear ICD-9 code to attribute to that hospitalization. Therefore, it is likely that the majority of the neglect-related hospitalizations to be associated with non-specific maltreatment codes is a function that the ICD-9 codes do not account for this etiology of injuries.

At the next step, the figure demonstrates a great variation between which children are reported to CPS with almost every child with a specific maltreatment code reported to CPS while only a fraction of children who had a non-specific maltreatment code reported. The finding that most children whose hospitalizations are diagnosed with specific maltreatment codes were reported to CPS is reassuring that the use of one of these codes coincides with a CPS report. However, the finding that very few of the hospitalizations with a non-specific maltreatment code did not result in a CPS report is a finding that requires additional discussion, which will follow later in this section. Finally, the Sankey diagram demonstrates that of all the children who experience a child maltreatment hospitalization, very few of these children are removed from their parents shortly after the hospitalization. This is information that may be helpful for health professionals who may have concerns regarding what happens after they make a CPS report. It is possible that health professionals understanding the outcomes and reasons for them by CPS may alleviate their concerns regarding making CPS reports.

These results are similar to the results found in regards to prenatal substance exposure in Washington State (Rebbe, Mienko, Brown, & Rowhani-Rahbar, 2019a). Those results found that less than half of infants diagnosed with prenatal substance exposure were reported to CPS and that there was great variation in reports and removals depending on the type of substance the infant was exposed to in utero. Similarly, the system responses to child maltreatment-related hospitalizations depend on the diagnosis associated with the hospitalization.

Distribution of System Responses

The analysis of the system responses in this dissertation first looked at the simple bivariate distributions of responses before conducting multinomial logistic regression models. These analyses provide increasingly more context to this examination of system responses.

Maltreatment type and specific code status. There are clear differences in the system responses by the maltreatment type. Less than ten percent of neglect-related hospitalizations were reported to CPS while abuse, sexual, and poly-maltreatment related hospitalizations had more than half resulting in at least a CPS report. Similarly, abuse-related hospitalizations had the highest rate of resulting in removals by CPS. But an important contextual factor here is the use of specific maltreatment codes. The use of a specific maltreatment code has a very different distribution than hospitalizations not associated with a specific code, with over 80% of hospitalizations related to specific code resulting in a CPS report. The explanation for these differences, however, is not clear.

One important aspect is that the ICD-9 codes do not adequately account for neglect. This may be the result of the medical field not considering neglect to be an important aspect of child maltreatment or one that necessitates a diagnostic code. This is further complicated in that it is difficult to discern, if this is true, whether this is representative of the ICD-9 code authors responding to the practices of health professionals or health professionals acting in accordance

with the established ICD-9 codes. Regardless, this illustrates the utility of the suggestive codes by Schnitzer et al. (2011) and that the ICD-10 codes include improved neglect codes, including one for inadequate supervision (McKenzie & Scott, 2011).

Another issue this elicits is how health professionals evaluate the suggestive diagnoses in regards to child maltreatment. One explanation is that health professionals in Washington State disagree with the Schnitzer et al. (2011) taxonomy of suggestive codes. This possibility indicates that further work is likely needed to authenticate this classification of suggestive codes. But, research has also indicated that health professionals are often reluctant to report child maltreatment to CPS (Flaherty, et al., 2008; Sege, et al., 2011) and often miss signs of child maltreatment (Berger & Lindberg, 2019). Thus, the source of the disagreement between the suggestive codes and the filing of CPS reports is unclear. This is an area for future research which should include an examination of variation at different levels, such as hospital or geographic variation, which may indicate cultural, policy, or training differences.

Finally, the finding that there are still some hospitalizations associated with child maltreatment specific diagnoses that do not result in a CPS report is concerning and supports previous research that health professionals do not always reports concerns of child maltreatment even when they suspect it has occurred (Flaherty, et al., 2008; Sege, et al., 2011). In this case the health professionals have made a diagnosis of child maltreatment but have not fulfilled their obligation as a mandated reporter to alert the local CPS agency. Further research is warranted to understand the patterns that may accompany this finding and to identify if improved policy or training is necessary.

Child age. The distributions by child age indicate that both health professionals and CPS evaluate children under the age of one to be the most vulnerable as this age group has the highest

proportions of CPS reports and removals. This is consistent with the national data that indicates this age group to have the highest rates of maltreatment substantiation and maltreatment-related fatalities (US HHS, 2019).

Sociodemographic Contexts and System Responses

The multinomial logistic regression results provide us with more context regarding the system responses as these models control for sociodemographic variables. This provides a more complete picture than the distributions as these models are able to account for multiple variables at once.

The effect size for both CPS reports and removals in the multinomial model is greatest for abuse-related hospitalizations compared to neglect. These results suggest that both systems – hospitals and CPS – are acting in similar manners with the greatest concern for hospitalizations related to abuse. This finding is somewhat surprising in comparison to the effect sizes of the poly-maltreatment hospitalizations, which are elevated compared to neglect for both CPS reports and removals, but not at the same magnitude. Poly-maltreatment-related hospitalizations were associated with longer average stays in the hospital and seem to indicate that the injuries had a complex etiology. However, the responses did match these indications.

Maternal race was not found to be a significant predictor of the system responses in the multinomial model. However, children whose births were paid for using public health insurance, the individual-level measure of poverty, had increased odds of experiencing both CPS reports and removals compared to children whose births were paid for using private health insurance. Similar to the results from Aim 2, these system response results provide context to the debate regarding disproportionality and disparities in the child welfare system. The conceptual framework by Boyd (2014) identifies disproportionate need and human decision-making as two of the five factors contributing to disproportionality and disparity in the child welfare system,

with the other three components agency systemic factors, policy impact, and placement dynamics. The Aim 2 results supported that disproportionate need may be contributing to disproportionality in the Washington state child welfare system. These system response results indicate that human decision-making, particularly in regards to bias, may also contribute to disproportionality, however, if it does exist, it is not taking the form of racial bias but the form of class bias. In other words, the systems may have a tendency to respond to children in poor families where they do not in regards to families not living in poverty. This is a similar finding in a California study that examined racial disparities in terms of CPS involvement and found that children born to black and Latino mothers were not more likely to have interactions with the child welfare system than children born to white mothers when socio-economic factors were taken into consideration (Putnam-Hornstein, Needell, King, & Johnson-Motoyama, 2013). This highlights the importance of taking multiple factors into consideration when examining disproportionality in child welfare systems.

CHAPTER 5:
CONCLUSION

This dissertation realizes the innovative utility of longitudinal, multisector multilevel administrative datasets identified by Jonson-Reid and Drake (2008). Specifically, the results here provide population-based new knowledge regarding three important aspects of child maltreatment. The first is the incidence and prevalence of child maltreatment resulting in hospitalizations. Historically, our understanding of the quantity of children who have experienced maltreatment has relied on reports to CPS or on retrospective surveys. This dissertation presents an enhanced approach to measuring maltreatment that is more objective and relevant for policy-makers. In particular, these results indicate that supervisory neglect is likely occurring at a higher rate than other forms of maltreatment, representing about three-quarters of maltreatment-related hospitalizations for children born in the state of Washington before the age of three. These results indicate that child maltreatment prevention efforts should incorporate the importance of appropriate supervision in the development of these programs.

The second aspect of child maltreatment that this dissertation adds new knowledge to is risk and protective factors. As a result of the majority of our knowledge of the counts of children who have experienced being based on official reports to CPS, most of our knowledge regarding risk and protective factors also come from the same source. This is problematic because these data are cross-sectional, contain limited sociodemographic variables, and do not capture the full population of children who experience maltreatment (Putnam-Hornstein, Webster, Needell, & Magruder, 2011). This dissertation identified sociodemographic variables at birth as risk factors in comparison to the general population. Children whose weight was below 2500 grams at birth, born to mothers who were teenagers at the time of birth, and who are not their mother's first

child all had increased likelihoods to be hospitalized as the result of child maltreatment. In line with ecological systems theory, high concentrated disadvantage at the zip code level (maternal residence at the time of birth) was also identified as a risk factor for maltreatment-related hospitalization. Finally, congruent with the injury mortality findings in California (Putnam-Hornstein, 2011), a prior CPS report was identified as a risk factor of maltreatment-related hospitalizations. The risk factors identified here can be utilized as targets for prevention programming and, except for the prior CPS report, just after a child is born.

The third area of new knowledge ascertains which maltreatment-related hospitalized children are reported to CPS by health professionals and, of those children, which are removed immediately by CPS. The findings in this dissertation build on previous studies that used linked administrative data to understand the system responses to diagnoses of prenatal substance exposure (Putnam-Hornstein, Prindle, & Leventhal, 2016; Rebbe, Mienko, Brown, & Rowhani-Rahbar, 2019a; Rebbe, Mienko, Brown, & Rowhani-Rahbar, 2019b). This dissertation examined a broader set of maltreatment-related diagnoses producing a more comprehensive view of mandated reporting and CPS responses. Two important findings came from this analysis. First, the responses were dependent on the subtype of maltreatment and type of diagnostic code used. Specifically, physical abuse and codes specifically related to maltreatment had higher rates of CPS reports and removals. The second key finding is that a small proportion of children identified as having experienced a maltreatment-related hospitalization were immediately removed from their parents. These results provide the broadest and most rigorous understanding of how children move from the health system of hospitals to CPS agencies.

This dissertation is part of a larger research movement that utilizes population-based linked administrative data to better understand how various systems interact with each and the

families they serve. This represents the largest and broadest study of hospitalizations related to child maltreatment to date. The new knowledge identified through this study has important implications for our understanding of child maltreatment, how we can prevent it, and how current systems are responding to it.

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Wood, J. N., Medina, S. P., Feudtner, C., Luan, X., Localio, R., Fieldston, E. S., & Rubin, D. M. (2012). Local macroeconomic trends and hospital admissions for child abuse, 2000–2009. *Pediatrics*, *130*(2), e358–e364. https://doi.org/10.1542/peds.2011-3755

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Wu, S. S., Ma, C.-X., Carter, R. L., Ariet, M., Feaver, E. A., Resnick, M. B., & Roth, J. (2004). Risk factors for infant maltreatment: A population-based study. *Child Abuse & Neglect*, *28*(12), 1253–1264. https://doi.org/10.1016/j.chiabu.2004.07.005

Zielinski, D. S., Eckenrode, J., & Olds, D. L. (2009). Nurse home visitation and the prevention of child maltreatment: Impact on the timing of official reports. *Development and Psychopathology*, *21*(2), 441–453. https://doi.org/10.1017/S0954579409000248

Rebecca Rebbe

EDUCATION

Ph.D., Social Welfare, expected June 2019
University of Washington, Seattle, WA
Demographic Methods Graduate Certificate
Statistics Concentration, Center for Statistics and the Social Sciences

MSW, Social Work, June 2007
Boston College, Chestnut Hill, MA

Ed.M., Risk and Prevention, June 2006
Harvard University, Cambridge, MA

B.A., Social Work; minors: Social Justice and Spanish, May 2004
University of Portland, Portland, OR

RESEARCH INTERESTS

Public child welfare; system responses to child maltreatment; child welfare law and policies; administrative data; transition-age youth; prenatal substance exposure; poverty; social welfare history

PEER REVIEWED PUBLICATIONS

Rebbe, R., Mienko, J.A., Brown, E.C., and Rowhani-Rahbar, A. (2019). Hospital variation in child protection reports of prenatal substance exposure. *Jounal of Pediatrics,* 208, 141-147. doi.org/10.1016/j.jpeds.2018.12.065

Rebbe, R., Mienko, J.A., Brown, E.C., and Rowhani-Rahbar, A. (2019). Child protection reports and removals of infants diagnosed with prenatal substance exposure. *Child Abuse and Neglect,* 88, 28-36. doi.org/10.1016/j.chiabu.2018.11.001

Killos, L.F., Vesneski, W., Pecora, P.J., **Rebbe, R.,** and Christian, S. (2018). A national analysis of guardianship assistance policy and implementation. *Children and Youth Services Review,* 94, 115-125. doi.org/10.1016/j.childyouth.2018.09.017

Rebbe, R., Nurius, P.S., Courtney, M.E., and Ahrens, K.R. (2018). Adverse childhood experiences of youth aging out of foster care and young adult health outcomes. *Academic Pediatrics,* 18(5), 502-509. doi.org/10.1016/j.acap.2018.04.011

Rebbe, R., (2018). What is neglect? State legal definitions in the United States. *Child Maltreatment*. 23(3), 303-315. doi.org/10.1177/1077559518767337

Rebbe, R., Nurius, P.S., Ahrens, K.R., and Courtney, M.E. (2017). Adverse childhood experiences among youth aging out of foster care: A latent class analysis. *Children and Youth Services Review,* 74, 108-116. doi.org/10.1016/j.childyouth.2017.02.004

Rogers, A., **Rebbe, R.,** Gardella, C., Worlein, M., and Chamberlin, M. (2013). Older LGBT adult training panels: An opportunity to educate about issues faced by the older LGBT community. *Journal of Gerontological Social Work,* 56(7), 580-595. doi.org/10.1080/01634372.2013.811710

Articles Under Review

Rebbe, R., Brown, S.E., Matter, B., and Mienko, J.A. Mothers with intellectual and developmental disabilities: A population-based assessment of child protective services interactions. *Child Abuse and Neglect*.

Articles in Preparation

Rebbe, R., Mienko, J.A., Brown, E.C., and Rowhani-Rahbar, A. Child protection reports of infants diagnosed with prenatal substance exposure not initially reported. Prepared for *Children and Youth Services Review.*

Rebbe, R., Mienko, J., Ahn, J., and Oh, J. Poverty and child maltreatment reports as risk factors for childhood injury mortality. Prepared for *Children and Youth Services Review.*

Rebbe, R. The timing and state variation of child maltreatment reports in the first year of life in the United States.

Romich, J.L., Marcenko, M.O., **Rebbe, R.,** and Ullrich, J. Addressing the economic needs of families in the child welfare system.

Book Chapters

Gavin, A. and **Rebbe, R.** (2017). *Maternal depression in pregnancy.* In N. Cohen (Ed.) *Public Health Perspectives on Depressive Disorders.* Baltimore: John Hopkins University Press.

Technical Reports

Killos, L., Vesneski, W., **Rebbe, R.,** Pecora, P., and Christian, S. (January 2018). *Guardianship assistance policy and implementation: A national analysis of federal and state policies and programs*. Seattle, WA: Casey Family Programs.

Killos, L., Vesneski, W., **Rebbe, R.,** Pecora, P., and Christian, S. (January 2018). *A national analysis of guardianship assistance policy and implementation: Research brief.* Seattle, WA: Casey Family Programs.

English, D.J., Pecora, P.J., Goodman, D., Wackerman, J., and **Rebbe, R.** (2017). *Interventions with special relevance for child welfare with age range, duration, effectiveness rating, effect sizes, and cost.* Seattle, WA: Casey Family Programs.

Awards, Grants, Fellowships

Center for Statistics and the Social Sciences (CSSS) Travel Award, University of Washington, 2019.

TL1 Interdisciplinary Translational Research Fellowship (TL1 TR000422), National Institutes of Health, Institute for Translational Health Science, 2018-2019.

Center for Studies in Demography and Ecology (CSDE) Travel Award, University of Washington, 2018.

Graduate School Fund for Excellence and Innovation Travel Award, University of Washington Graduate School, 2016.

TL1 Interdisciplinary Translational Research Fellowship (TL1 TR000422), National Institutes of Health, Institute for Translational Health Science, 2015.

Naomi Gottlieb Fellow, University of Washington School of Social Work, 2014.

Allegretti Scholar, Merit scholarship for full-tuition, room, and board, University of Portland. 2000-2004.

PEER REVIEWED PRESENTATIONS

Rebbe, R., Mienko, J.A., Brown, E.C., and Rowhani-Rahbar, A. (January 2019). *Hospital variation in child protection reports of prenatal substance exposure.* Oral Presentation. Society for Social Work and Research 23rd Annual Conference, San Francisco, CA.

Rebbe, R., Mienko, J.A., Prindle, J. (January 2019). *Estimating the Total Maltreatment Rate in the US: Methodological Innovations and Considerations.* Roundtable. Society for Social Work and Research 23rd Annual Conference, San Francisco, CA.

Rebbe, R. (January 2019). *The Timing and State Variation of Child Maltreatment Reports in the First Year of Life in the United States*. Poster Presentation. Society for Social Work and Research 23rd Annual Conference, San Francisco, CA.

Rebbe, R., Mienko, J.A., Brown, E.C., and Rowhani-Rahbar, A. (April 2018). *Child protection reports and placements of infants prenatally exposed to substances.* Oral Presentation. Population Association of America Annual Meeting, Denver, CO.

Oien, E., Ahn, J., **Rebbe, R.,** and Mienko, J.A. (April 2018). *Impact of migration on estimating the prevalence of child maltreatment allegations.* Poster Presentation. Population Association of America Annual Meeting, Denver, CO.

Rebbe, R., Mienko, J., Anh, J., and Oh, J. (January 2018). *Poverty and child maltreatment reports as risk factors for childhood injury mortality.* Oral Presentation. Society for Social Work and Research 22nd Annual Conference, Washington, DC.

Romich, J.L., Marcenko, M.O., **Rebbe, R.,** and Ullrich, J. (January 2018). *Meeting the material needs of child welfare involved families: The perspective for frontline workers.* Oral Presentation. Society for Social Work and Research 22nd Annual Conference, Washington, DC.

Eastman, A.L., Kim, H., Mienko, J.A., Parrish, J., Prindle, J. Putnam-Hornstein, E., and **Rebbe, R.**. (January 2018). *Rates of child welfare system activity: Methodological challenges and policy implications.* Roundtable. Society for Social Work and Research 22nd Annual Conference, Washington, DC.

Rebbe, R. and Mienko, J.A. (January 2018). *Opioid exposed infants and child welfare system involvement: A multilevel analysis.* Poster presentation. Society for Social Work and Research 22nd Annual Conference, Washington, DC.

Rebbe, R., Mienko, J., and Waismeyer, B. (January 2017). *Differential child welfare case trajectories of substance exposed infants.* Oral Presentation. Society for Social Work and Research 21st Annual Conference, New Orleans, LA.

Rebbe, R., Nurius, P.S., Ahrens, K., and Courtney, M.E. (January 2017). *Adverse childhood experiences among youth aging out of foster care: A latent class analysis.* Oral Presentation. Society for Social Work and Research 21st Annual Conference, New Orleans, LA.

Nurius, P.S., Lanesskog, D., and **Rebbe, R.** (March 2016). *Your research careers: Using conferences to build and leverage training supports.* Oral Presentation. 6th Annual European Social Work Research Association Conference, Lisbon, Portugal.

Rebbe, R. (January 2016). *What is neglect? A comparative analysis of state definitions of child neglect in the United States.* Poster. Society for Social Work and Research 20th Annual Conference, Washington, D.C.

Rebbe, R. (June 2012). *Defining child sexual abuse: Legal and academic definitions in the United States.* Poster. American Professional Society on the Abuse of Children 20th Annual Colloquium, Chicago, IL.

Rogers, A., Julka, D., **Rebbe, R.,** and Mirasol, H. (April 2002). *Gender differences in academia: Faculty perceptions of roles and responsibilities.* Poster. 82nd Western Psychological Association conference, Irvine, CA.

INVITED PRESENTATIONS

Heyd, J., Kas, S., Walker, J., Brown, S.E., and **Rebbe, R.** (May, 2018). *Protecting families with disabilities: What we know, what we need to know when developing appropriate sevice plans, and how the ADA applies.* Oral presentation. Children's Justice Conference, Spokane, WA.

Rebbe, R. (April, 2018). *Child protection reports and placements of infants prenatally exposed to substances.* Oral Presentation. Center for Studies in Demography and Ecology (CSDE), University of Washington.

Rebbe, R. (May, 2017). *Adverse childhood experiences among youth aging out of foster care: A latent class analysis.* Webinar. Practice and Research Together (PART) Canada.

Research Experience

Pre-Doctoral Research Analyst. Partners for Our Children, Data Science and Research Informatics Group, University of Washington School of Social Work, Seattle, WA. Risk of Death and Injury Study (RODIS). Performed quantitative analyses on population-based linked administrative datasets. 2015 - present.

Pre-Doctoral Research Assistant. University of Washington School of Social Work, Seattle, WA. Income Stability of Families Involved with the Child Welfare System (PI: Jennifer Romich). Collected focus-group data and performed qualitative analysis. 2015 - present.

Pre-Doctoral Research Assistant. Casey Family Programs, Seattle, WA. National Subsidized Guardianship Survey. Collected survey data and performed quantitative analysis. (PI: Peter Pecora). 2016 - 2017.

Pre-Doctoral Research Assistant. University of Washington School of Social Work, Seattle, WA. Adverse Childhood Experiences Among Youth Aging Out of Foster Care (PI: Paula Nurius). Conducted quantitative analyses, and preparation of two manuscripts. 2015 - 2016.

Pre-Doctoral Research Assistant. Social Development Research Group, University of Washington. Fostering Higher Education (PI: Amy Salazar). Assisted with data collection. 2015.

Pre-Doctoral Research Assistant. University of Washington School of Social Work, Seattle, WA. Depression During Pregnancy (PI: Amelia Gavin). Conducted comprehensive literature review for book chapter. 2015.

Professional Practice Experience

Adolescent Permanency and Adoptions Supervisor, Washington State DSHS - Children's Administration, Seattle, WA. 07/2012 - 09/2014
Supervised a unit of social workers (6-7) carrying caseloads of legally free adolescents. Member of statewide and regional co-leader of Missing from Care workgroups. Regional trainer for Permanency Roundtable staffings. Member of Quality Assurance Team.

Social Worker (Ongoing and Child Protective Services Investigator), Washington State DSHS - Children's Administration, King County, WA. 05/2008 - 07/2012.
Provided case management and placement monitoring to dependent children and their families. Provided written reports, oral updates, and sworn testimony on dependency court cases. Developed case, safety, and permanency plans. Investigated and assessed allegations of child abuse and neglect.

Clinician, Family Stabilization Team, Family Services of Greater Boston, Boston, MA. 09/2007 - 04/2008.
Provided home-based, client-centered, strengths-based individual and family therapy. Provided case management and assessment of diverse families in crisis and collateral collaboration. Conducted trauma and sexual abuse evaluations based on national protocols.

MSW Practicum, Children's Hospital Boston, Child Protection Clinical Services, Boston, MA. 08/2006 - 06/2007.
Provided extended forensic sexual abuse evaluations in an outpatient setting. Member of the interdisciplinary hospital-wide Child Protection Team.

MSW Practicum, Children's Bridge Home, Boston, MA, 06/2006 - 08/2006.
Provided clinical therapy to school-age children recently placed into protective custody in a small group setting.

AmeriCorps Member - Youth Advocate, Glencoe High School, Hillsboro, OR. 08/2004 - 06/2005.
Carried a caseload of at-risk students, providing tutoring and mentoring in individual and group settings. Developed, implemented, and managed an after school homework program. Co-led a boys' group and a girls' group for at-risk youth.

BSW Practicum, Oregon State Department of Human Services, Child Protective Services, Portland, OR. 08/2003 - 05/2004.
Carried a caseload of ongoing cases in public child welfare system.

PROFESSIONAL SERVICE

Reviewer, *Child and Family Social Work*, 2018-
Reviewer, *Journal of Public Child Welfare*, 2018-

Member, PhD Admissions Committee, University of Washington School of Social Work, 2019.

Board Member, Student Member-at-Large, Society for Social Work and Research (SSWR), 2016 - 2018.
Chair, Doctoral Student Task Force
Member, Research Capacity and Development Committee

Member, Faculty Recruitment Committee, University of Washington School of Social Work, 2016 - 2017.

Chair, Social Work Q's Student Group, University of Washington School of Social Work, 2015 - 2017.

Member, Doctoral Program Curriculum Committee, University of Washington School of Social Work, 2015 - 2017.

Reviewer, MSW Admissions Committee, University of Washington School of Social Work, 2015.

TEACHING INTERESTS

Foundation Curriculum: Introduction and History of Social Work; Social Work Policy; Introduction to Macro Practice; Poverty and Inequality; Foundation Practice

Advanced Curriculum: Child Welfare Practice; Children and Family Services Policy

TEACHING EXPERIENCE

Sole Instructor, Advanced Practice with Diverse Children and Families: Focus on Child Welfare (SOC W 532), University of Washington MSW course, Winter 2018.

Sole Instructor, Intellectual and Historical Foundations of Professional Social Work Practice (SOC W 500), University of Washington MSW course, Fall 2017.

Teaching Practicum, Macro Practice I: Organizations, Community, Policy Practice. University of Washington MSW course, Winter 2016.

Rebbe, R. *Quantitative Research with Secondary and Administrative Data.* Invited lecture for MSW course on Research Methods. University of Washington School of Social Work, Seattle, WA., February 2017.

Rebbe, R. *Poverty and Child Welfare.* Invited lecture for MSW course on Poverty and Inequality. University of Washington School of Social Work, Seattle, WA., March 2016.

Rebbe, R. *The Child Welfare System(s).* Invited lecture for undergraduate Introduction to Social Work course. University of Washington, Seattle, WA., February 2016.

Field Instructor, MSW and BSW students placed at Washington State DSHS Children's Administration, Seattle, WA, 2011 - 2014.

Rebbe, R. *Maintaining Professional Boundaries.* Invited lecture for undergraduate course on mental health and counseling. Northeastern University, Boston, MA., Spring 2008.

PROFESSIONAL MEMBERSHIPS

Society for Social Work Research
Council on Social Work Education
Population Association of America