An Epidemiologic Analysis of Intergenerational Child Maltreatment

A DISSERTATION
SUBMITTED TO THE FACULTY OF
UNIVERSITY OF MINNESOTA
BY

Dylan Louis Galos

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

J. Michael Oakes, Adviser

May 2017

Acknowledgements

I could write a dissertation's length thanking the people who have helped me succeed, so I will keep this brief. First, I would like to thank my advisor, Michael Oakes, not only for his continual academic advice and support, but for giving me the advice that got me through my first winter of biking in Minnesota. I want to thank the rest of my committee: Darin Erickson, Susan Marshall Mason, Lynette Renner, and Julian Wolfson for their support, advice, and thoughtful comments that have challenged me to become a better scholar. I thank Heidi Fall for proofreading this dissertation prior to its final submission. My partner, Paul Dykes, has been an endless source of support; there are no words for how much I appreciate his care, planfulness and willingness to brainstorm with me as I ramble about epidemiologic methods to no end.

Importantly, this work was supported by the Minn-LInK Doctoral Fellowship via the National Science Foundation under grant No. SMA1338489. I thank the team at Minn-LInK, especially Nicole Mickelson and Saahoon Hong, their continual support. For the last year, my work has been funded through the Graduate School's Interdisciplinary Doctoral Fellowship. Both of these fellowships have made conducting a study I would have laughed at on day one feasible. I thank the state agencies Minnesota Department of Education and Minnesota Department of Human Services for access to these records and support during the writing and review process.

Having the mentorship of senior students and postdocs has helped tremendously; I especially thank Erika Fuchs, Hilary Whitham, Nicole VanKim, Derek Smolenski, Gene Danilenko and Jessica Bestrashniy for their advice. I would not have made it through

coursework and prelims without the support of my peers, especially Jennifer Pelletier, Jessica DeWolfe, Bozena Morawski, Allan Tate and Ifrah Biyoow. The mentors I have had throughout this program have taught me so much. I thank Mary Marczak, Bill Spinelli, Heather Britt, Kristine Piescher and Traci LaLiberte for the many things you have taught me. I have learned much from coworkers during assistantships and I have enjoyed our intellectual adventures.

The people in my life outside of academia have helped me find balance; I especially thank Katie Schuver, Kitty Orient, Lucia Yess, Marnie Bounds, and Matt and Jaina Portwood for reminding me to be a whole person in the midst of this process. My friends have kept me sane. I am especially grateful for Jack Thompson, for our long walks; Kirstie Kimball and Jesselyn Toufar, for the many listening sessions; Archer Madsen, for the endless push to do better; Rabi'h Nahas, for our conversations; Mike Toppe, for all that you have done; Jared Shenk, for our many concert outings; and Seirra Fowler, Andy McFerrin, Angel Lemke, Thea DeArmond, Pouneh Behin, and Darryl Smallwood, for continuing to connect with me from afar. Last, but certainly not least, I thank my family for trusting me to achieve the goals I set out to, even if you did not see how I was going to make it happen at the time.

Dedication

This dissertation is dedicated to those who seek to create evidence to inform social policy, practitioners who value evidence to inform their practice, and scholars who value practice to inform their evidence. Most of all, this dissertation is dedicated to the families whose lives were represented by the rows and columns in the data used for this study.

Abstract

Objective: Child maltreatment is a serious social and population health problem in the United States, with an estimated incidence proportion of 9.2 victims per 1,000 children. Prior research identifies experiencing maltreatment as a risk factor for perpetrating maltreatment, also called intergenerational child maltreatment (IMT). Many prior studies of IMT have been conducted in individualistic methodologies that are well-suited to describe nuanced mechanisms and individual treatments. A public health approach, focused on surveillance, risk factor identification, and intervention development and implementation can inform this literature by examining IMT as a population health issue. This dissertation used 15 years of linked administrative records from child protection and public schools to examine: 1) the incidence of IMT; 2) the association between IMT and academic achievement, and; 3) the accuracy of offenders' self-report of maltreatment when compared to their prior CPS records.

Methods: In Manuscript 1, child protection records (N = 8,701) from 2000 through 2014 were linked to public school records for demographics. The transmission probability of IMT was estimated by measuring the proportion of childhood victims in accepted CPS reports who appeared as offenders when they became adults. Adjusted transmission probabilities were estimated using log-binomial regression. In Manuscript 2, statewide records from child protection (years 2000 – 2014) and public schools (academic years 2011 – 2012, 2012 – 2013, and 2013 – 2014) were linked to create a dataset of students in third to eighth grades who had contact with both child protection and public school

systems. The association between caregivers' history of maltreatment and the child's academic achievement (i.e., test proficiency, school mobility, and school attendance) was estimated by using multilevel logit and ordered logit regression. Finally, in Manuscript 3, the self-report of 253 offenders with prior CPS contact as potential victims were compared to their records. Misclassification in reporting was defined using the proportion of offenders in households where no offender reported a history of maltreatment who had prior CPS contact. Associations with demographic variables and maltreatment-related risk factors were measured using chi-square statistics.

Results: In Manuscript 1, the total transmission probability among all groups was 11.26%. Transmission probabilities were highest among those who experienced multiple forms of maltreatment and were lowest among those who experienced sexual abuse. Transmission probabilities were lowest among Asians and highest among Native American/American Indian subjects. Prior substantiation and out-of-home placement were both associated with higher IMT probabilities. In Manuscript 2, a caregiver's history of maltreatment had no association with test proficiency, school mobility or attendance after adjustment for school-related covariates, demographics and maltreatment-related risk factors. Regardless of caregivers' history, there were differences by maltreatment type experienced by the child for reading proficiency, science proficiency, mobility and attendance. In Manuscript 3, 54.55% of caregivers with prior contact reported never experiencing abuse. Proportions with misclassification differed by offender's gender, age, relationship to the victim, and prior experience of out

of home placement. Substantiation and type of maltreatment experienced were not associated with misclassification.

Conclusions: This dissertation offers three major contributions to the existing literature. First, it examined IMT as a population health issue, unprecedented in Minnesota. Second, it examined the intergenerational association between maltreatment and education in late childhood, a developmental stage with high potential for intervention. Last, it highlighted the methodological potential of state-level administrative records for surveillance, as well as the limitations in capability of administrative records for population health research on IMT.

Table of Contents

List of Tables

List of Figures

1. Introduction

The Centers for Disease Control defines child maltreatment as "all types of abuse and neglect of a child under the age of 18 by a parent, caregiver, or another person in a custodial role (e.g., clergy, coach, teacher).[1]" In 2015, 3.4 million children were listed as victims of at least one report that received a response from child protective services (CPS), 1,670 of which died.[2] In the state of Minnesota alone in 2015, there were 31,634 alleged victims in reports, twenty-one fatalities and forty-two life-threatening injuries. Four types of maltreatment are commonly defined: physical abuse, sexual abuse, neglect and emotional abuse, also called mental injury. The institution of child welfare, though commonly thought of as being exclusively a part of social work had its beginnings in medicine, and epidemiologic methodology has led to numerous population-level insights about maltreatment prevention. Studies of the etiology and risk factors are common, and one commonly-cited risk factor is a caregiver's history of maltreatment. The occurrence of maltreatment in multiple generations is called intergenerational child maltreatment (IMT). Prior studies of IMT have been very mixed, and methodologically rigorous, population-level studies of IMT are uncommon and difficult to achieve

This dissertation builds upon the existing literature by using epidemiologic methods to study intergenerational maltreatment and its association with disadvantage in education. By linking fifteen years of data from the child protection and education systems, this cross-systems research approach allows a population-level analysis of maltreatment and education. The first manuscript is a descriptive epidemiologic study of the incidence of IMT in a cohort of victims in reports, estimating the transmission

probability and identifying risk factors. The second manuscript tests the hypothesis of cumulative disadvantage by comparing educational outcomes between two groups of maltreated children: those whose parents report experiencing abuse and those whose parents do not. The third manuscript examines the accuracy of a screening tool of caregivers' history of abuse by comparing validated CPS reports to records, tests for differential misclassification based upon risk factors and demographics and illuminates an example of both the limitations and potential of administrative records for research on this topic.

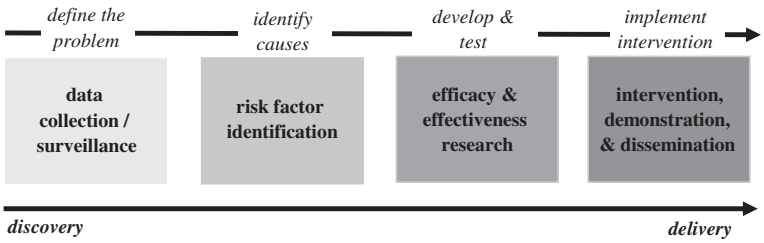
2. Background and Significance

2.1. Child Maltreatment as a Public Health Issue

Child maltreatment, defined as the physical abuse, sexual abuse, neglect, or mental injury of persons under the age of 18, is a prevalent social and public health problem with effects during child development and long-lasting into older age.[3–7] Child maltreatment is associated with several adverse outcomes including behavioral problems, attenuated educational attainment, increased propensity for engaging in risk behaviors, and higher risk for several leading causes of death.[3–7] The incidence, prevalence, and health effects of child maltreatment have been the subject of study for decades with large studies using epidemiologic methodology such as the National Incidence Study (NIS), the Adverse Childhood Experiences (ACE) Study, and the National Longitudinal Study of Adolescent Health (Add Health).[4,8,9]

A public health approach to studying child maltreatment addresses maltreatment as a population health issue, following the steps of data collection and surveillance, risk factor identification, efficacy and effectiveness research, and finally intervention, demonstration and dissemination (see Figure 2.1).[10] This is in contrast with a more individualistic framework seen in studies conducted by psychologists and social workers.[11] Both approaches are necessary, as a public health approach allows the examination of population-level trends, but is unable to identify the nuanced mechanisms and individual-level efficacy of treatments seen in psychological studies.

Figure 2.1. A Public Health Approach to Child Maltreatment



Design of studies using a public health approach. Screenshot from Putnam-Hornstein et al, 2011.[10]

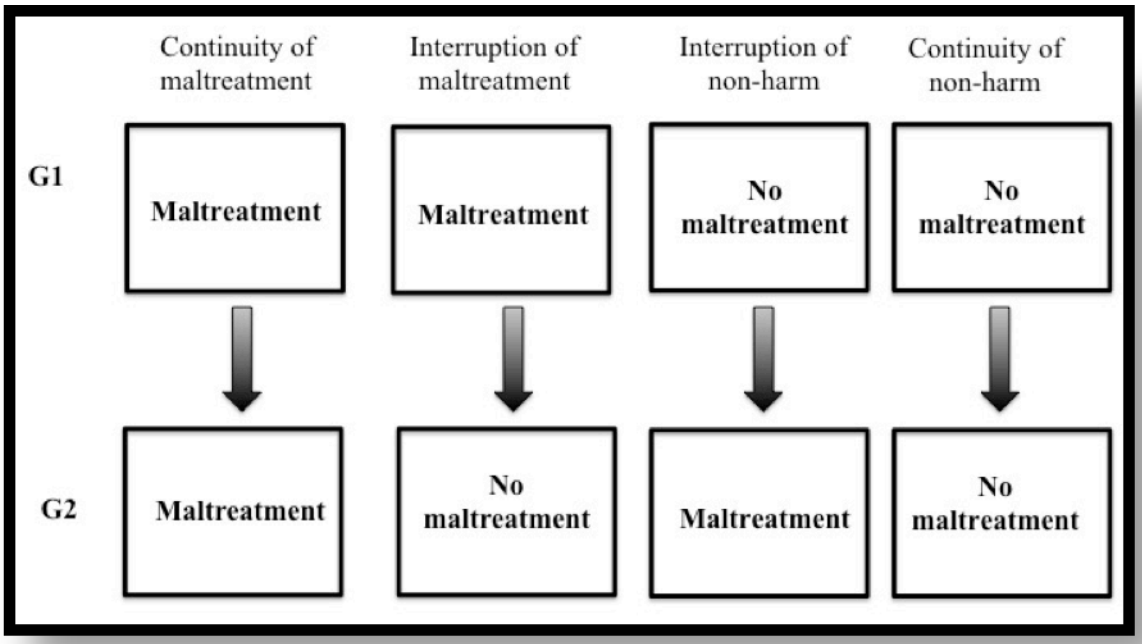
Studies using a public health approach have attempted to identify risk factors for both perpetrating and experiencing maltreatment. Examples of risk factors for maltreatment include: harsh parenting practices, substance and alcohol abuse, interpersonal violence, and poverty.[12]

2.2. Intergenerational Child Maltreatment

Another commonly cited risk factor for perpetrating child maltreatment is a caregiver having experienced child maltreatment.[12] This is more commonly called intergenerational child maltreatment (IMT) and is represented in lay culture with phrases such as "apples don't fall far from the trees." IMT represents continuity of maltreatment between generation 1, caregivers (denoted as G1), and generation 2, children (denoted as G2). While IMT may be type-specific (e.g., a caregiver who experienced physical abuse

perpetrating physical abuse), it also may not be type-specific (e.g., a caregiver who experienced physical abuse perpetrating neglect). IMT is one of four potential intergenerational patterns of maltreatment, represented in Figure 2.2.

Figure 2.2. Intergenerational Continuity and Interruption of Maltreatment



Four potential patterns of intergenerational continuity are represented above. The leftmost, continuity of maltreatment (IMT), represents maltreated caregivers perpetrating maltreatment. The second, interruption of maltreatment, represents caregivers who experienced maltreatment not perpetrating maltreatment. The third, interruption of non-harm, represents a caregiver who did not experience maltreatment perpetrating maltreatment. Last, the furthest right, continuity of non-harm represents caregivers who did not experience maltreatment not perpetrating maltreatment.

A number of theories have been posited to explain IMT, and several pertinent theories are presented below. First, Social Learning Theory posits that through

observation or direct experience, maltreatment is modeled as a learned behavior.[13] Social Learning Theory has commonly been used to explain continuity of physical abuse.[12] Attachment Theory focuses on the attachment between a child and caregiver at birth and when a child relies on the caregiver for survival.[12,14] Maltreatment is posited to adversely affect this caregiver-child attachment and then serve as a template for future relationships. In experiencing maltreatment, attachment with the caregiver is not secure, and this may affect future interpersonal relationships.[14] Ecological models posit that humans are affected by and simultaneously affect their environment, and views maltreatment as an interaction between factors in biology, the immediate family and community environment, and the social landscape.[15] Ecological models are especially useful for accounting for the multifaceted nature of maltreatment, especially in multiple generations.[15] Last, strengths and resilience frameworks are used in human services and focus on both the risks associated with IMT, as well as the strengths that prevent continuity or mitigate the risk.[12] A strengths-based approach asks questions about protective factors; for example, focusing on interruption of maltreatment. Theory is commonly used in studies focused on a more individualistic approach, but incorporating theory into population-level studies is challenged both by data structures, which may not have necessary variables to test it, and disciplinary debates over the value of theory.[16–18]

The academic study of IMT began with the influential paper, "The Battered Child Syndrome," which asserted that parents of maltreated children were likely maltreated themselves, stating that, "data in some cases indicate that such attacking parents had themselves been subject to some degree of attack from their parents in their own

childhood."[19] Since then, the majority of prior studies of IMT have been conducted within individual-level frameworks, examining case reports or following (comparatively) small numbers of families.[20–22] Though studies of maltreatment with epidemiologic designs have advanced our understanding of maltreatment, large, population-based studies of intergenerational maltreatment are less common.[22–26] Studies of IMT generally follow two approaches: estimating a probability (sometimes denoted as a rate) of transmission and estimating the relative likelihood of maltreatment between maltreated caregivers and other caregivers. Table 2.1 summarizes prior studies estimating rates of IMT.[12]

Table 2.1. Prior Studies Estimating Transmission Rates of IMT

Authors (Year)	Rate	Factors	Self-Reports	Official Reports
Bartlett & Easterbrook (2012)	44.0%	N	G1	G2
Ben-David et al. (2015)	4.99%	Y	N	G1, G2
Berlin et al. (2011)	16.7%	Y	G1	G2
Cort et al. (2011)	46.7%	N	G1	G2
Dixon et al. (2005, 2009)	6.7%	Y	G1	G2
Hunter & Kilstrom (1979)	18.36%	Y	G1	G2
Jaffee et al. (2013)	46.0%	Y	G1	G2
Oates et al. (1998)	34.0%	N	G1	G2
Pears & Capaldi (2001)	23.0%	N	G1	G2
Putnam-Hornstein et al. (2015)	12.1% - 18.0%	N	N	G1, G2
Sidebotham et al. (2001)	10.0 – 13.0%	Y	G1	G2
Thornberry et al. (2013)	14.9%	Y	N	G1, G2
Valentino et al. (2012)	54.9%	Y	G1, G2	N
Widom et al. (2015)	21.4%	N	G1, G2	G1, G2

Summary rates from prior studies are included. The leftmost column includes the author names, the second column includes the rate or probability (as a percentage), the third column indicates whether authors adjusted for pertinent risk factors, the fourth column indicates which generation, if any, had self-report data about maltreatment history, and the final column indicates which generation, if any, had official or administrative data about maltreatment history. Table adapted from Schelbe & Geiger, 2017.[12]

As can be seen in Table 2.1, prior studies have found high variability of transmission probabilities and rates, ranging from 4.99% to 54.9%. This may be attributable to between-study variability in design, as studies using self-reports tend to have higher transmission rates and studies using official records for both generations tend

to have lower transmission rates.[12] A meta-analysis and systematic review by Kaufman & Ziegler (1989) estimated a summary transmission rate of 30 percent.[22] It is worth noting, however, that this summary relied upon studies that would be deemed as low-quality based upon current standards.[12,20,27,28]

Pertinent prior studies of IMT are described below. In a decades-long cohort study of adults with substantiated records of maltreatment and a matched (i.e., by age, sex, and neighborhood socioeconomic advantage) comparison group without child protective services (CPS) records, Widom combined administrative records with interviews and surveys. In a recent paper, Widom, Czaja & DuMont reported: 1) children of maltreated parents were more likely than children of control parents to both report that CPS had been concerned and to have been involved in a CPS case (AOR = 2.28); 2) maltreated parents were more likely than control parents to report neglecting their children (but not physically or sexually abusing them), and their children were more likely to report experiencing neglect or sexual abuse; 3) there was not a measurable association between maltreatment of parents and physical abuse of their offspring; 4) detection bias may be a plausible competing explanation for the higher CPS involvement of children of maltreated parents.[29] This is in contrast with earlier findings from this study that physically abused and neglected children have a higher probability of being arrested as adults for criminal behavior.[30] Importantly, Widom has also interviewed adults with confirmed histories of maltreatment and found an approximate 40 percent rate of underreporting for both physical abuse and sexual abuse.[31,32]

The Parents' Study from Add Health asked caregivers about their history of maltreatment and has allowed for population-level studies of IMT. Kim (2009) found evidence of type-specific continuity of physical abuse and neglect based on the parent's maltreatment history (collected by self-report of parents) and their behavior toward their children (measured during the study).[26] Specifically, parents who recalled being neglected were 2.6 times more likely to demonstrate neglectful behavior; parents recalling physical abuse were five times more likely to have abusive behavior and 1.4 times more likely to show neglectful behavior.[26] Savage, Palmer & Martin (2014) found that a history of physical abuse increases probability of both violent and non-violent criminal behavior in adolescence as compared to their non-abused counterparts.[23] This may be reflected in continuity of physical abuse later in life, but study participants are too young to have this measured in this study.[23] The examination of behavior in adolescence highlights two important issues with this literature: first, a study needs sufficient follow-up time to have data on the maltreatment history of two generations; and second, maltreatment is one of several types of adversity, and behaviors such as interpersonal violence and criminal behavior are important variables to incorporate.

The linkage of administrative records from vital statistics and CPS records in California have allowed population-level surveillance of maltreatment and adversity.[10] Results from this data linkage project have identified racial and ethnic disparities in CPS contact,[33] the identification of risk factors associated with CPS contact,[34] and the study of IMT at a population level.[35] Using the records of a cohort of adolescent mothers, Putnam-Hornstein et al. identified increased probability of CPS involvement for mothers who

were listed as possible victims in prior CPS reports, whether the records were substantiated (i.e., confirmed in court and determined to have had maltreatment) or unsubstantiated, after adjustment for demographic covariates.[35] Rates of maltreatment being reported and substantiated were both increased for mothers with prior contact when compared to mothers with no prior record (44.1 reports per 100 births compared to 17.4 per 100 births, respectively and 18 confirmed reports per 100 births compared to 5.1 per 100 births).[35] Putting existing evidence together, the U.S. Department of Health and Human Services concluded: 1) caregivers who have experienced maltreatment are more likely than caregivers who have not experienced maltreatment to become perpetrators; and 2) the majority of people who experience maltreatment do not perpetrate it.[36]

Before proceeding, it is important to note that a number of methodological limitations constrain the study of IMT. It takes decades to collect prospective, longitudinal data about maltreatment in multiple generations, which presents issues of feasibility and cost. Measurement of maltreatment is subject to multiple sources of potential bias; misclassification is possible using CPS records and self-report data, and whether or not substantiation is the best definition of maltreatment is a subject of debate.[37] In Minnesota, the rate of substantiation has sharply decreased as the proportion of cases receiving an alternative response for low-risk cases that does not end in substantiation has increased.[38] These issues become more problematic when measures of maltreatment differ between generations. Sampling and selection present other issues, as how subjects are selected can greatly influence results; systematic issues are present with detection by CPS, and responders to surveys also may differ. Table 2.2 summarizes the

methodological best practices for research on IMT based upon two critical reviews and a later section details issues with administrative records.[12,28,39]

Table 2.2. A Summary of Methodological "Best Practices" for IMT Research

Category of Standards	Ertem et al. (2000)	Thornberry et al. (2012)
Clear definition of maltreatment	Clear description of abuse	A clear definition of maltreatment
Measurement of maltreatment	1. Clear description of person who abused G2 2. Clear definition of outcome	1. Measure of maltreatment with proven reliability and validity 2. Different reporters of maltreatment for each generation
Considering other factors	Adequate control for intervening variable	Controls for antecedent factors that may cause spurious relationships
Sampling	Equal demographic and clinical susceptibility	1. A sample that is representative of the general population 2. Maltreated and non-maltreated members in the focal generation 3. A satisfactory participation rate and low levels of attrition
Control/comparison group	Ensuring nonabuse of controls	Assessment of maltreatment status of comparison group
Data sources	Avoidance of recall and detection bias	Prospective data
Research design	Equal surveillance of both groups for the outcome event	1. The same exposure period for treatment and comparison 2. Follow-up over an extended portion of the life course

2.3. Effects of Child Maltreatment and Intergenerational Maltreatment

A growing body of literature examines the association between experiencing maltreatment among other adverse childhood experiences (ACEs; e.g., witnessing interpersonal violence, having an incarcerated parent) and many of the leading causes of

death in late adulthood.[4] Studies have typically focused upon later adulthood, leaving the health of younger adults and adolescents less studied. Some of this is related to the natural history of diseases, as many of the diseases documented in studies such as the ACE study occur in later adulthood and are rare earlier in life (e.g., cancers, cardiovascular disease).[3,4] Studies of young adults typically focus on risk behaviors such as substance use and suicide.[40–42] Another possible way to examine the association between IMT and the health of younger people is to select a predictor of health in later life as an outcome.

A consistently documented adverse correlate of maltreatment is educational attenuation (i.e., reduced educational attainment when compared to peers who have not experienced maltreatment). Specific adverse educational outcomes associated with maltreatment include: enrollment in special education, lower high school graduation rates, declined matriculation into college, and behavioral problems.[6,43–45] As education is a strong predictor of health in later life,[46] education may be a useful outcome for studies focused upon populations in the developmental periods of adolescence and late childhood.

The case for a link between maltreatment and education is strong,[7,47–49] although the effect of IMT on academic achievement is less studied. Eckenrode, Laird & Doris (1993) found a statistically significant decrease in standardized test scores of maltreated children, independent of family income.[47] Leiter and Johnson (1994) studied 1,661 children and found a statistically significant decrease in several school outcomes among maltreated children compared to a non-maltreated comparison group after adjustment for

demographic covariates (e.g., race, family income, parent educational attainment).[6] However, they did not find substantive differences between substantiated child maltreatment and receipt of social welfare.

Sullivan & Knutson (2000) linked school records with CPS records of approximately 40,000 students, estimating that children with educationally relevant disabilities were 3.4 times more likely than children without disabilities to have experienced maltreatment of any variety.[7] In a review of global studies and agency reports for effects of maltreatment on children globally, Gilbert et al (2009) found a strong association (i.e., twenty to thirty percent differences in graduation or college education rates) between child maltreatment and poorer educational outcomes, but there is limited information to suggest a causal link, particularly from studies outside the United States.[49] An important event that can co-occur with maltreatment is victimization that occurs outside the home and at the school; maltreatment does not occur alone and its impacts and occurrence are not self-limited. Holt, Finkelhor & Kantor (2007) examined the association between multiple forms of victimization and educational outcomes in a sample of 689 fifth-grade students.[48] Their cluster analysis identified three profiles based on numbers of victimizations, with higher numbers of victimizations strongly associated with psychological distress and lower grades.[48]

Though the literature describes the association between experiencing child maltreatment and both poorer health and educational attainment, studies examining the impact of IMT on health-related outcomes are fewer. Intergenerational studies contribute to population health by examining the nature of cumulative disadvantage between

generations and potential identification of both the groups most vulnerable (who stand to benefit the most from efforts in intervention and prevention) and identification of protective factors.

A recent study found a consistent association between the educational attainment of grandmothers (G1) and the birth weight of grandchildren (G3), even after adjustment for events in the life of the mother (G2).[50] Data from the Parents' Study of Add Health, examining other measures of intergenerational adversity, suggests that parental imprisonment has effects on the child's educational attainment during imprisonment and is associated with adverse educational outcomes later in life.[51] Foster and Hagan (2007) found that incarceration of fathers and subsequent social exclusion is associated with adverse consequences for the children.[24] In addition to higher probability for state sanctioning of youth, the father's delays in educational attainment are associated with educational delays for children and with higher risk for daughters experiencing maltreatment from non-biological father figures.[24] Finally, Siennick found that parental imprisonment is associated with lower probability of providing material support to the child and affects the behavior of non-imprisoned co-parents.[52] Though this literature on intergenerational adversity presents a consistent case, limitations in the variables collected do not answer specific questions about whether cumulative disadvantage across generations is associated with the educational trajectories of children in families experiencing IMT. Answering this question could identify a potential high-risk group, demonstrate resilience of families, or advance our understanding in other unexpected

ways. Data linkages of administrative records may be a way to address these questions about IMT as a population health issue.

2.4. Cross-Systems Research and a Population Health Approach

Cross-systems research is defined as the linkage of administrative data from multiple government systems for research purposes. This is distinct from conducting research using administrative records from one system. The use of administrative data for research purposes has a long history in public health; for example, health services research has used the electronic health record to conduct research with claims data.[53] Environmental health sciences have used employer databases for retrospective cohort studies for occupational health.[54] Studies about child welfare often use CPS records as a data source.[55,56]

Cross-systems research advances this approach by constructing datasets using records from multiple agencies in order to conduct research across systems. For example, combining the records of CPS and public schools can allow studies of the association between child maltreatment and education. Methodologically, cross-systems research has the advantages of not relying on self-report, minimizing the effort of data collection, and with the case of topics like maltreatment, avoiding asking difficult and potentially sensitive questions in the research process. Cross-systems research, however, has the limitations of being constrained to the limits of using data that was neither collected nor intended originally for research purposes. Contextual variables may be unavailable, and administrative and clerical errors in data entry may impact the quality of results. European countries such as Denmark have made intellectual advancements in the

methodology of cross-systems research for public health, due in large part to their extensive data systems. The linkage of their record system via a national registry allows epidemiologists to study health over the life course.[57–59] Conducting studies with similar designs may advance the study of population health in the United States. One promising place to start is examining at a statewide level.

As previously mentioned, the work of Emily Putnam-Hornstein has made a strong intellectual contribution to cross-systems research and population-level studies of child maltreatment by linking CPS records to vital statistics.[10,34,60] This study models in part that approach by linking CPS data from the Minnesota Department of Human Services and school records from the Minnesota Department of Education.

2.5. Methodological Challenges in IMT Research Using Administrative Data

Studies of IMT typically rely on self-report data of history of maltreatment, administrative records or some combination of the two.[12] Both of these data sources present limitations. The use of administrative records restricts the sample to cases that have received the attention of CPS. There is evidence that this approach may systematically overrepresent people living in poverty, people of color, and people with disabilities.[33,56,61] Additionally, cases detected by CPS tend to be the most obvious and severe, termed the "tip of the iceberg" by NIS.[8] Using CPS records also requires the decision of whether to use substantiation of a case as a "confirmed" case of maltreatment, which may lead to false negatives, while avoiding substantiation may lead to false positives where maltreatment did not occur. This is made more complicated in CPS systems which use multiple response, in which not every case *has* the potential to be

substantiated. In Minnesota, for example, eighty percent of CPS reports were on an assessment response track that did not end with potential for substantiation.[62]

Likewise, using self-report data presents its own challenges. Self-report data is reliant upon the memory of subjects, which may or may not be accurate, reliable or consistent.[32,63,64] Estimates of prevalence of maltreatment using self-report tend to find higher estimates than those using CPS records; for example, the Centers for Disease Control identifies a higher prevalence of maltreatment than a recent study estimating the national prevalence of confirmed maltreatment using CPS records.[56,65] This difference in estimates may be due to systematic issues, such as detection, as well as psychological mechanisms leading to underreporting, such as social desirability (i.e., responding to survey questions in a way that allows a subject to be viewed more favorably).[66] In addition, definitions of maltreatment may differ in that what one may have experienced as traumatic and maltreatment may not be classified as such on official reports, and vice versa.

In addition to its widespread belief in popular opinion, IMT is considered a risk factor in child welfare practice in Minnesota, and documentation relies on a single-item recall by parents and other caregivers during a response by child protective services (CPS).[67] The reliability of adult recall of maltreatment, however, is suspect. In prior studies of documented victims of maltreatment, adult recall has been consistently underreported.[32,64,68,31] This dissertation takes advantage of existing data from a screening instrument used in CPS respect with a sample of caregivers who are alleged perpetrators and have prior contact with CPS as potential victims.

2.6. Specific Aims

Using a statewide linkage of administrative records in Minnesota from CPS and the Minnesota Department of Education (MDE) from 2000 through 2014, these three aims will be explored: 1) estimate the statewide incidence of IMT in a cohort of people who had childhood contact with CPS; 2) examine the association between IMT and educational attenuation; and 3) examine the reliability of adult recall of maltreatment. This cross-systems research study allows this dissertation to utilize administrative data to study IMT and its association with social disadvantage in Minnesota in an unprecedented way.

3. Methods

3.1. Data Source

3.1.1. Overview, Study Design and Study Population

All manuscripts in this study used data from Minnesota Linking Information for Kids (Minn-LInK), a data linkage project using statewide administrative data from multiple agencies in Minnesota, including the Minnesota Department of Education (MDE), Minnesota Department of Human Services (DHS), and Minnesota Department of Corrections (DOC). Data sharing agreements between these two agencies and Minn-LInK allow the exchange of identified data for research purposes. Specific datasets used for this dissertation include a linkage of DHS data on child welfare from the Social Services Information System (SSIS) to data from MDE in the Minnesota Automated Reporting Student System (MARSS) and Minnesota Comprehensive Assessments (MCA) datasets. The study population includes Minnesotans from all counties who had contact with these systems between January 1, 2000 and August 31, 2014.

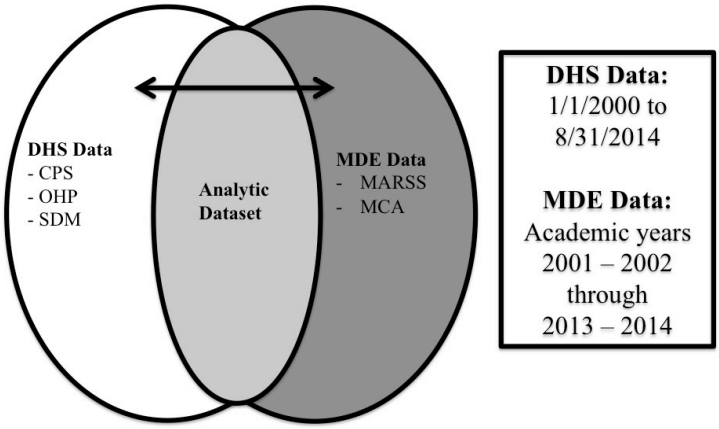
3.1.2. Minn-LInK

Minn-LInK is a research center at the University of Minnesota housed in the School of Social Work. Minn-LInK, through collaboration of state agencies, builds integrated datasets between administrative systems to work on evaluation and research projects. Through this "cross-systems" research, Minn-LInK has published a number of

research briefs and studies on a variety of topics, including juvenile justice, child welfare and education.[44,69,70] In collaboration with the National Science Foundation, Minn-LInK provided data assembly and data access, as well as academic and administrative support.

Datasets are linked by fuzzy matching using the first, middle and last names, as well as birth dates. Using a Soundex function, probabilities of matches are estimated based upon these variables. Matches that are close but are likely to be the same person (e.g., potential typographical errors, hyphenation after marriage) are then hand-matched. Minn-LInK staff handled all work with identifiable data, then encrypted ID codes were generated for use in analysis in this dissertation to protect anonymity and privacy of records, resulting in a de-identified cross-systems dataset. All other data management and analysis were conducted by the author. A visual representation of the linked dataset is presented in Figure 3.1.

Figure 3.1. Linkage of Datasets for Study



Datasets within each administrative system were linked prior to combination across systems (e.g., CPS and OHP data were combined before linking to MARSS data). After datasets were linked, an analytic dataset containing subjects who had contact with multiple systems was prepared and then used.

3.2. Relevant Study Components

A description of the datasets within each administrative system that were included in the study follows, as well as a description of the administrative functions for which this data is collected. As each manuscript used different variables and had its own methods section, the specifics of variables for each analysis are presented within each manuscript, for the sake of brevity.

3.2.1. Data Source One: Department of Human Services (DHS) Data

Child Protective Services Data

In the state of Minnesota, allegations of maltreatment go through initial screening of reports. If CPS responds, cases involving a caregiver as a perpetrator receive a family assessment (FA) or family investigation (FI).[38] A diagram of the screening process is presented in Figure 3.2. The FA track aims to identify needs and potential resources without separating the child from the caregiver.[71] While data is collected and entered during FA response, assessments do not result in substantiation (i.e., a case being determined to have had maltreatment by court). When cases receive an FI response, it is because they have a higher risk of injury to the child based upon the report. In addition, type of maltreatment is important; cases of sexual abuse receive an FI response, for example.[38]

Figure 3.2. Path From an Initial Report to Potential CPS Response

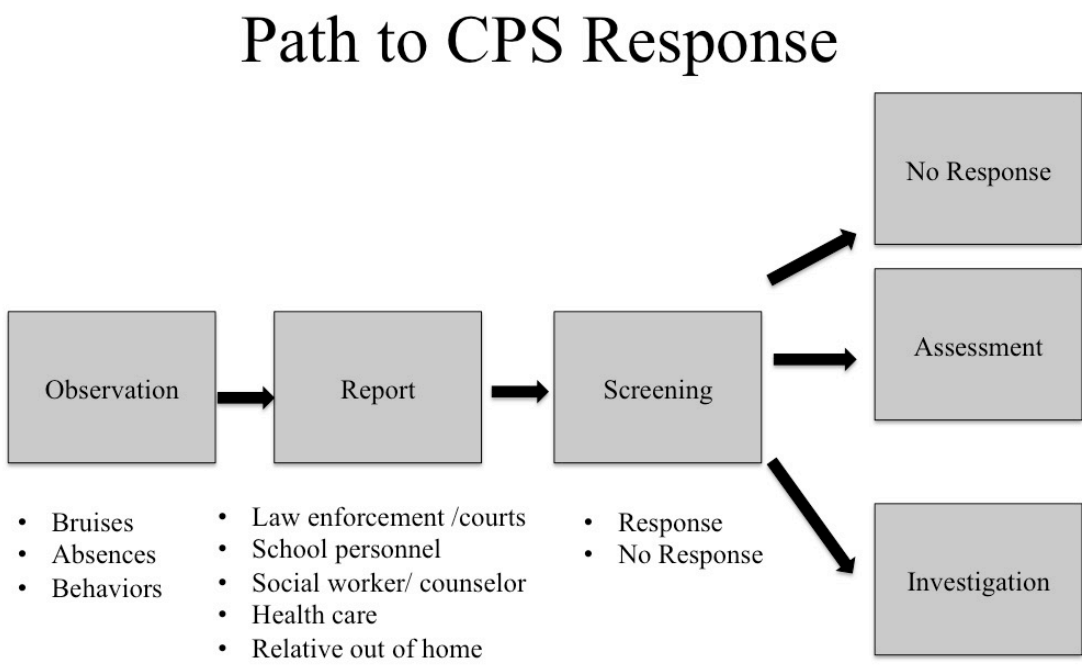


Figure 3.2. exemplifies the pathway that leads to a CPS response for cases of maltreatment. For consistency with analysis, facility investigations are omitted. Cases begin with an observation of something atypical (e.g., bruises, absences from school, or behaviors), and reports come to CPS (common and mandated reporters are listed in Figure 3.2.). After initial screening, three outcomes are possible: no response, an assessment (FA), or investigation (FI).

Data are collected for all reports of maltreatment that go through FA or FI that involve a family caregiver. Allegations that involve staff at organizations such as schools (i.e., facility investigations) are not included in this study. An important caveat to the CPS data is that because of implementation of FA in 2006, the proportion of cases that could end in substantiation during the study period dropped significantly, though the use

of FI has gone up in the time after the study period (see Figure 3.3). This presents an important secular trend that could bias results using substantiation as a definition of maltreatment, particularly those over multiple years. The definition of substantiation or CPS contact for maltreatment is one of scholarly debate,[37] and decisions for each manuscript are presented in the methods section.

Figure 3.3. Cases Receiving FA and FI Response

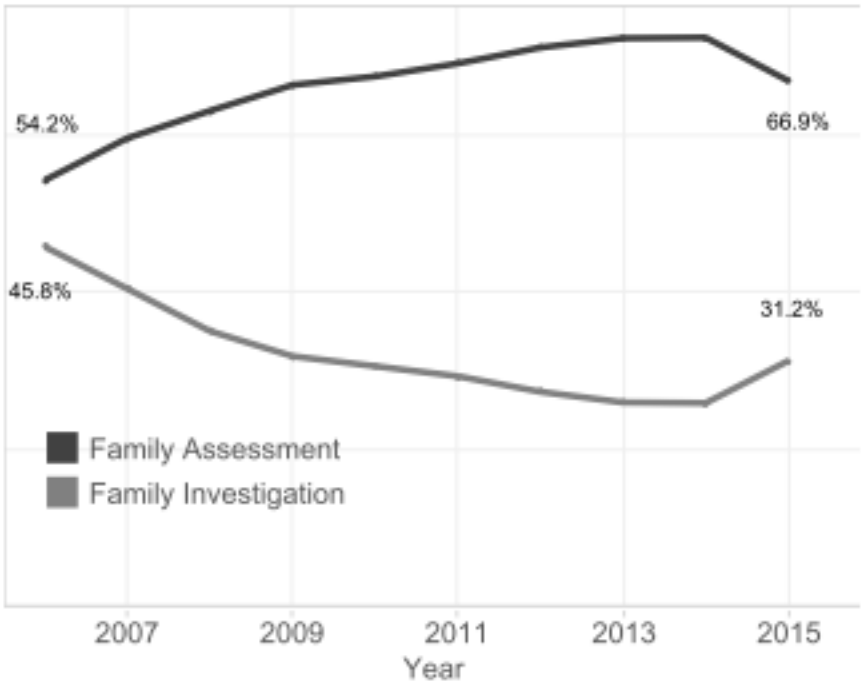


Figure 3.3. shows the proportion of all reports receiving a response in Minnesota annually that received an FA or FI response, since statewide implementation of FA in 2006. The proportion of cases receiving FA increased steadily, reducing the proportion of cases with potential substantiations, and since the end of the study period (i.e., 2014) the trend has begun to reverse. Figure adapted from 2015 statewide Child Protection report. [38]

Structured Decision Making (SDM) Data

The SDM tool is used in CPS response to aid the decision by caseworkers. The SDM includes a risk assessment (designed to predict risk of future maltreatment), strengths and needs assessment, and follow up assessment.[67] These data are collected for all cases since its implementation statewide, which occurred during the middle of the study period, though it was initially tested in individual counties prior. All SDM records after January 1, 2001, are included in this study. For this study, measures from the 25-item risk assessment were used, which focuses on documented risk factors and leads to a risk score. Abuse and neglect have separate risk assessments. While the reliability and validity of the instruments as a whole have been tested, the validity and reliability of individual items have not been studied, as its use in practice is in its entirety and individual items are not used to make decisions.[67,72]

Out of Home Placement (OHP) Data

OHP data is available in the SSIS dataset in DHS. OHP is pertinent for CPS cases that end in removal, and also for children who may have been reunited with families. It is also important to note that children in OHP may have been placed there for reasons other than maltreatment (e.g., via juvenile justice). Additionally, many CPS cases do not end in OHP; while it may be an indicator of severity, OHP may also be temporary (e.g., placed with a relative while a caregiver implements a safety plan). While some placements are temporary, others result in foster care and some end in adoption. The experience of OHP

is associated with adverse impacts on academic achievement. All CPS-related placements were included, regardless of whether they originated in child protection or elsewhere.

3.2.2. Data Source Two: Minnesota Department of Education (MDE) Data

Minnesota Automated Reporting Student System (MARSS) Data

Minnesota Automated Reporting Student System (MARSS) data is an individual student record system collected within all public schools statewide primarily for the purposes of surveillance and recordkeeping (e.g., student count). Data submission is mandatory multiple times per academic year for all school districts. Submitted data are verified by data managers before being included in the final dataset.[73] All academic years were included in this study, including students with individualized education plans (IEPs), students up to age 21, and students enrolled in special programs (e.g., special education). Commonly used variables available to Minn-LInK include: Birthdate; District Number/District Type; School Number/School Type; Grade; Gender; Home Primary Language; Race/Ethnicity; Migrant Flag; Homeless Student; Limited English Proficiency; Free or Reduced Lunch Eligibility; Primary Disability; Special Education Service Receipt/Service Hours; School Transfer; Marriage; Detention; Dropout; Graduation; Gifted & Talented Participation; State Aid Category; and Supplemental Education Services. Those included in analysis are specified in each manuscript.

Minnesota Comprehensive Assessments (MCA) Scores

The MCA is a standardized test that is administered to assess academic progress and identify strengths and weaknesses in children's learning throughout the span of education. Standardized tests are also used to address the variability between schools that might make comparisons of GPAs difficult.[72] The MCA covers three separate content areas: reading, mathematics, and science. Mathematics and reading tests are administered every year in grades 3 through 8 and in high school (in grade 10 for reading and grade 11 for mathematics). The science test is administered in grades 5 and 8, and once in high school, during the year when the student takes a Biology or Life Science course.[74]

The MCA has gone through several iterations during the temporal coverage of this dataset, specifically the MCA – II and MCA – III. Throughout this timeline, however, there have been consistent standards for grading; those that are used for decisions about academic progress. Achievement Level Descriptors (ALDs) describe the four levels of achievement on the Minnesota Academic Standards. Developed by panels of Minnesota teachers, ALDs from the Individual Student Reports for reading, mathematics, science, and English learner assessments are provided here. These values include: *"Does Not Meet Standards;" "Partially Meets Standards;" "Meets Standards;" and "Exceeds Standards." Among them, the "Meets Standards" and "Exceeds Standards" are considered proficient.* As such, MCA scores were constructed as a categorical variable, and then dichotomized. While raw scores were available, the interpretability of ALDs was deemed more appropriate for this study. Specifics about analysis are included in manuscript two.

3.3. Human Subjects

All work with identifiable data was done by staff at Minn-LInK. Usage of this data was subject to review by Minnesota state agencies and required the use of a data-sharing agreement between agencies. The proposal for this study was reviewed and approved by Minn-LInK staff, Department of Human Services staff, and Minnesota Department of Education staff. All manuscripts and findings in this dissertation underwent a 30-day review period prior to presentation and publication to ensure confidentiality of people whose records were used in the study. This specific study was also approved as an exempt study using existing records by the University of Minnesota Institutional Review Board, IRB number 1509E78646.

4. Manuscript 1: Estimating the Incidence of Intergenerational Child Maltreatment in Minnesota, 2000 – 2014

4.1. Abstract

Background: Child maltreatment is defined as the physical abuse, sexual abuse or neglect of persons under age 18. Maltreatment is a pervasive problem in the U.S., with 1 in 8 children estimated to be involved in a substantiated case by the age of 18. Direct causes of maltreatment are currently unknown; however, risk factors include family income, race and ethnicity, and the caregiver's history of domestic abuse and substance abuse. A parent's childhood experience of maltreatment is an assumed risk factor for being an offender of maltreatment, however, prior studies remain inconclusive. The presence of intergenerational transfers of child maltreatment (IMT) is difficult to test using study designs that focus on individuals and families, but advances in accessibility of child protective services (CPS) records may facilitate epidemiologic population-level studies.

Aims: This study had two aims: 1) Estimate the proportion of victims of child maltreatment who become offenders in adulthood; 2) Identify risk factors for and demographic correlates of IMT.

Methods: 8,701 child protection records from 2000 through 2014 were linked to public school records for demographics. The transmission probability of maltreatment was

estimated by measuring the proportion of childhood victims in accepted CPS reports who appeared as offenders when they became adults. Differences in rates between types of maltreatment were tested using chi-squared statistics, and adjusted differences between types of maltreatment and demographic groups were tested using multiple log-binomial regression.

Results: Among all groups, the total transmission probability was 11.26%. Transmission probabilities varied between types of maltreatment experienced in childhood. Transmission probabilities were highest among those who experienced multiple forms of maltreatment and were lowest among those who experienced sexual abuse. Females were more likely than males to have contact as potential offenders in adulthood. IMT was least common among Asians and most common among Native American/American Indian subjects. Prior substantiation and out-of-home placement were both associated with higher IMT probabilities.

Discussion: This study builds on prior research by using administrative records to estimate population-level transmission probability of IMT. Results suggest that the majority of victims of maltreatment do not become offenders in adulthood, although rates differ between demographic groups and typology of maltreatment experienced in childhood. Implications for practice are a potential benefit from focusing maltreatment prevention efforts on groups at highest risk. These results are not generalizable to the entire population of victims and offenders of maltreatment because the study period

restricted this to young parents and results may reflect potential detection bias. Future work should use longer periods of records, examine the role of out-of-home placement, and use other systems to avoid detection bias.

4.2. Introduction

Child maltreatment is defined as the physical abuse, sexual abuse or neglect of persons 18 years of age and under.[62] Child maltreatment is a pervasive problem in the United States (U.S.). Researchers using a national database child welfare reports recently estimated that a child born in the U.S. has a 1 in 8 probability of being a victim in a case substantiated by child protective services (CPS) by the age of 18.[56] Studies suggest that maltreatment detected by CPS represents a portion of all maltreatment, making CPS-based results an underestimate.[8] Data from the Behavioral Risk Factor Surveillance Survey (BRFSS) indicates a prevalence of 15.9% of physical abuse and 10.9% of sexual abuse.[65] Because data from BRFSS is retrospective self-report, estimates may be subject to recall and social desirability bias. The most recent report from the National Child Abuse and Neglect Data System estimated a national child maltreatment incidence rate of 9.4 cases per 1,000 children.[75] Child maltreatment is associated with higher risk of substance use, attenuated educational attainment, involvement with the criminal justice system, and emotional problems.[23,44,76,77] In addition, child maltreatment is associated with adverse physical health outcomes including COPD, heart disease, cancer, and early death.[4]

4.2.1. Prior Research

Multiple studies have identified demographic risk factors for and correlates of maltreatment. These include the child's sex, age, race, and disability status.[8,62,75] These individual-level characteristics listed are most pertinent to this study, but a number of other important family, community, and population-level factors are also correlated with risk of maltreatment. Identification of risk factors does not identify direct causes of maltreatment, although risk factors may be proxies for other underlying causes. For example, Social Learning Theory posits that learning can happen through observation; applied to maltreatment, it suggests that witnessing or experiencing maltreatment leads to a higher risk of perpetrating maltreatment.[12,13] Social Learning Theory and other theories are applied to address the question of causality.[12]

A leading theory of causes of maltreatment is the intergenerational transmission of child maltreatment (IMT).[12] IMT suggests that parents with a history of maltreatment are more likely than non-maltreated parents to maltreat their children. Exact mechanisms of IMT are unknown; prior research has attempted to test and explain IMT using a variety of theories ranging from observational learning, theories of cumulative adversity, attachment after experiencing maltreatment, and potential biological mechanisms after experiencing trauma.[12] Though IMT has been studied for decades, the frequency at which caregivers who experienced maltreatment become perpetrators of maltreatment is not yet established (transmission rates in prior studies vary substantially), largely because of methodological limitations of prior research. However, because some caregivers who experienced maltreatment *do* maltreat their children, this theory is widely held both in the

general public and in practice.[12,36] This theory has influenced child welfare practice, including consideration of a caregiver's history of maltreatment as a potential risk factor for severity during CPS response.[67]

Prior work summarized in recent meta-analyses identifies suggestive evidence that maltreated parents are more likely to become offenders than non-maltreated parents, although the majority of victims of maltreatment do not become offenders.[36] A recent study reported that children of maltreated parents were more likely than children of non-maltreated parents to have contact with CPS, but authors also pointed out that detection bias (i.e., characteristics other than maltreatment making them likely to have contact with the child welfare system) may be a plausible explanation for the higher CPS involvement of children of maltreated parents.[29] Likewise, a recent study using CPS records and vital statistics found that young mothers with a prior history of maltreatment were more likely to be involved as offenders in substantiated maltreatment, but only followed up through child age of five.[35] Other studies have identified evidence for type-specific continuity of physical abuse and neglect based upon self-report.[23,26] Results from studies estimating transmission rates of maltreatment have varied substantially.[12] One critical review found transmission rates ranging from near zero to nearly 100%, varying based on sampling and definition of maltreatment, but synthesized a transmission rate of approximately 30 percent.[78] A more recent systematic review found that the existing literature was too methodologically weak to make any definitive claims.[20]

It is worth noting that maltreatment occurs among a spectrum of other behaviors, and is correlated with both victimization and perpetration of other types of violence (e.g.,

intimate partner violence, bullying, and assault).[23,79,80] Studies have identified intergenerational associations between these types of violence, and some studies of intergenerational physical abuse lacking sufficient follow-up time use these as correlates for potential physical abuse.[23] In addition to directly experiencing maltreatment, witnessing violence is a form of childhood adversity that has been studied and is associated with poor health outcomes in adulthood and is considered a risk factor for perpetration of maltreatment.[4] A less studied but important type of witnessing is the witnessing of maltreatment of siblings, which has been documented to have similar effects on mental health as witnessing other types of interpersonal violence.[81]

Though IMT has been studied for decades in the fields of social work and psychology, its treatment as a public health issue is newer. An epidemiologic framework (i.e., focusing on IMT as a population issue rather than one family at a time) may be well-suited to offer new insights to scientific questions about IMT.[10] By focusing on the entire population rather than individual families or groups of families, it may be more feasible to estimate rates generalizable to the public and provide a stronger base to build upon for surveillance and prevention. Further, many earlier studies have been limited by small sample sizes, short periods of follow-up time, inconsistent measurement of parents and children, and inconsistent definitions of maltreatment between generations.[27,28] Thus, methodologically rigorous epidemiologic studies of IMT stand to make a strong contribution to this literature.

The current study builds upon prior research by using a population-level approach to study IMT in Minnesota over 15 years. This is advantageous over prior studies because

selection based on an entire state's records is systematic, making it more representative, has a large enough sample size to have adequate statistical power, and the length of time for data allows for two generations to have had contact with CPS. In addition, this study examines multiple demographic and maltreatment-related variables, and uses consistent definitions of maltreatment for both generations. We address the following research questions: 1) What proportion of victims of maltreatment appear again as offenders in adulthood; and 2) Do transmission probabilities of IMT vary between demographic groups (e.g., gender, race) and across maltreatment-related risk factors (e.g., physical abuse, neglect)?

4.3 Methods

4.3.1. Data Source

Administrative records from statewide child protection practice were linked to demographic data from education records for our study. Demographic data in CPS records is less consistently collected and entered than demographic data in education records, so education records were selected to improve data quality. Data from child protection and education were linked by a research project that synthesizes administrative records from multiple state systems to conduct cross-systems research studies on child and family wellbeing. More information can be found hereon the Center for Advanced studies in Child Welfare website.[69] The current study used statewide CPS records from January 1, 2000 through December 31, 2014, linked to demographic data from statewide

records from public schools over the same time period (from academic years 1999 - 2000 through 2013 - 2014).

A retrospective cohort study was designed to follow one generation of victims listed in CPS reports (generation 1, denoted as G1) and identify the proportion who appeared as offenders (maltreating generation 2, denoted as G2) within the 15-year study period. Selection criteria were as follows: involvement in an accepted CPS report in childhood (i.e., any report that received a response from CPS, regardless of response type or substantiation); 18 years of age or younger on January 1, 2000; 25 years or older (i.e., of potential reproductive age and likely to have had children) on December 31, 2014; child protection case was not a facility investigation; and records available from both the state's Department of Human Services and Department of Education. To avoid confusion due to potential clerical errors, those identified as parents must have had a birthdate at least 13 years older than their child(ren).

Minnesota adopted a multiple response system for CPS cases in 2006. Two responses are possible based on type(s) of alleged maltreatment and severity of the report: an assessment track and an investigation track. An assessment track is intended to connect parents with resources in cases where the child is not in immediate danger; the investigation track is intended for higher-risk cases, and only investigation cases have the potential for substantiation. All family CPS cases prior to 2000 followed the investigation track and potentially ended with substantiation. More details about Minnesota's multiple response system can be found in available reports and fact sheets.[71] The assessment response became more commonly used during the study period, making the proportion of

cases that *could* be substantiated sharply decrease over time. Because of this limitation and to avoid potential bias, maltreatment was defined as having an accepted rather than a substantiated child protection report.

4.3.2. Data Linkage

Any subjects with CPS records but missing education records were excluded (n = 26,663) so that demographic contrasts could be made. 40,839 records successfully merged with MDE demographic data. Twenty-nine observations were dropped for having ages of G2 greater than ages of G1, possibly due to errors in data entry. Thirty-six observations were removed for G1 age under 13 at the time of first report as offender. 3,784 observations were removed for G2 having a relationship code other than the categories specified (only 242, a small proportion of these, were unmarried partners of the primary caregiver), 121 observations were dropped because they were listed as caregivers less than 13 years older than the victim. Thirty observations were deleted because G1 involvement dates were later than G2 involvement dates. Last, to restrict analysis to subjects likely to have had children (and thus contact with CPS), 28,138 observations were removed for G1 age under 25 at end of study period. This led to a final analytic dataset of 8,701 unique observations with complete data.

Intergenerational Maltreatment

All subjects in CPS data are assigned a unique ID code which follows them through life. Because any person who is both a victim and an offender has the same ID code, a dataset with victim ID codes was merged to a dataset with offender ID codes, and

matching ID codes were defined as a subject who was involved in CPS as both a victim and a perpetrator in different reports. IMT was defined as "any" child maltreatment victimization type in G1 and "any" perpetration of child maltreatment in G2.

Caregivers

All offenders in each case included in the study were in one of the following categories: "Biological Parent," "Adoptive Parent," "Legal Guardian," and "Stepparent." Because the length and nature of relationship is unknown, unmarried partners of caregivers were excluded from this study.

4.3.3. Measures

Maltreatment - Related Variables

All maltreatment-related variables were defined identically for G1 and G2. Intergenerational maltreatment was the primary outcome of this study, typology of maltreatment was used as a predictor, while all other maltreatment-related variables were considered potential risk factors.

Maltreatment Type

Child maltreatment typology was defined using the following four mutually exclusive categories: physical abuse, sexual abuse, neglect (i.e., medical neglect, non-medical neglect and mental injury), and multiple types of maltreatment. For subjects involved in multiple cases, records were aggregated to reflect a summary.

Substantiation

Substantiation was defined as ever having been a listed target child in a case that was substantiated in the data range. For those involved in multiple cases, listed victim in any substantiated report were classified as "ever substantiated." Substantiation was restricted to cases in which the subject was a listed victim, excluding relatives of substantiated victims.

Out-of-Home Placement

Out-of-home placement (OHP) was defined as ever having been involved in a case that ended with an OHP of any length.

Sibling

Having a sibling with a history of maltreatment was defined as being listed with another victim in a case that had a different ID variable.

Demographic Variables

All demographic variables were collected from MDE data and were used as covariates in regression models.

Race and Ethnicity

Race and ethnicity from public school records (collected by parent/guardian report, child self-report if parent/guardian is not available, or by sight of principal if neither of the prior two are available) were classified as follows: White, Black or African American, Asian or Asian American, Alaska Native or American Indian or Hispanic/Latino, any race. This data does not include categories for multiple or other races.

Gender

The following gender categories were assigned using codes from MDE: male and female.

Age

Age data from public school records were used to define the following age variables: age at beginning of study period, age at end of study period, age during CPS case, age of victim during CPS case, age difference between G1 and G2. Age of G1 at end of study period was defined in three categories: 13 to 18; 19 to 24; 25 and over. Because of the dates in which data was collected, the maximum age for parents was 32. Analysis was restricted to subjects 25 and over at the end of the study period as this group was most likely to have had children.

4.3.4. Analysis

Tabular methods were used to estimate the overall cumulative incidence (i.e., total number of events throughout the time period divided by the number of people at risk, denoted as transmission probability) for the study population, as well as the transmission probability stratified by type of maltreatment. Transmission probabilities were estimated using the population of listed victims as the denominator and listed victims who were listed perpetrators as the numerator. Differences in transmission probabilities across maltreatment-related predictors and demographic predictors were evaluated for statistical significance using chi-squared tests. Then, adjusted risk ratios were estimated using log-binomial regression. Two models were run: an unadjusted model for differences between types of maltreatment and risk of IMT was estimated, and an adjusted regression model that included age, gender, race/ethnicity, maltreatment type as demographic covariates and substantiation, OHP, witnessing maltreatment of a sibling as potential risk factors (see Table 4.3).

Three potential interactions were evaluated: maltreatment type-by childhood substantiation; maltreatment type-by-out of home placement; and race-by-gender. The type-by-substantiation and type-by-OHP interactions were explored on the basis that the cumulative impact of experiencing maltreatment and the results of CPS involvement (e.g., interruption in home stability during out of home placement) may differ between types of maltreatment. The race-by-gender interaction was explored on the basis of Intersectionality Theory. For example, a Latino male and an Asian female may have different experiences with CPS based on both their race and gender. While it is currently a subject of debate how best to incorporate and test intersectionality in regression

modeling, interaction terms were included to address this question.[17] Because interactions on the multiplicative scale (e.g., in log binomial regression) are not necessarily the most informative the relative excess risk due to interaction (RERI) was planned as a measure of statistically significant interaction terms.[82]

Log-binomial regression is advantageous to other approaches when risk is the parameter of interest because it directly estimates risk ratios.[83] Confidence intervals are presented wherever possible; results of tests were deemed statistically significant where $p < 0.05$. All tests of categorical variables and interactions were tested using a joint Wald chi-square test. To assess potential multicollinearity, the variance inflation factor (VIF) was computed for all covariates in the adjusted model. The highest VIF was 1.32; as only a VIF > 10 is cause for concern, this suggested that multicollinearity was not a likely problem.[84] Analyses were conducted using Stata 14.[85]

4.3.5. Missing Data

Logistic regression was conducted to identify predictors of missingness of demographic data. Maltreatment type, gender and substantiation were all unassociated with missingness, but older subjects were more likely to have missing data (OR = 0.86, $p < 0.001$).

4.4. Results

4.4.1. Estimated Probabilities of Intergenerational Child Maltreatment

Demographics of sample and distributions of maltreatment and IMT can be found in Tables 4.1. and 4.2., respectively. The transmission probability for all types of maltreatment was 11.26 percent, with 1,612 people in this study population offending in adulthood. There was substantial variability of IMT probabilities between types of maltreatment caregivers experienced in childhood. Children who experienced multiple types of maltreatment were the most likely to become offenders in adulthood (6.0%), victims of sexual abuse were least likely (4.1%), and victims of neglect and physical abuse were in-between, with 4.4% and 4.6% of victims becoming offenders respectively. Typology of maltreatment experienced in childhood was orthogonal to type of alleged maltreatment in adulthood ($\chi^2_9 = 9.8$, $p = 0.45$).

4.4.2. Predictors and Risk Factors for Intergenerational Child Maltreatment

Maltreatment-related risk factors

Substantiation of case (versus assessment or investigation without substantiation) in childhood was also associated with higher probability of IMT; 9.6% and 11.8% of unsubstantiated and substantiated victims respectively experienced IMT. Out-of-home placement during childhood was also a risk factor for IMT, with transmission probabilities of 9.2% and 12.99%, respectively. Before adjustment, compared to victims

of neglect alone, IMT was approximately equally common among victims of physical abuse alone (RR = 1.05; 95% CI: 0.89, 1.22), less common among victims of sexual abuse alone (RR = 0.95; 95% CI: 0.76, 1.20) and more common among victims of multiple types of abuse (RR = 1.41; 95% CI: 1.22, 1.62). These associations were in the same direction after adjustment, with different magnitude, with risk ratios of 1.09 (95% CI 0.93, 1.28), 0.81 (95% CI: 0.64, 1.02) and 1.17 (95% CI: 1.02, 1.36) respectively (see Table 4.4). Substantiation, holding other variables constant, was weakly associated with higher risk of IMT (RR = 1.12; 95% CI 0.96, 1.30). Out of home placement was also a risk factor (RR = 1.36; 95% CI: 1.20, 1.53). Having a maltreated sibling was orthogonal to IMT (RR = 1.01; 95% CI: 0.89, 1.15). Tests for interaction of maltreatment type by OHP and by substantiation both were not statistically significant.

4.4.3. Demographic Variables

Probabilities of IMT varied between racial and ethnic groups; IMT was least common among Asians and most common among American Indian/Alaska Native subjects (see Table 4.2.).

Risk of IMT varied substantially across demographic groups, in addition to maltreatment-related variables mentioned above. Compared to white caregivers who experienced maltreatment, Asians had substantially lower probabilities of IMT (RR = 0.47; 95% CI: 0.29, 0.78), Hispanic/Latino victims of maltreatment had approximately equal risk (RR = 1.01; 95% CI: 0.78, 1.32), and risk was highest among African American (RR = 1.49; 95% CI: 1.30, 1.70) and American Indian (RR = 1.66; 95% CI: 1.40, 1.99) victims of maltreatment. Compared to females, males had substantially lower

IMT probabilities (RR = 0.28; 95% CI: 0.24, 0.33). Test for interaction of gender by race/ethnicity was statistically non-significant, suggesting racial patterns were consistent between genders.

4.5. Discussion

Overall, the transmission probability was quite low; of 8,701 subjects with CPS contact in childhood, only 980 (11.26%) were offenders in adulthood. Although there was substantial variability in transmission probabilities between groups based on maltreatment-related characteristics (e.g., substantiation, out-of-home placement) and demographic characteristics (e.g., race/ethnicity, gender), it is important to interpret in the context of the population-level findings. These results, consistent with results of other studies, suggest that while there is evidence of intergenerational child maltreatment, the majority of victims of maltreatment do not become offenders as measured here.[12,35,36,78]

4.5.1. Maltreatment-Related Variables

It is an important finding that there were differences in transmission probabilities by type of maltreatment experienced by caregivers, particularly in the light of no evidence of type-specific continuity in these results. It is possible that each experience of maltreatment has different impacts on behavior. While other studies have found links between childhood sexual abuse and perpetrating behaviors such as sexual violence, sexual risk behavior, and alcohol abuse, this group being the least likely to have IMT does not corroborate this body of literature.[86–88] Types of services and treatment received

may play an intervening role as well, but it is unknown what services were received by each group.

Behavioral theories such as Social Learning Theory suggest experiencing physical abuse provides a role model for this behavior that if uninterrupted, could lead to these behaviors later on.[13,89] The combination of multiple types of maltreatment might suggest not only a higher frequency of maltreatment, but a multi-dimensional impact of maltreatment on development. The higher rate of IMT among victims of multiple types of maltreatment also corroborates findings from the CDC's ACE Study suggesting additive compound effects of experiencing multiple adverse events in childhood.[90] This being said, the orthogonal relationship between type of maltreatment experienced in childhood and type of maltreatment reported in adulthood suggests that these behavioral pathways are not necessarily as straightforward as one might assume.

Higher rates of IMT based upon childhood substantiation may reflect multiple things. First, substantiation is generally indicative of severity of cases. In Minnesota, cases on a response track where substantiation is possible (i.e., FI) typically represent cases deemed more severe during screening prior to response.[71] Second, substantiation likely reflects a more intensive interaction with CPS; cases with more involvement could increase likelihood of out-of-home placement, involvement with the child welfare system later in life, and detection in adulthood.

4.5.2. Demographic Variables

Results identified a large difference in rates of IMT between mothers and fathers. This is likely to reflect other trends rather than a maternal propensity for IMT. Three

potential competing explanations are worth considering: gender differences in child custody, detection bias, and inherent challenges of engaging fathers in child protection. 2011 U.S. Census data suggests that nationally, only 1 in 6 fathers are given primary custody.[91] In addition, when parents are unmarried at the time of birth, Minnesota law assigns mothers full custody; fathers do not have visitation rights without a court order.[92] Continued contact, more time with the child, and continued surveillance by the child welfare system, particularly among young mothers, may be a potential explanation for these findings. Studies have shown that families with prior contact with CPS are more likely to have contact with CPS in adulthood.[29]

Given the younger age of this sample and the demographic trend for young people to delay marriage, it is likely that many members of this study were unmarried.[93] Data on marital status, however, was unavailable for this study to test this. However, repeating the analysis to include unmarried partners of primary caregivers did not change these conclusions (RR = 0.35; 95% CI: 0.30, 0.40). Last, the child welfare system has historically had challenges with detecting and engaging fathers, which may also influence the gender difference in rates of CPS contact. These challenges are rooted both in assumed gender roles of parents, such as assuming that care for children is primarily the duty of mothers and that young fathers (including step-fathers and unmarried partners) don't play as active a role in childcare, shifting the focus of child protection on mothers.[94–96]

The oldest subjects in this study were 32 years of age; this sample represents younger parents in general. According to vital statistics, 78% of U.S. births are to

mothers between 20 and 34 years of age.[97] While it is possible, then, that many participants would have given birth, only a subset would have had children old enough to have multiple years of follow-up time. Further follow-up with more years of data may present more opportunity to see if this trend of parent age is consistent.

Another finding potentially explained by detection bias is the set of racial disparities in rates of IMT. Though the baseline IMT rates did vary between groups, risk of IMT was substantially different, particularly after accounting for other variables. It may be that increased surveillance, cultural differences in discipline, residential segregation, and poverty may explain these to some extent.[33,61,98] Last, it is possible that racial disparities also reflect disparities in income; without data on household income, it is not possible to test this.[99]

4.5.3. Limitations and Strengths

This study has several limitations. There is the potential for misclassification of the outcome. Defining maltreatment using accepted CPS reports assumes that there is some level of maltreatment or adversity for all cases regardless of substantiation, which may not true. However, as approximately 80% of CPS reports do not receive a response, these represent the most severe reports in the state.[38] A second limitation of this data source is that it is unrepresentative of the entire population. Use of CPS reports means that cases require detection and response to be included; this may lead to an underestimate of the prevalence of maltreatment and IMT.[100] Restricting this data to one state prevents accounting for migration. Because data from public schools was used to

document demographics, results are not generalizable to anybody who did not attend public schools.

There are other limitations with respect to the generalizability of these results. Because all parents in this analysis were younger parents, these rates may not be generalizable to other age groups. In particular, the 15-year study period prevented following a generation from birth to age 18, giving differential follow up time to both caregivers (likely to have been aged at least 25 in 2014) and children (unlikely to have been followed through entire childhood). This may have impacted findings. Additionally, these findings are only generalizable to maltreatment detected by CPS. Defining both maltreatment and parity using CPS contact means that it is not possible to identify the number of G1 victims who had children and *did not* have contact with CPS. Subjects who did not appear as perpetrators in adulthood could have either: 1) had children and not had contact with CPS; or 2) not had children, but the data structure does not inform which of these is the case. Therefore, the probabilities presented in this manuscript are best interpreted as descriptive estimates of the IMT transmission rate for the entire population rather than among of those who had children.

An important data source for further exploration of reasons behind gender differences would be the marital status and household characteristics of IMT. However, that data was only available for 8.9% of IMT families and as such was not usable. Last, maltreatment is one dimension of adversity in childhood that does not reflect other events such as interpersonal violence between parents; using a broader range of events, such as the adverse childhood event (ACE) score, was not possible using the available data.[90]

In spite of these limitations, this study has several strengths. First, the longitudinal data linkage and length of time of this study allows inference over time, rather than a cross-sectional examination. Because this study was conducted using system-wide administrative records, it is likely more generalizable to an entire population than data from a sample of families. While there is reason to believe that CPS cases are not representative of all incidents of maltreatment,[100] any government response to maltreatment typically goes through CPS. It stands to reason, then, that using CPS records makes these results applicable to child welfare practice and policy. Another advantage of CPS records is eliminating the possibility of underreporting due to self-report of maltreatment, which has been documented in other studies.[32,31] Last, maltreatment was defined the same way for both parents and children. This allowed the test for type-specific transmission of maltreatment as well as rigor, as recent commentaries and critical reviews have suggested that variability in definitions of maltreatment between generations can induce measurement bias (i.e., by inflating or attenuating point estimates) in studies of IMT.[27,28,36]

4.5.4. Public Health Implications

While it is newer to study as a public health issue, child maltreatment has long-lasting impacts on health, including strong associations with physical health, health behaviors and social determinants of health ,such as education.[4,41,44,101] Because maltreatment is a highly prevalent problem in the U.S. population, a public health approach can provide important complements to the work done in child welfare.[10,56] A public health perspective emphasizes the importance of population-level surveillance,

identification of risk factors, and implementation of prevention strategies. Such a perspective can be applied to CPS data to refine understanding of groups at high risk of IMT and the potential contributors to that risk. Findings can inform child welfare practice and targeting of existing resources, and also provide a foundation for prevention work. For example, better understanding of risk factors can guide development of interventions.[12] Understanding the intergenerational patterns of maltreatment can inform community health and clinical practice by providing rigorous information about impacts of maltreatment.

As the number of population-level studies of IMT increase, research stands to inform practice to interrupt and prevent cyclical violence. These estimates suggest that IMT, while prevalent, may not be as common as prior studies and beliefs suggest, including a review finding wide range of transmission.[78] These results build upon findings of recent epidemiologic studies of IMT and intergenerational social determinants of health.[26,35,39,50] Accurate data about the likelihood of IMT can prevent CPS worker bias and direct attention to those most in need of services, identifying ways in which public health and social work can collaborate to improve child welfare practice.[36] Research indicates that stable relationships in adulthood and late adolescence have potential to change outcomes of childhood adversity, including IMT.[102,103] Future studies can include longer follow-up times, a wider range of ages, and find data on other important variables such as household income, interpersonal violence, marital status of offenders, and identifying victims who have children and "break the cycle." This type of

interdisciplinary approach stands to make a strong impact for our population of families for generations to come.

4.6. Tables

Table 4.1. Demographics of G1 Stratified by Maltreatment History

	Overall	Neglect	Phys. Abuse	Sex. Abuse	Multiple
Race/Ethnicity					
White/Caucasian	4,849	2,215	1,185	525	924
Black /African American	2,199	1,209	384	98	508
Asian/ Pacific Islander	318	149	70	23	76
American Indian/Alaska Native	806	493	116	60	137
Latino/Hispanic	529	228	136	98	508
Gender					
Male	3,534	2,050	818	115	551
Female	5,167	2,244	1,073	661	1,186
Total	8,701	4,294	1,891	779	1,737

Demographic data is presented describing the prevalence of maltreatment among G1. Types of maltreatment are mutually exclusive, age reflects G1 age at end of study period, substantiation and out of home placement reflect G1 ever having each of those outcomes. Percentages are not presented due to space limitations.

Table 4.2. Distribution of Maltreatment-Related Variables, G1 and G2

	G1 N(%)	G2 N(%)
Variable		
G1 Maltreatment Type		
Neglect	4,294 (49.35)	562 (56.83)
Physical Abuse	1,891 (21.73)	85 (8.59)
Sexual Abuse	779 (8.95)	12 (1.21)
Multiple Forms	1,737 (19.96)	330 (33.37)
G1 Out of Home Placement		
Yes	4,759 (54.69)	330 (33.67)
No	3,942 (45.31)	650 (66.33)
G1 Substantiation		
Yes	6,642 (76.34)	428 (43.28)
No	2,059 (23.66)	561 (56.72)
G1 Maltreated Sibling		
Yes	5,583 (64.17)	454 (45.90)
No	3,118 (35.83)	535 (54.10)

The distribution of maltreatment-related variables in generation 1 (G1; i.e., those who were potential caregivers) and generation 2 (G2; i.e., children of G1) are presented in this table.

Table 4.3. Unadjusted Regression Estimates of IMT Transmission Probability

Variable	Risk Ratio	Standard Error	LB	UB
Maltreatment Type (neglect ref)				
Phys. Abuse	1.05	0.08	0.89	1.22
Sex. Abuse	0.95	0.11	0.76	1.20
Multiple Types	1.41	0.10	1.22	1.62

Risk ratios from log-binomial regression of IMT on type of maltreatment experienced by G1 during childhood with 95% confidence intervals are presented. Neglect was the referent group for comparisons between types of maltreatment. Difference between risk ratios was tested using a joint Wald chi-squared test.

Table 4.4. Adjusted Regression Estimates of IMT Transmission Probability

Variable	Adjusted RR	Std. Error	LB	UB	N(%) IMT
Maltreatment Type					
Neglect (ref)	-	-	-	-	445 (10.4)
Physical Abuse	1.09	0.09	0.93	1.28	205 (10.8)
Sexual Abuse	0.81	0.10	0.64	1.02	77 (9.9)
Multiple Types	1.17	0.09	1.02	1.36	980 (11.3)
G1 Substantiation	1.12	0.09	0.96	1.30	783 (11.8)
G1 Out of Home Placement	1.36	0.08	1.20	1.53	618 (12.99)
Male Gender	0.28	0.02	0.24	0.33	162 (4.58)
Race / Ethnicity					
White / Caucasian (ref)	-	-	-	-	460 (9.49)
American Indian / Alaska Native	1.66	0.15	1.40	1.99	130 (16.13)
Asian / Pacific Islander	0.47	0.12	0.29	0.77	15 (4.72)
Hispanic / Latino	1.02	0.14	0.78	1.32	54 (10.21)
Black or African American	1.49	0.10	1.30	1.70	321 (14.60)
Sibling Maltreated	1.01	0.07	0.89	1.15	622 (11.14)

Log-binomial regression was used to estimate the association between type of maltreatment experienced by G1 and risk of IMT later in life, adjusting for the following sets of 1) demographic covariates: G1 gender, G1 race/ethnicity and 2) maltreatment-related risk factors: G1 substantiation, G1 out of home placement, and G1 sibling history of maltreatment. Categorical predictors were tested using a Wald chi-squared test; 95% confidence intervals are presented next to risk ratio and standard error estimates. Non-Hispanic white was the reference group for race/ethnicity contrasts, neglect was the referent group for maltreatment typology contrasts. The column on the far right displays the IMT probabilities of each stratum.

4.7. Transition to Manuscript 2

Manuscript 1 highlights the importance of population-level understanding of IMT. While several prior studies found wide ranges of transmission rates, estimating rates at a statewide level found a substantially lower number.[12] In addition, manuscript 1 highlights the possibilities of data linkages; as demographic data available from CPS records is not necessarily complete (e.g., data on race and ethnicity were unavailable), linking this to records from MDE allows a more robust analysis. While manuscript 1 focused on this descriptive epidemiological question of the frequency of IMT at a population level and identification of risk factors, it does not advance our understanding of the potential impact of IMT beyond the impact of maltreatment.

Manuscript 2 addresses this question by examining the association between IMT and education. By comparing two groups of children involved with CPS, the association between caregivers' self-reported history of maltreatment and academic achievement was tested. Academic achievement was measured with three outcomes: MCA proficiency, school mobility, and school attendance. By examining multiple measures of academic achievement, this study allows a more thorough analysis than focusing on a sole dimension, such as MCA proficiency, which may not indicate completely the picture, especially between third and eighth grade. Last, this manuscript demonstrates the potential for linking records between systems to understand education with variables unavailable in MDE data.

5. Manuscript 2: Intergenerational Child Maltreatment and Academic Achievement: Population-Level Findings from a Data Linkage Project

5.1. Abstract

Background: Child maltreatment is a public health problem in the US, affecting between 12% and 28% of the population. A widely cited risk factor for maltreatment is a caregiver's history of experiencing maltreatment during childhood, also called intergenerational child maltreatment (IMT). Maltreatment is adversely associated with multiple aspects of academic achievement. Although the link between maltreatment and academic achievement has been documented, the impact of IMT on academic achievement is less known. Understanding multigenerational patterns has potential to identify whether students whose parents were maltreated are at greater risk and provide evidence to target solutions. The study examines the association of IMT with three dimensions of academic achievement: standardized testing, attendance, and mobility.

Methods: Statewide records from child protection (years 2000 – 2014) and public schools (academic years 2011 – 2012, 2012 – 2013, and 2013 – 2014) were linked to create a dataset of students in third to eighth grades who had contact with both child protection and public school systems. Maltreatment for children was defined as having an accepted child protection report. Maltreatment for caregivers was defined based on their self-report during child protective services (CPS) response to their child's maltreatment report. Attendance was defined as mean and then dichotomized into high and low.

Mobility was defined as the number of transfers between school districts. Test proficiency was defined using achievement-level descriptors for science, math, and reading proficiency. Generalized linear mixed model (GLMM) regression was used to analyze these data.

Results: Compared to other children enrolled in public schools, children involved with CPS had lower MCA scores, higher rates of mobility, and lower attendance. Before adjustment for school-related variables and maltreatment-related risk factors, maltreated children with maltreated parents had lower odds of reading proficiency and higher odds of school mobility than maltreated children whose parents were not maltreated. However, after adjustment, a parent's history of maltreatment had no association with test proficiency, school mobility, or attendance. Regardless of parental history, there were consistent differences by maltreatment type (e.g., physical abuse, sexual abuse) for reading proficiency, science proficiency, mobility, and attendance.

Discussion: These results suggest that, at a population level, third through eighth graders in families experiencing IMT were not different than other children with CPS involvement with respect to academic achievement. Nevertheless, all maltreated children had poorer outcomes than children who did not have contact with CPS. Future studies should include the maltreatment history of caregivers of children uninvolved with CPS, incorporate multiple measures of maltreatment and include data on caregivers' education.

5.2. Introduction

Child maltreatment is a highly prevalent problem; recent estimates suggest that a child born the U.S. has a 1 in 8 chance of being involved in a substantiated child protection report by age 18.[56] Population surveillance surveys estimate rates closer to 28 percent.[104] Risk factors for maltreatment have been described in a large body of literature, but identifying direct causes of maltreatment is difficult.[12] One theorized cause is intergenerational child maltreatment (IMT), which posits that parents who were victims of maltreatment as children are more likely to become offenders of maltreatment as adults.[12] Though IMT is a widely held hypothesis, there is little research methodologically rigorous enough to evaluate this claim.[27,28,36] It is also not clear whether IMT has different impacts on children's outcomes than single-generation maltreatment.

5.2.1. Intergenerational Adversity and Maltreatment

A growing body of scientific literature describes the importance of child maltreatment as a threat to public health. In particular, there has been a recent focus on maltreatment's association with adverse health and health behaviors in adulthood.[4] The study of IMT is newer to epidemiologic inquiry, and few studies examine the association between IMT and health. Some literature explores the transmission of genetic and epigenetic markers of maltreatment as well as neurochemical connections to maltreatment across generations and risk for maltreatment.[105,106] Studies like these follow a more individualistic approach, which has potential to identify nuanced mechanisms and individual treatments. Epidemiologic investigation offers a population health perspective,

which has potential to improve surveillance and identify groups of children at increased risk.[10] Both of these approaches are necessary, but as a population-level issue addressed by social systems, a population-based approach is well suited to identify children at highest risk for IMT, as well as find opportunities to intervene in larger-scale contexts than individual approaches.

Much of the literature examining maltreatment and health focuses on outcomes that occur in late adulthood (e.g., cardiovascular disease); fewer studies have examined this association during or before adolescence.[42] While it is important to understand the health of older adults, a challenge in focusing on later adulthood is the missed opportunity to identify high-risk groups and focus on prevention, something that is possible by working with younger populations. Studying health outcomes earlier in life, however, is challenged by of the natural history of chronic diseases that are either unlikely to have developed or are uncommon in early adolescence. Acute outcomes (e.g., injuries) can be documented in early adolescence, but other measures of health may not yet be available.[107] One approach to address this limitation is to measure a predictor of health in later life, such as education.[46] Several studies have identified an adverse association between maltreatment and academic achievement.[44,49,108] Recent research has also examined the association between education in one generation and health in future generations.[50] Identification of children at higher risk for IMT and attenuated educational attainment allows the possibility of intervention and changing the trajectories of disadvantaged children.

There are a number of reasons to think that intergenerational maltreatment may impact education. Parents with histories of maltreatment may have attenuated educational attainment, affecting the educational attainment of their children. In families where children experience some combination of limited opportunity, maltreatment, contact with child protective services (CPS), and out of home placement (OHP), disadvantage may accumulate beyond the direct experience of maltreatment. If caregivers have also experienced maltreatment and/or educational disadvantage, they may be less able to support their child's academic achievement. Despite the plausibility of a link between IMT and academic achievement, prior studies are limited in their ability to test it. Sullivan & Knutson, using linked school records and CPS records, estimated that children with educationally relevant disabilities were more likely than children without disabilities to experience maltreatment of any variety.[7] A review by Gilbert et al (2009) found an association between child maltreatment and poorer educational outcomes, but with limited information to suggest a causal link, particularly from studies outside the U.S.[49]

Several multigenerational epidemiologic studies have used data from Add Health, a national survey of adolescents. While they did not measure the maltreatment history of caregivers, they incorporated data on caregivers' imprisonment, which is correlated to and may have similar impacts as experiencing maltreatment.[90] One study found that parental imprisonment is negatively associated with the child's educational attainment.[52] Foster and Hagan similarly found that incarceration of fathers and social exclusion are associated with maltreatment victimization and educational delays for children and higher risks of daughters experiencing maltreatment from non-biological father figures.[24,51]

Finally, Siennick found that parental imprisonment decreases the probability of providing material support to the child and impacts the behavior of non-imprisoned co-parents.[52] This suggests that adversity experienced by caregivers may affect the potential outcomes of children.

This study builds upon prior literature by testing for differences in academic achievement based on IMT specifically by comparing maltreated third through eighth graders whose caregivers report experiencing maltreatment to those whose caregivers do not. By using this epidemiologic approach, this study contributes in its methodological rigor and ability to identify population-level trends. We focus on school-aged children, a target population that is in a stage of child development where there is a strong opportunity to intervene and where children are developmentally similar.[46,108] Three measures of education are included to more thoroughly examine academic achievement: standardized test proficiency, attendance, and mobility.

5.3. Methods

5.3.1. Study Population and Data Source

Records from CPS were linked to education records from public schools from an upper Midwest state for academic years 2011 – 2012, 2012 – 2013 and 2013 - 2014 (denoted as AYs 2012, 2013 and 2014). Records were first matched based upon name and birthdate of child using a fuzzy matching algorithm to predict probabilities of matching for close matches (e.g., misspelling of names, hyphenated names, typographical

errors), and close matches were then hand-matched. After matching, records between systems were linked to construct an integrated cross-systems dataset for analysis.

Two generations were included in this study: generation 1 (denoted as G1), who were caregivers (i.e., "Biological Parent," "Adoptive Parent," "Legal Guardian," and "Stepparent") listed as offenders in child protective services (CPS) reports, and generation 2 (denoted as G2), who were listed as victims in CPS reports and were enrolled in public schools. All students with public school records between third grade and eighth grade for the AYs 2012, 2013 and 2014 were included as part of the eligible population. For students who aged out into high school before AY 2014 or entered third grade after AY 2012, only records of grades 3 through 8 were included for two reasons: 1) individual-level trajectories were not of specific interest and; 2) to keep comparisons between the same grades.

After removing cases due to missing education data, inconsistent dates (i.e., G2 birth date listed as earlier than G1 birth date, G2 contact with CPS after the study period, missing data on parent's history of maltreatment, G2 contact with CPS earlier than G1, and age gaps between G2 and G1 less than 13 years), the final analytic sample was 7,006 unique subjects. Statistical testing found that missingness of data on G1 history of maltreatment was unassociated with all maltreatment-related variables in G2.

5.3.2. Child Maltreatment Variables

Maltreatment

Maltreatment was defined for G2 by involvement in an accepted CPS report and defined for G1 by self-report during the interview process of CPS response. During CPS

response, caregivers are routinely asked their history of maltreatment. For families with multiple reports, caregivers who ever responded with a history of "yes" were classified as maltreated and caregivers who never responded with a history of "yes" were classified as non-maltreated.

Temporality of CPS cases

CPS cases were included based on the following dates. All accepted CPS reports beginning January 1, 2000, and ending on March 31, 2014 were included in the source population. The study period was defined as systematic statewide collection of records began on January 1, 2000, and ending on March 31 to allow sufficient time for follow up. All cases with first contact with CPS after the study period were excluded. Indicator variables of whether maltreatment occurred prior to testing / academic year were constructed, to examine whether ongoing maltreatment may have differential impacts than previous maltreatment.

Out of Home Placement

Out of home placement (OHP) was classified based upon having a record of a child's removal from the home as a result of a CPS case. OHP was constructed as a dichotomous variable indicating "ever OHP" and "never OHP."

Substantiation

Substantiation of a CPS case was constructed as a dichotomous variable categorized as "ever substantiated" and "never substantiated." For children with multiple records, having any case substantiated led to classification as "ever substantiated." Because substantiation rates decreased throughout the study period,[38] substantiation was not selected to define maltreatment and was only included as a covariate.

Typology of Maltreatment

Maltreatment was categorized with three types: "Physical Abuse," "Sexual Abuse," and "Neglect." Cases of medical neglect and mental injury were categorized as neglect due to small numbers and their similar etiology. For children with multiple records, polyvictimization (i.e., experience of multiple types of maltreatment) was categorized as "Multiple Types."

5.3.3. Education Variables

Standardized Testing

All students in public schools statewide take three standardized exams: Reading, mathematics and science. Reading and mathematics proficiency tests are administered in each grade in third through eighth grade; science tests are administered in third and eighth grade. For analysis, test scores were classified using scoring guidelines based on proficiency categories (i.e., "proficient," "not proficient"). While proficiency is not a requirement for grade advancement, proficiency was advantageous to test scores because proficiency is a more interpretable measure; in addition, cutoffs for proficiency changed between years.

Attendance

Attendance was measured and computed using two variables: average daily membership (ADM; i.e., the proportion of the school year in which the student is enrolled) and average daily attendance (ADA; i.e., the proportion of the school year in which the student is present in class). For students concurrently enrolled in multiple schools, as well as for students who transfer, ADM and ADA are calculated using the number of days or hours at each respective institution. Average attendance throughout the academic year was computed as the ratio of ADA/ADM (i.e., the proportion of all enrolled time at school that the student attended). For the purpose of analysis, attendance was dichotomized to two levels: high attendance (i.e., greater or equal to 0.90) and low attendance (i.e., less than 0.90) following the precedent of policy and because numbers of days varied between districts.[73,109] Dropouts were classified as low attendance.

Mobility

School mobility was computed using three categories: "no transfers," "one transfer," and "two or more transfers." Because students may be concurrently enrolled in multiple schools within the same district or students who skip grades may change schools within the same district, only school transfers between districts were counted. Mobility was verified using administrative codes for the reason for leaving school.

Mobility and attendance in elementary and middle school are both correlates of high school dropout and poorer academic achievement.[109–115] Standardized tests are implemented statewide to compare performance on sets of standards across three areas: math, science, and reading.[74]

Open Enrollment

There are a number of statewide open enrollment program, allowing students to voluntarily move between districts. This was created to provide opportunities for students in disadvantaged urban school districts to attend schools within suburban districts with more resources. Participation in an open enrollment program was included as a categorical covariate.

Disability

Eligibility for a disability (i.e., participation in special education) was categorized as a dichotomous variable based upon whether G2 ever received services for a learning disability.

Free/Reduced Lunch

Eligibility for free/reduced lunch (FRL) was used as a measure of socioeconomic status. Because incomes and hence eligibility change over time, this was categorized as a dichotomous variable, with students who were ever eligible for FRL categorized as having FRL.

Race/Ethnicity

Race and ethnicity were measured with five mutually exclusive categories: "White/Caucasian," "American Indian/Alaska Native," "Black/African American," "Asian/Pacific Islander," and "Hispanic or Latino, any race." Statewide educational data does not include multiracial or other categories.

Sex/Gender

Sex/gender was obtained from education records, and had two categories: male and female.

Dropout

Dropouts from school were classified using status end codes. Only students who dropped out and did not return by the end of the academic year were classified as dropouts.

Homeless Status

Students ever having a status of homeless during the study period were categorized using a dichotomous indicator variable.

5.3.4. Analytic Approach

Only children involved with CPS were included in this study. First, because detection by CPS is correlated with non-maltreatment-related demographic factors, the

population of children involved with CPS may differ from other children in important ways.[29,44] In addition, data on caregiver history of maltreatment was only available for children involved with CPS. For these reasons, we restricted our study by comparing CPS-involved students to other CPS-involved students, aiming to increase internal validity. Data from children without CPS involvement are included in Table 5.2. as a reference to anchor findings within the distribution of these variables in the general population.

Analyses were conducted using generalized linear mixed modeling (GLMM). GLMM accounts for correlation between the outcome of students in the same school and district, allows direct estimation of the amount of correlation, and is more flexible in model specification than other approaches such as generalized estimating equations (GEEs). However, this approach requires making additional statistical assumptions about the distribution of clusters (i.e., school districts). A generalized linear mixed model was fit with random intercepts for the first school attended at the beginning of the academic year. Time was included as a fixed covariate because growth curves or individual-level or group-level trajectories over time were not of specific interest to the research question.

For all outcomes, a non-adjusted model including only caregiver's history of maltreatment and time was fit prior to an adjusted model. For all models, random intercepts were fit for the first attending school district and the student. Test score proficiency and attendance were modeled using multilevel logistic regression, estimating odds ratios. Because there were three levels of mobility, mobility was modeled using a mixed effect ordered logit model.

Statistical models for test proficiency and attendance were adjusted for maltreatment typology, substantiation, FRL, disability, sex/gender, race/ethnicity, OHP, and timing of first maltreatment (prior or during the study period). Models for mobility were adjusted for all of the above variables, as well as homeless status and participation in open enrollment. Results from regression models are presented in Tables 5.3., 5.4., and 5.5. Because estimates for covariates were not central to the research question, only point estimates for parental history of maltreatment and typology of maltreatment are presented in Tables 5.3, 5.4 and 5.5. All analyses and data processing were done using Stata version 14.[85]

5.4. Results

5.4.1. Intergenerational Maltreatment and Race, Poverty, and Disability

The study sample showed substantial demographic variability between children in public schools who had contact with CPS and children who did not. Patterns of maltreatment differed across race and ethnicity (see Table 5.2.). African American and American Indian families had the highest probability of IMT, White and Asian families had the lowest, and Latino families had similar proportions of families with IMT. A comparatively small number of Asian students experienced maltreatment, especially IMT (n = 113 and 63, respectively). Patterns of maltreatment differed between levels of socioeconomic status (i.e., eligibility for free or reduced lunch); low-income families were more frequently represented in both the maltreatment and IMT groups, while families ineligible for FRL were less frequently in contact with CPS (90.37%, 91.44%,

and 37.87% respectively). Children with a disability during the academic year were more frequently represented in both maltreatment and IMT groups (39.07% and 45.87%, respectively); children not receiving disability services were less likely to be in contact with CPS (15.32%).

5.4.2. Test Proficiency

Math Proficiency

Prior to adjustment, on average, maltreated children of parents who reported a history of maltreatment were moderately less likely to be proficient in math (OR = 0.88, $p = 0.09$). However, after adjustment, this association was attenuated (OR = 0.98, $p = 0.68$). Variability was present by maltreatment type, with victims of sexual abuse being the most likely to be proficient (OR = 1.5 vs. neglect; $\chi^2(3)= 17.01$, $p < 0.001$).

Reading Proficiency

On average, prior to adjustment, children of parents with a history of maltreatment were less likely to be proficient in reading (OR = 0.87, $p = 0.028$). After adjustment, this association was attenuated (OR = 0.99, $p = 0.92$). Victims of sexual abuse were more likely than victims of other types of maltreatment to be proficient in reading (OR = 1.29 vs. neglect), but this finding was not statistically significant ($\chi^2 (3) = 12.22$, $p = 0.007$).

Science Proficiency

On average, prior to adjustment, children of parents who experienced maltreatment were 14% less likely to be proficient in science tests, but this difference was not statistically significant (OR = 0.86, p = 0.24). After adjustment, no difference was present between groups (OR = 1.02, p = 0.82). Victims of sexual abuse were more likely to be proficient in science than victims of other types of maltreatment, but this difference was not statistically significant (OR = 1.22 vs. neglect; $\chi^2(3) = 3.73$, $p = 0.29$).

Attendance

Before adjustment, on average, there was no statistical difference in odds of high attendance between maltreated children of maltreated parents and maltreated children of non-maltreated caregivers (OR = 0.92, $p = 0.14$). After adjustment, on average, this association remained approximately the same (OR = 0.92, $p = 0.17$). Variability between types of maltreatment was high; victims of physical abuse and sexual abuse were more likely to have high attendance than victims of neglect (ORs = 1.56 and 1.52, respectively), while students who experienced multiple types of maltreatment were less likely than students who experienced neglect (OR = 0.93; $\chi^2(3) = 37.51$, $p < 0.001$).

Mobility

On average, prior to adjustment, G1's history of maltreatment was associated with mobility (OR = 1.1, $p = 0.013$). However, after adjustment, this association was attenuated (OR = 0.99, $p = 0.88$). Rates of mobility varied substantially by typology of

maltreatment; victims of multiple types of maltreatment had the highest odds on average of transferring between districts (OR = 1.31 vs. neglect; χ^2 (3)= 37.31, $p < 0.001$).

5.5. Discussion

This study of the association between IMT and education found that children involved with CPS had poorer academic achievement than children without CPS involvement, but a history of maltreatment in G1 was not associated with academic achievement in G2. These results suggest that while a child's experience of maltreatment is negatively associated with academic achievement as measured by test proficiency, school mobility and attendance, the cumulative disadvantage of intergenerational maltreatment was not associated with academic achievement. These findings may reflect several possibilities. First, it is possible that any impact of maltreatment in G1 on academic achievement in G2 was muted when compared to the direct experience of maltreatment (i.e., a ceiling effect). Second, this may be evidence of resilience, in particular of children in families with multigenerational history of maltreatment. Further, results suggest that academic achievement varies by type of maltreatment, with variability in which type was associated with higher odds of proficiency between outcomes. This suggests that findings may be more related to typology of maltreatment and other characteristics of maltreatment history.

Our findings are consistent with other studies in that maltreatment is associated with poorer educational outcomes.[7,44,108] The findings are in contrast, however, with other intergenerational studies of associations between impacts of adversity in caregivers'

development and educational outcomes of children.[24,51,52] However, as studies that were inconsistent with our results did not compare the parents' history of maltreatment and academic achievement, this may due to different measures of caregiver disadvantage. In addition, because students in this study population were younger than those in Add Health, in contact with CPS during the study period, and some experienced ongoing maltreatment, differences in results from this study may reflect variability in timing of exposure and follow-up from studies that followed G2 into late adolescence and early adulthood.[24,51]

Similar outcomes prior to adjustment between groups of maltreated children may be due to resilience in children in families experiencing IMT, owing to reasons likely unaccounted for in this data. While both groups of maltreated children were disadvantaged in terms of academic achievement when compared to public school children without CPS contact, they were also more likely to participate in open enrollment programs. This may suggest a potential effort either on part of caregivers, caseworkers, or both, to send disadvantaged students to districts with more resources, though it was beyond the scope of this study to disentangle the impact of open enrollment on other academic outcomes. This may also be a potential explanation for the initial difference in mobility rates between both groups of children who experienced maltreatment.

Finally, differences both in educational outcomes and in rates of IMT between types of maltreatment experienced by G2 present an important competing explanation, which is that other variables related to maltreatment may be more pertinent to academic

achievement. For example, 42% of children in families experiencing IMT experienced multiple types of maltreatment compared to 26% of children whose parents were not maltreated. This pattern was reversed with neglect; 36% of children whose parents were maltreated experienced neglect only when compared to 61% of children whose parents were not maltreated. Some studies suggest that experiencing multiple types of maltreatment is associated with more severe outcomes than experiencing one type of maltreatment.[116] The cumulative disadvantage experienced by families may be reflected in these differences, or in other maltreatment-related indicators of disadvantage that were not available in this data. For example, if children who experienced multiple types of maltreatment had a greater number of total cases, a caregiver asked their history multiple times may have changed their self-report, as prior studies suggest that self-reported history of maltreatment is variable.[63] Because it was beyond the scope of this study to examine these other important dimensions of maltreatment (frequency, timing, duration), further study is needed.

5.5.1. Limitations and Strengths

This study has several limitations. First, data about parents' education was not available. Parental education may be an important confounder of the IMT–education association. Second, while comparing two groups of maltreated children increased internal validity, excluding non-maltreated children prevented studying families in which parents have broken the "cycle of abuse." Third, the statistical model may have had unmeasured confounding, and any correlation between measures of academic achievement was not addressed with this approach. Fourth, the population-level scope of

this study limits our capability to measure individual-level changes. The self-report nature of caregivers' history of maltreatment makes it prone to potential underreporting, which has been documented in studies of self-reported history of maltreatment.[32,31] Finally, the observational nature of this study design prevents causal inference.

Despite these limitations, this study has several important strengths. First, the population-level approach allows these results to be generalizable to specific populations. As child maltreatment garners more attention from medicine and public health, the epidemiologic tools of surveillance and identification of risk factors are necessary. The strengths of public health include surveillance and identification of high-risk populations, but surveillance of child maltreatment is a challenge because we do not know what data to use. This study illustrates the potential for using linked administrative records for public health surveillance and research. In addition, the longitudinal nature of this study and its sample size allow greater confidence that these findings were not a result of inadequate power or secular trends as one might find in a cross-sectional study. This study builds upon prior literature measuring the presence of IMT by examining the association of IMT and academic achievement, a contribution to literature about multigenerational adversity. Last, by including multiple measures of academic achievement and restricting between grades three and eight, this study makes a stronger contribution to the literature about the wellbeing of school-age children experiencing adversity.

5.5.2. Implications

It is important for practitioners in child welfare to recognize that in addition to safety, maltreatment affects multiple dimensions of wellbeing, including academic achievement. Future research might investigate how the child welfare system and other social welfare programs serving maltreated children can mitigate these impacts. Likewise, educators can benefit from understanding that experiences of trauma may underlie reduced educational achievement. Integrating a trauma-aware lens into educational practice and strengthening collaborations between education, child welfare, and public health systems may improve the long-term outcomes of children who experience maltreatment.

5.5.3. Conclusion

Our results suggest that maltreated children with maltreated caregivers appear no more educationally disadvantaged than maltreated children whose parents were not maltreated. This study is the first, to our knowledge, to examine the association between IMT and education in adolescence using administrative records. Strengths of this study include using a statewide sample over fifteen years and rigorous statistical methodology, and study limitations should be considered in the light of providing evidence with direct relevance to practice. These preliminary results provide a foundation to build upon to study IMT and its impacts.

5.6. Tables

Table 5.1. Maltreatment-Related Variables

Variable	G1 Maltreated	G1 Not Maltreated
Maltreatment Type		
Neglect	1118 (35.56)	2344 (60.69)
Physical Abuse	528 (16.79)	396 (10.25)
Sexual Abuse	174 (5.53)	135 (3.5)
Multiple Types	1324 (42.11)	987 (25.56)
Ever in Out of Home Placement	1553 (49.40)	1629 (42.18)
Report Ever Substantiated	2092 (42.18)	2593 (67.14)
First CPS Report Prior to Study Period, AY 2012	2550 (92.63)	2045 (94.46)

Descriptive statistics are presented for maltreatment-related variables included in regression models. Because subjects' status for maltreatment prior to academic year changed throughout the study period, only the results for the first academic year are presented.

Table 5.2. Descriptive Statistics of Education-Related Measures

Variable	G1 Not Maltreated N (%)	G1 Maltreated N (%)	No CPS N(%)
Proficient in Math	1443 (42.06)	1050 (38.52)	277426 (70.05)
Proficient in Reading	1629 (47.49)	1179 (43.03)	258576 (65.43)
Proficient in Science	593 (24.06)	425 (22.40)	121146 (54.60)
High Attendance	3118 (80.74)	2529 (80.44)	383394 (93.70)
Transfers	0.71 (0.65)	0.76 (0.65)	0.35 (0.56)
No Transfers	2552 (66.08)	1938 (61.64)	344435 (81.41)
One Transfer	1742 (45.11)	1500 (47.71)	98232 (23.22)
Two or More	1249 (32.34)	1090 (34.67)	51357 (12.14)
Race			
Non-Hispanic White	1891 (48.96)	1501 (47.74)	307130 (72.59)
Asian/Pacific Islander	113 (2.93)	63 (2.00)	31788 (7.51)
Black/African American	1227 (31.77)	1009 (32.09)	43865 (10.37)
Hispanic/Latino	288 (7.46)	296 (9.41)	34440 (8.14)
American Indian/Alaska Native	446 (11.55)	395 (12.56)	7885 (1.86)
Gender			
Male	1969 (50.98)	1659 (52.77)	216777 (51.24)
Female	1896 (49.09)	1487 (47.30)	206464 (48.80)
Free/Reduced Lunch	3490 (90.37)	2875 (91.44)	160199 (37.87)
Disability Eligible	1509 (39.07)	1442 (45.87)	64830 (15.32)
Homeless	498 (12.89)	516 (16.41)	5849 (1.38)
General Open Enrollment	590 (15.28)	503 (16.00)	41661 (9.85)
Choice is Yours	82 (2.12)	57 (1.81)	1443 (0.34)
Charter School	371 (9.61)	335 (10.66)	26031 (6.15)

Cross tabulations are presented summarizing between-subjects variability throughout the study period. Numbers and percentages add up over 100% when subjects transitioned in statuses between academic years. Because error terms are affected by clustering, chi-squared tests were not used for inference.

Table 5.3. Regression Results, Test Proficiency

	Unadjusted Estimates			Adjusted Estimates		
Variable	**OR**	**SE**	**95% CI**	**OR**	**SE**	**95% CI**
Math Proficiency						
G1 Maltreated	0.88	0.08	0.76, 1.02	0.98	0.05	0.89, 1.08
Maltreatment Type						
Physical Abuse	-	-	-	0.96	1.08	0.83, 1.10
Sexual Abuse	-	-	-	1.50	1.11	1.22, 1.86
Multiple Types	-	-	-	0.98	1.06	0.88, 1.08
Reading Proficiency						
G1 Maltreated	0.87	0.07	0.76, 0.98	1.00	1.05	0.91, 1.09
Maltreatment Type						
Physical Abuse	-	-	-	0.87	1.07	0.76, 1.00
Sexual Abuse	-	-	-	1.29	1.11	1.06, 1.58
Multiple Types	-	-	-	0.99	1.05	0.89, 1.09
Science Proficiency						
G1 Maltreated	0.86	0.13	0.67, 1.11	1.02	1.09	0.86, 1.21
Maltreatment Type						
Physical Abuse	-	-	-	0.88	1.14	0.66, 1.14
Sexual Abuse	-	-	-	1.22	1.21	0.84, 1.77
Multiple Types	-	-	-	0.89	1.10	0.74, 1.08

Mixed logistic regression was computed for math, science, and reading proficiency. An unadjusted model was fit containing only the caregiver's history of maltreatment and school year as a fixed covariate with random intercepts for school and student for math and reading. The unadjusted model for science proficiency did not include school year, as it was not possible for students to take the test multiple times. An adjusted model was fit with the same fixed and random effects, additionally adding fixed covariates for race/ethnicity, gender, out of home placement, maltreatment type, special education status, eligibility for free/reduced lunch, and whether maltreatment began before or during the study period.

Table 5.4. Regression Results, School Mobility

	Unadjusted			Adjusted		
Variable	**OR**	**SE**	**95% CI**	**OR**	**SE**	**95% CI**
School Mobility						
G1 Maltreated	1.10	0.04	1.03, 1.19	0.99	0.04	0.92, 1.08
Maltreatment Type (neglect referent)						
Physical Abuse	-	-	-	1.18	0.08	1.04, 1.34
Sexual Abuse	-	-	-	1.01	0.10	0.83, 1.23
Multiple Types	-	-	-	1.31	0.06	1.20, 1.43

A mixed ordered logistic regression model was fit to estimate the association between intergenerational maltreatment and school mobility. An unadjusted model was fit containing only the caregiver's history of maltreatment and school year as a fixed covariate with random intercepts for school and student. An adjusted model was fit with the same fixed and random effects, additionally adding fixed covariates for race/ethnicity, gender, out of home placement, maltreatment type, special education status, eligibility for free/reduced lunch, homeless status, participation in an open enrollment program, and whether maltreatment began before or during the study period.

Table 5.5. Regression Results, Attendance

	Unadjusted			Adjusted		
Variable	**OR**	**SE**	**95% CI**	**OR**	**SE**	**95% CI**
Attendance						
G1 Maltreated	0.92	0.06	0.82, 1.03	0.92	0.05	0.83, 1.03
Maltreatment Type (neglect referent)						
Physical Abuse	-	-	-	1.56	0.14	1.30, 1.87
Sexual Abuse	-	-	-	1.52	0.22	1.14, 2.03
Multiple Types	-	-	-	0.93	0.06	0.82, 1.05

A mixed logistic regression model was fit to estimate the association between intergenerational maltreatment and attendance. An unadjusted model was fit containing only the caregiver's history of maltreatment and school year as a fixed covariate with random intercepts for school and student. An adjusted model was fit with the same fixed and random effects, additionally adding fixed covariates for race/ethnicity, gender, out of home placement, maltreatment type, special education status, eligibility for free/reduced lunch, and whether maltreatment began before or during the study period.

5.7. Transition to Manuscript 3

Manuscript 2 examined the association between IMT and education, finding evidence that maltreatment is associated with poorer academic achievement, but not finding evidence of any additional disadvantage among maltreated children whose caregivers were also maltreated. Importantly, manuscript 2 found evidence that typology of maltreatment is associated with academic achievement, regardless of parental history. Caregiver self-report from SDM data was selected in part because of feasibility; the number of caregivers of CPS-involved children who had prior records as potential victims since 2000 whose children were old enough to be in third grade through eighth grade in AY 2011 – 2012, 2012 – 2013, or 2013 – 2014 was small enough to present problems with statistical power and presented such a narrow age range that generalizability was problematic.

Two important limitations of manuscript 2 were rooted in the use of caregivers' self-report as a measure for maltreatment of G1. First, using different definitions of maltreatment for generations is associated with potential bias and less rigorous than consistent measures.[12,20,28] Second, the accuracy of the self-report data collected in SDM is not known. Prior studies of the accuracy and validity of self-reported history of maltreatment suggest that its reliability is suspect, but the accuracy of self-report in the context of a risk assessment tool used for practice is unprecedented. Manuscript 3 examines the accuracy of this data, tests for predictors of misclassification, and identifies

important needs for future studies and the possibility of using epidemiologic methods such as bias analysis to better understand the implications.

6. Manuscript 3: Accuracy of a Single-Item Measure of Child Maltreatment: Implications for Practice

6.1. Abstract

Background: Child maltreatment is a serious social and population health problem in the United States, with an estimated incidence proportion of 9.2 victims per 1,000 children. Prior research identifies experiencing maltreatment as a risk factor for perpetrating maltreatment, but results from prior studies vary, in part depending on how maltreatment is defined. Self-reported history of maltreatment is suspect to be subjected to recall, social desirability, and other forms of bias, and the accuracy of self-report data collected in the context of CPS involvement is rare. Using a sample of 253 perpetrators with prior CPS records, accuracy of self-report collected during CPS response was tested.

Methods: CPS records from 2000 through 2014 were used for this analysis. Self-reported history was defined with an item from a risk assessment used during CPS response. Perpetrators with prior history in households where neither caregiver reported abuse were categorized as having potential misclassification. Variability in frequency of underreporting was tested by the offender's prior substantiation of case as victim, out of home placement as victim, type of maltreatment experienced, age, gender, and relationship to victim.

Results: One hundred thirty eight (54.55%) caregivers with prior contact reported never experiencing abuse. This was a much smaller percentage than non-prior contact offenders. Proportions with misclassification differed by offender's gender, age, relationship to the victim, and prior experience of out of home placement. Substantiation and type of maltreatment experienced were not associated with misclassification.

Discussion: A substantial proportion of offenders with prior CPS contact reported not having experienced maltreatment. This was a higher proportion than prior studies using self-report collected during the research study. Typology of maltreatment experienced was orthogonal to underreporting. These results are limited by the relatively small sample size and the potential for informative missingness of self-report data. Future studies can examine caregiver-specific self-reports and the interpretation of items, and compare multiple measures of self-report to prior CPS contact. These results should be viewed as preliminary and descriptive, but, in this sample, suggest that offenders' self-report during CPS response is often inconsistent with official reports.

6.2. Background

Child maltreatment is a major social and public health problem in the United States. Nationally, 3.4 million children were the subject of at least one report of child maltreatment in 2015 in the United States.[117] Apart from its initial impacts, child maltreatment is associated with adverse outcomes on cognition, development, academic achievement, health, and health behaviors in later life.[4,44,108,118] Because of its frequency, burden, and sequelae, there are strong arguments for incorporating a public health approach into responding to child maltreatment.[10] A public health approach to addressing maltreatment focuses upon identification of risk factors to develop interventions and allocate resources toward those groups most vulnerable.[10] Causes of maltreatment are unknown, but several risk factors have been consistently identified in the literature. Some consistently identified risk factors for perpetrating maltreatment include younger caregiver age, attitudes toward discipline, intimate partner violence, and substance use.[12]

Another widely cited risk factor for perpetrating maltreatment is a caregiver having a history of maltreatment, also called intergenerational transmission of child maltreatment (IMT). IMT posits that experiencing maltreatment begets perpetrating maltreatment.[20] Prior research suggests that while caregivers who have experienced maltreatment are more likely to perpetrate maltreatment than caregivers who have not, the majority of caregivers who have experienced maltreatment do not perpetrate it in adulthood.[12,36]

Informed by this evidence base, a caregiver's history of maltreatment is considered a risk factor when assessing the risk of future maltreatment during child

protection response. In Minnesota's child protective services (CPS) system, caregivers (i.e., parents and other guardians of children) are asked their history of maltreatment during the response. This self-reported history of maltreatment is considered among several other risk factors for potential future physical maltreatment.[12,67] Although the reliability and validity of the entire instrument have been studied, the accuracy of this specific item has not.[72] As a caregiver who is an alleged perpetrator is asked their history of maltreatment during a stressful life event by a person who they may perceive to have unlimited power,[119] it is reasonable to suspect that they may underreport their history of maltreatment. The accuracy of self-report collected during the context of CPS involvement is understudied and a contribution to the existing literature on accuracy of self-reported history of maltreatment.[120]

Two prior studies of accuracy of recall among adults who experienced substantiated (i.e., confirmed by court) maltreatment found that subjects underreported their history of physical abuse and sexual abuse by approximately 40 percent.[32,31] In comparing self-reports of 938 subjects in a longitudinal survey, subjects were asked about their history of prior physical abuse and sexual abuse at ages eighteen and twenty-one.[63] Researchers found that among those at age 18 who had reported a history of physical or sexual abuse, approximately 50% responded differently at age 21 regarding both physical abuse and sexual abuse. A systematic review of studies of the validity of self-report compared to official records found consistent underreporting, but none of these retrospective reports were collected using official data.[121] Recent studies have also

compared survey data about household income with consumption data about receipt of social services and found evidence of underreporting.[122]

Misclassification of self-reported maltreatment history in CPS cases has implications both for child protection practice and for research that uses CPS data to measure child maltreatment. A number of studies rely on self-report for measurement of maltreatment. As researchers of the topic of IMT use administrative records as a data source, understanding the accuracy of self-report administrative data can assess the viability of this data for research purposes, especially at a population level.[12,35] Measurement error also has direct implications for practice as well; inaccurate data from assessments could lead to biased decision making and erroneous conclusions. For a number of ethical and logistical reasons, child maltreatment cannot be measured objectively (i.e., with a gold standard as exists with laboratory tests). Random measurement error may attenuate regression estimates via regression dilution; measurement error due to underreporting in this context could be systematic and lead to incorrect inferences.[123] It is plausible, though, that measurement error is also non-random, which requires more complex analysis to assess its impact. The first step toward this understanding is assessing the amount, direction, and predictors of measurement error.

Using data from cases in which the perpetrator had prior contact with CPS as a potential victim, this study will examine the accuracy of self-report. This study has the following objectives: 1) Quantify the amount and direction of misclassification of self-reported history of child maltreatment; 2) Test if misclassification is differential with

respect to maltreatment-related risk factors; 3) Test if misclassification is differential across types of maltreatment; and 4) Identify whether any demographic groups are more or less likely to underreport. These objectives will address the following research question: What is the accuracy of adult recall of child maltreatment in the context of a CPS case?

6.3. Methods

6.3.1. Data Sources

Data was taken from the Minnesota Department of Human Services from January 1, 2000, through August 31, 2014. Data sources included CPS records, records from out of home placement (OHP), and data from the risk assessment from the Structured Decision Making (SDM) tool used in CPS response.[67] CPS and OHP data were linked using the ID for the offender. CPS and SDM data were linked using the work group ID for the case. Duplicate records were reduced to summary cases with substantiation and out of home placement categorized as "ever" for any report indicating yes.

6.3.2. Inclusion Criteria

Subjects were included who had self-report data in SDM and records in CPS. Initial analysis compared those with prior contact to those without prior contact for context, but analyses of potential predictive variables were restricted to offenders with prior CPS contact. Offenders thirteen years of age or more at the time of most recent report were included, and the following relationship codes to victim were included:

"Biological parent," "Adoptive parent," "Stepparent," "Unmarried partner of parent," "Legal guardian," "Relative foster parent," "Other relative (non-foster)," and "Sibling."

6.3.3. Availability of Data

There was substantial variability in the data structure based upon prior contact. The vast majority of caregivers with data on self-reported history of maltreatment did not have prior contact (n = 8,400, 94.96%). Of 3,606 caregivers who had had prior contact, 253 had records on self-reported history of maltreatment (14.26%).

6.3.4. Variables

Prior Maltreatment of Perpetrators

Data collected by CPS measure whether either caregiver (in situations where there are multiple caregivers) was abused with the wording "either caregiver was abused as a child." Because this answer is not linked to a specific caregiver, it is not possible to determine to which caregiver "yes" responses correspond.[67]

Involvement in Accepted CPS Report:

Involvement in an accepted CPS report (i.e., a report which received a response after screening) was used to define maltreatment. Prior contact was defined by linking records based on ID numbers in reports (i.e., where offender ID in a later report matches victim ID in earlier report).

Substantiation of CPS Report:

Substantiation is the end result in which a case is decided to either be confirmed (i.e., substantiated) maltreatment or not. Not all reports have potential for substantiation; in Minnesota, many cases go through an alternative response called Family Assessment that does not result in substantiation.[62] Response tracks are assigned during initial screening based upon the severity of the case (e.g., immediate potential physical harm and reports of sexual abuse escalate to Family Investigation immediately). Substantiation was defined as a dichotomous variable, "substantiated case" and "non-substantiated case or alternative response." For subjects with multiple records, ever being in a case resulting in substantiation was categorized as substantiation.

Out of Home Placement

Out of home placement (OHP) was measured by having a record of an out of home placement during prior cases where they were listed as victims. For subjects with multiple reports, any out of home placement was classified as "ever OHP".

Maltreatment Type

Maltreatment was measured using the following four mutually exclusive categories: "Physical Abuse," "Sexual Abuse," "Neglect," and "Multiple Types of Maltreatment." Cases of medical neglect and mental injury were categorized as neglect due to small numbers and their similar etiology.

Age

Age was measured by calculating the difference between date of birth and two dates: the end date for the most recent child protection report and at the end of the calendar year for the study period (i.e., December 31, 2014). For analysis, age at the end of the most recent report was categorized into a dichotomous variable: "13 to 24" and "25 and over."

Gender

Sex/gender was available in CPS data and had two categories: male and female.

Relationship To Victim

Relationship codes from CPS reports were categorized into a dichotomous variable with the following categories: "Parents, caregivers and other guardians" and "other relatives". The following relationship codes were classified as "Parents, caregivers and other guardians": "Biological parent," "Adoptive parent," "Stepparent," "Unmarried partner of parent," and "Legal guardian." The following codes were classified as "other relatives": "Relative foster parent," "Other relative (non-foster)," and "Sibling."

Misclassification

Because the item "either caregiver was abused as a child" was a household-level variable, records did not indicate to which caregiver a response of "yes" applied. However, in cases where a perpetrator had a prior history of CPS involvement and

neither caregiver reported a history of abuse, this was defined as misclassification or underreporting.

6.3.5. Analysis

Accuracy of self-report was defined using the proportion of caregivers who had prior contact and self-reported "no" during CPS response. In addition, the proportion of people with self-report data who did not have prior contact and proportions of people with prior CPS contact who were missing self-report data were calculated. After these contextual analyses, the proportion of misclassified reports was compared between the following set of variables: substantiation of record, out of home placement, maltreatment type experienced, gender and age. Differences between groups were tested using a chi-squared test (see Table 6.3). Statistical significance was determined where $p < 0.05$. All data management and analyses were conducted using Stata 14.[85]

6.4. Results

6.4.1. Differential Misclassification

Results from comparisons by characteristics are presented in Table 6.2. Of the caregivers with prior contact 54.55% (n = 138) reported they had not been abused. This was different from the group without prior contact, of whom 73.43% (n = 8,147) reported no prior abuse ($\chi^{2}_{1} = 44.23$, $p < 0.01$). There was little difference between levels of substantiation ($\chi^{2}_{1} = 1.00$, $p = 0.32$). Underreporting in self-report varied, however, by

OHP; offenders who experienced OHP more likely to self-report yes ($\chi^{2,}{}_1 = 10.64$, $p < 0.01$). Differences by maltreatment type were small ($\chi^{2,}{}_3 = 2.42$, $p = 0.49$).

Younger people were less likely to underreport, with 58.74% (n = 121) of offenders aged 13 – 24 reporting no and 38.17% (n = 17) of caregivers 25 and over reporting no ($\chi^2 = 7.86$, $p < 0.01$). Females were less likely than males to underreport; 44.9% of females (n = 66) and 67.92% of males (n = 72) reported a history of abuse. Last, relationship type was associated with underreporting; 46.11% (n = 77) of offenders with a parent or guardian relationship reported no history of abuse, compared to 70.93% (n = 61) of those with other family relationships reporting no history of abuse ($\chi^{2,}{}_1 = 14.11$, $p < 0.001$). The stability of reports was comparable between those with and without prior contact. Only 3.08% of those without prior contact and 2.73% of those with prior contact had changes in self-report through multiple cases ($\chi^{2,}{}_1 = 0.16$, $p = 0.69$).

6.5. Discussion

This study found substantial differences in self-reported history of maltreatment between parents with prior CPS contact and parents without prior CPS contact. This suggests that many alleged perpetrators may have a history of experiencing maltreatment. This also indicates that the majority of perpetrators do not have prior contact with CPS. In addition, more than half of offenders with prior CPS contact reported they did not have history of maltreatment. This proportion varied by perpetrator's age, gender, relationship to victim and history of OHP, but not by the substantiation of the case. Importantly, though the self-report item is worded around physical abuse and is used to predict risk of

future physical abuse, maltreatment type experienced was not associated with accuracy of self-report.

There are a number of potential reasons more caregivers with prior contact would report having experienced maltreatment than those without prior CPS contact. First, maltreatment that receives a response from CPS is known to be the "tip of the iceberg" of all maltreatment.[8] Detecting and responding to all cases of maltreatment would require a massive input of resources and personnel, a surveillance effort that may be bolstered by a public health approach. These results also may indicate the limitations of current infrastructure to detect cases.

It is important to consider the possibility of overreporting as well; although this analysis focused on underreporting, it is possible to have measurement bias in the other direction. Only a small number of offenders changed their response over time from replying "no" to "yes" to this question, also suggesting that overreporting is unlikely. This is consistent with a prior review of similar studies which suggested that the probability of false positives (i.e., overreporting) of maltreatment history is low.[121]

Another potential source of measurement bias may be in how this item was worded. The proportion of offenders with prior contact who did not report a history of maltreatment may reflect how the item was worded. This is an important consideration, as offenders with a history of experiencing physical abuse were no more likely than others to report yes. Because the item asks if either caregiver was "abused" as a child, this may be interpreted in several ways. "Abused" may be interpreted synonymously with any maltreatment, it may be interpreted strictly as it pertains to sexual or physical abuse,

and it may be interpreted more broadly to include harsh parenting and other experiences that may have been *experienced* as abuse by the person and not *detected* as abuse by CPS.[121] How the question is asked and assessed is suggested in a procedural manual, but data on the fidelity to which this instrument is adhered to in practice is unknown. Further study both on fidelity and how this item is interpreted can advance understanding. Differences in gender, with more males than females underreporting is consistent with prior studies on this subject.[121] Last, the finding that more young people underreported may be due to temporal proximity of maltreatment to CPS response, but also may be associated with memory. A number of psychological factors (e.g., false and recovered memories) unmeasured in this data may play a complex role and should be examined.[121]

6.5.1. Limitations and Strengths

The proportion of subjects with missing records is important to note here. The SDM instrument was deployed statewide midway through the CPS data coverage period, and while data were available for all years in some counties, a high number of offenders with prior CPS contact who did not have self-report data in SDM. It is with this in mind that we strongly recommend interpreting these results as preliminary and descriptive. The number of cases must also be viewed with the potential for information bias. Studies of the management of this data, which is not reported nationally, may guide understanding the scope of bias. For example, if low-risk cases are purged routinely, available cases in this analysis would be more severe and potentially induce selection bias. Additionally, the age of subjects may play a role; subjects with SDM data who did not have CPS data may have been in an age range which would not have allowed for prior contact with CPS

as a potential victim. Perpetrators' age in SDM is listed as "under 30" and "30 and over" and was not available for all subjects; this variable would not have provided sufficient detail to assess this possibility.

Another substantial limitation is that the self-report data is not offender-specific, meaning that while it was possible to classify a "no" where there was prior CPS contact as potential misclassification, it was not possible to discern which caregiver a "yes" applied to in households and reports with multiple offenders. This may have influenced some of the results. A number of other potentially important variables were missing, including marital status, history of interpersonal violence, race/ethnicity, socioeconomic status, and social support. Last, the standard to which self-report was compared to, official CPS reports, has systematic bias related to which cases are detected and receive a response,[29,61] and thus identification of a "gold standard" for this type of research is not straightforward.

These limitations must be viewed in the context of the strengths of this study. These strengths include the applicability of these findings to practice, as this study used an instrument from practice. In addition, the study identified several potential correlates of underreporting. In addition, this study is a strong contribution in using administrative records to answer this research question.

6.5.2. Recommendations for Practice and Future Research

As child maltreatment gains recognition and attention as a population health issue, administrative records offer a potential tool for advancing surveillance and risk factor identification.[10] Studies of IMT can benefit from the availability of administrative records

to describe multiple generations. It is important to know, however, how accurate administrative records are. Inaccurate data can induce both worker bias and spurious research conclusions, particularly of studies using administrative records.[36] As this study identified potential non-random error in classification, studies of the amount and impact of measurement bias are necessary.

This self-report item is not used in practice as a deciding factor, but is considered and scored among others, suggesting that any misclassification is likely limited in its impact on practice. Future practice-based studies can benefit from understanding the specificity of wording of this question about caregivers' history, potentially by conducting interviews and testing different items, and testing of potential caregiver-specific items on history of maltreatment can potentially offer a more accurate history during risk assessments such as this one. Educating workers on the available information on IMT can help lead to more effective decisions in practice, especially when self-report items about maltreatment history like the one examined in this study are used in reports.

6.5.3. Conclusions

Overall, more than half of offenders with a history of CPS involvement did not report experiencing abuse. Underreporting to this item did not differ between types of maltreatment experienced during childhood, and self-reports were generally stable when offenders were involved in multiple records. This suggests that this risk assessment question may lead to inaccurate conclusions when used for research studies, and, consistent with how it is currently used, should not be used in isolation to determine risk of perpetrating maltreatment. Toward a population health approach, asking

intergenerational questions may be useful in some other surveys to build upon this history. This small preliminary study, however, is not conclusive and should be repeated with more years of records. To best understand the accuracy of this question, more data is needed, and self-reported history of maltreatment must be considered in context with other types of interpersonal violence and how they may affect development. In the end, we must collect better data to have better answers to research questions.

6.6. Tables

Table 6.1. Demographics of Prior Contact Caregivers with Self-Report History

Variable	Number	Percent
Gender		
Male	106	41.90
Female	147	58.10
Age During Most Recent Case		
13 - 24	206	81.42
25 and over	47	18.58
Ever in Substantiated Case		
Yes	170	67.19
No	83	32.81
Ever in OHP		
Yes	148	58.50
No	105	41.50
Maltreatment Experienced		
Neglect Only	114	45.24
Physical Abuse Only	52	20.63
Sexual Abuse Only	25	9.92
Multiple Types of Maltreatment	61	24.21
Relationship to Victim		
Parent, Caregiver or Guardian	167	66.07
Other Family Member	86	33.99

Table 6.2. Self-Reported History of Abuse by Prior CPS Contact

Variable	Report Yes N (%)	Report No N (%)	Total
Prior contact	115 (45.45)	138 (54.55)	253
No Prior Contact	2,165 (26.57)	5,982 (73.43)	8,147
Total	2,280 (27.14)	6,120 (72.86)	8,400

Table 6.3. Self-Reported History of Abuse Among Offenders with Prior Contact

Variable	Report Yes N (%)	Report No (N %)
Gender* **		
Male	34 (32.08)	72 (67.92)
Female	81 (55.10)	66 (44.90)
Age During Most Recent Case* **		
13 - 24	85 (41.26)	121 (58.74)
25 and over	30 (63.83)	17 (36.17)
Ever in Substantiated Case		
Yes	81 (47.65)	89 (52.35)
No	34 (40.96)	49 (59.04)
Ever in OHP **		
Yes	80 (54.05)	68 (45.95)
No	35 (33.33)	70 (66.67)
Maltreatment Experienced		
Neglect Only	47 (41.23)	67 (58.77)
Physical Abuse Only	28 (53.85)	24 (46.15)
Sexual Abuse Only	11 (44.00)	14 (56.00)
Multiple Types of Maltreatment	29 (47.54)	32 (52.46)
Relationship to Victim* **		
Parent, Caregiver or Guardian	90 (53.89)	77 (46.11)
Other Family Member	25 (29.07)	61 (70.93)

Self-reported history of prior abuse was compared by a set of maltreatment-related and demographic variables among offenders who had prior contact with CPS as victims earlier in life. When offenders were involved in any report indicating that "either caregiver experienced abuse," this was classified as a self-report yes, and when offenders were never involved in reports indicating that "either caregiver experienced abuse," this was categorized as self-report no, and considered misclassification when compared to records. Differences in misclassification were tested using Pearson chi-squared tests, and statistical significance was indicated with the following: * where $p < 0.05$, ** where $p < 0.01$, and *** where $p < 0.001$.

7. Conclusions

7.1. Summary of Findings

This study sought to apply a population health perspective to better understand the issue of intergenerational child maltreatment in Minnesota. Using fifteen years of linked administrative records from child protection and public schools, this study aimed to: 1) estimate the incidence of IMT; 2) estimate the cumulative impact of intergenerational child maltreatment on academic achievement in late childhood and; 3) estimate the accuracy of self-report of offenders' history of maltreatment among potential offenders who have official records of prior CPS contact as a potential victim. This dissertation contributes to the existing literature by examining IMT as a population health issue, evaluating the impact of IMT on other dimensions of wellbeing in late childhood, when prior studies have usually focused on one generation and later in life, and in assessing the accuracy of a measure used in child protection practice.

The first manuscript found that of a cohort of people who experienced maltreatment, only 11.26% appeared in adulthood as offenders. Additionally, differences were found in transmission probabilities between males and females, between the types of maltreatment experienced in childhood, by substantiation and OHP and by race/ethnicity. Importantly, however, there was no evidence of type-specific continuity of maltreatment.

The second manuscript found that among CPS-involved third through eighth graders, a parent or caregiver's history of maltreatment was not associated with any measure of academic achievement (i.e., test proficiency, school mobility, or school

attendance). Academic achievement, however, varied by types of maltreatment experienced by children, regardless of parent's history.

The third manuscript found that a higher proportion of perpetrators with prior CPS contact as victims reported a history of maltreatment than those without prior CPS contact. However, among perpetrators with prior CPS contact, more than half reported not being abused, suggesting potential misclassification. This misclassification did not differ by type of maltreatment experienced or substantiation, but did vary based on OHP, gender, age, and relationship of alleged offender to victim.

Together, these findings suggest several cohesive interpretations. First, based upon the low transmission probabilities of IMT in the first manuscript (even among those groups with the highest transmission probabilities) and the lack of evidence of cumulative disadvantage as measured by academic achievement in the second aim, there is strong evidence of general resilience among the population of those who experienced maltreatment in Minnesota. The combined findings of these manuscripts also show the utility of data linkage projects such as Minn-LInK for an epidemiologic approach to responding to child maltreatment as a population health issue and changing the trajectories of disadvantaged children. That said, the strong limitations of each manuscript highlight the need for more comprehensive data, more detailed data in administrative records, and the gap between existing data and what would be necessary to conduct better research. Additional contextual data is needed to truly understand IMT from a population health perspective.

7.2. Broader Implications of Each Manuscript

7.2.1. Manuscript 1

In its core, this manuscript suggests that the majority of those who experience maltreatment do not perpetrate it. Eleven percent of the cohort who experienced maltreatment in childhood appeared in Minnesota CPS as offenders. For reference, the range of transmission rates and probabilities in prior studies with similar designs ranges between 4.99% and 21.4%.[12] This manuscript identified several maltreatment-related risk factors: polyvictimization, experiencing OHP, and having a case substantiated in childhood. While demographic differences were identified, these may have more to do with differences in likelihood of CPS contact, rather than higher propensities for maltreatment, all of which will be discussed.

Findings about substantiation may not be relevant or replicable today, given the changes in CPS response since the beginning of the study period. The implementation of multiple response in Minnesota has changed the rate of substantiation.[37,38] Because only reports of sexual abuse and others that pose immediate danger to the child at the time of screening are referred for a FI, results may not be replicable if present day were used a baseline. Prior substantiation, while still likely to indicate severity of a case, may not be as applicable as a risk factor. Figure 3.2 highlights the trends in alternative response since its statewide implementation.[62]

The finding that experiencing multiple types of maltreatment was associated with both higher probabilities of IMT and poorer academic achievement has several potential explanations. Polyvictimization indicates cumulative adversity; this is consistent with

prior findings that experiencing multiple ACEs is associated with higher risks of negative health outcomes in adulthood, as well as literature that documents associations between polyvictimization and adverse associations on mental health and substance use.[116,124] To advance our understanding of this finding, larger samples can test for interactions between types of maltreatment, the total number of types of maltreatment experienced (similar to the ACE score), and other measures of adversity. Other such measures from CPS data could include the total number of cases, number of OHPs, and the proportion of cases that end with out-of-home placements. Accurately assessing such measures, however, would require following a cohort from birth, rather than counting person-time beginning from first CPS involvement, as was done in this study.

Findings about demographic differences raised more questions than answers. The disparity in transmission probabilities between males and females was large, but the mechanism for this disparity is unknown. Explanatory data was unavailable in this study, as SDM was implemented statewide in 2005, midway through the study period, and was thus unavailable for many subjects. There are a number of potential reasons why in this young group of parents (aged 25 through 34 at end of study period), females would end up in contact with CPS more frequently than males.

Many people in this source population are likely to be unmarried, as surveys of the general population have indicated that the majority of adults aged 25 to 34 are unmarried.[93] Minnesota law assigns full custody of children of unmarried co-parents to mothers by default unless co-parents make an alternate arrangement.[92] It is entirely possible that other mechanisms, such as continued contact with systems whose staff are

mandated reporters (e.g., public schools), made these females more likely to be detected by CPS. As prior studies of IMT have identified surveillance bias in CPS response, it merits consideration as a potential explanation for this finding.[29]

More research is needed to contextualize these findings. Linkage with data from vital statistics would be an important piece to add more information. As public health emphasizes surveillance, accuracy and interpretation of the denominator for the population are important considerations. This manuscript defined people involved with CPS as a denominator, which may not be an ideal denominator for inference to the general population of parents who have experienced maltreatment. By linking CPS records to data from vital statistics, a more accurate population level of surveillance could be obtained. This approach would make the denominator more accurate and allow a more accurate estimate of IMT transmission frequency. Additional years of CPS data would allow a study design that follows a cohort through the life course into later adulthood. It is likely that data from more than two systems would need to be linked, however, for this approach. Court records would be needed to identify the marital status of caregivers, as well as whether parents are incarcerated. Such a linkage project would require an intensive investment of time and finances, as well as inter-agency collaboration, but could advance the study to be a more accurate system for surveillance in this population health approach.[10] Additional data collection may be necessary outside of these systems for unmeasured variables, as well as incorporating multiple methods of measuring maltreatment (e.g., using codes from medial records) may be necessary; relying upon CPS data alone could induce selection bias.

7.2.2. Manuscript 2

The second manuscript identified evidence of resilience among families involved with CPS. Although both groups of children who experienced maltreatment fared poorer academically than their non-CPS-involved counterparts, that a caregiver's history of abuse was unrelated to their child's academic achievement shows potential resilience. A prior study using CPS contact to define maltreatment for both generations showed mixed results for test proficiency in one academic year, with a caregiver's history being associated with poorer math proficiency, but not with poorer reading proficiency.[125]

This paper's findings should be interpreted in view of its limitations. Child maltreatment does not occur in a vacuum and among third through eighth graders, any impacts of maltreatment are likely influenced by other forms of adversity, such as bullying, witnessing intimate partner violence, and forms of family disadvantage. The data from this manuscript does not include these variables, and incorporating these variables would allow understanding these mechanisms. Importantly, this manuscript, by design, excluded an important group in understanding intergenerational adversity: caregivers who have experienced maltreatment and do not perpetrate maltreatment (i.e., cycle interrupters). As with manuscript 1, additional data sources are needed to more fully answer the research question.

Because selection presented such an important limitation, it merits consideration whether other data sources could be used to answer this research question. For example, because the relationship between generations was established by their both having contact with CPS, finding a way to link the administrative records of caregivers who had

contact with CPS and their children who did not would advance this area of research. Other potential data sources include vital statistics, BRFSS data on ACEs, and collecting supplemental data to use in conjunction with administrative records. Expanding the exposure to include more types of adversity than maltreatment is also worth considering. Understanding the intergenerational association between maltreatment and other outcomes is a large undertaking, and ideally, the same variables would be collected for both generations.[20,27,28] The findings from manuscript 2 should be viewed in the context of findings of manuscript 3, which identified that more than half of offenders with prior CPS contact as victims did not report experiencing abuse. It is, then, suspect, how accurate the self-report data used in this study is.

This study did not incorporate information about caregivers' history of education. Including that information with these administrative records would have restricted the sample to a younger group of caregivers (i.e., those who were in Minnesota public schools between 2000 and 2014). It is possible that a mixture of administrative records and survey data from a sample would provide more generalizable results. Nevertheless, as the first study to examine the intergenerational association between maltreatment and education, this manuscript is a contribution that sets the stage for more rigorous future studies.

7.2.3. Manuscript 3

Manuscript 3 identified large gaps in accuracy of caregivers' self-reported history of maltreatment, as well as limitations in data coverage that may induce bias. Many perpetrators with a prior history of victimization that received CPS response did not have

self-report data. Among those who did, more than half did not report a prior history of abuse. While a competing explanation, because this item is focused on physical abuse, is that not all maltreatment is abuse, the type of maltreatment experienced was not associated with reporting yes or no to this question. It is also important to note that this item is not a true self-report; it is collected by caseworkers, and while the manual recommends it as self-report, fidelity in its use is unexamined. Prior reports indicate variability between counties in SDM implementation.[126]

The statewide implementation of SDM in 2005, midway through the study period, also limits the amount of data available, and routine purging of low-risk cases may also affect the results of this study.[127] The limitation of a household-level indicator being used to answer an individual-level question is important, and while in cases where all offenders reported a "no" can be interpreted with confidence, a "yes" does not specify which offender is referred to in households with multiple caregivers. Further investigation is needed, although it is important to consider that this item was written for the purposes of risk assessment. Its validity as a single indicator, however, is suspect. Further study is needed, but it is likely that this item is not suitable for use in research studies.

The intended analysis for the third manuscript was a bias analysis to examine the potential impact of misclassification on analyses that use this item from SDM data. Such a bias analysis would involve measuring changes in associations within a range of observed misclassifications to quantify the impact of systematic error.[128,129] An alternative approach would have been to use inverse probability weighting to compute the

likelihood of underreporting based on observed characteristics and simulating results after accounting for propensity to underreport based upon observed characteristics (i.e., gender, maltreatment typology, substantiation, OHP, age, and relationship to victim). After examining data quality and availability, none of these approaches were suitable for this study.

The first approach, probabilistic bias analysis, uses observed data to then simulate ranges of bias on the entire population. With 97% of subjects with SDM data not having had prior CPS contact as of January 1, 2001, and 87% of subjects with prior contact not having SDM data, the groups without data far outnumbered the groups with data. While simulation studies that use randomly generated data can be informative, the approach of quantitative bias analysis uses observed data to inform the simulation. With the balance of observed and unobserved subjects in this range (i.e., such that the number of subjects without data greatly outnumbered those with data), any results would have reflected the assumptions made, and not the impact of assumptions on observed data. As Lash (2009) writes, "Quantitative bias analysis is therefore most valuable when studies yield narrow conventional confidence intervals – so have little residual random error – and when these studies are susceptible to a limited number of systematic errors."[129] Because there were a number of potential systematic errors (i.e., delayed statewide implementation, routine purging of low-risk records, county by county variability in fidelity), quantitative bias analysis would not have been a valuable approach. Inverse probability weighting would not necessarily have been a problematic approach, even with 87% of data missing, as the impact of missing data has more to do with the mechanism of missingness rather than the

amount of missingness.[130,131] If this data were missing completely at random (MCAR; i.e., missing due to no systematic mechanism), imputation could have been appropriate. If it were reasonable to assume this data were missing at random (MAR; i.e., missing is due to a mechanism measured by observed data), then these approaches may have been appropriate.[131]

However, it is likely that these data were missing not at random (MNAR; i.e., systematically missing due to variables that cannot be accounted for). Distinguishing between records that did not have data due to SDM's delayed implementation, records that did not have data because of routine purging (i.e., being lower risk), records that did not have data because of random clerical errors or server errors, and cases that did not have data because of other unknown mechanisms was not possible with the data available in this dataset. For these reasons, conducting a bias analysis or form of imputation, though high in potential for advancing the field and practice, was inappropriate. Simply put, sometimes conducting a simpler analysis is more scientifically justified within the constraints of available data.

A final problem is that for the third manuscript to be a true validation study, a gold standard for comparison is necessary. While an inarguably important data source, CPS data is not inherently flawless in measuring population-level maltreatment. The cases detected by CPS are the most obvious and among people in more frequent contact with public systems, representing the "tip of the iceberg," as stated in the National Incidence Study.[8] Results from manuscript 3 are best interpreted as preliminary results from a pilot study, and follow up of further years without purging of data would be

necessary to truly understand the amount, direction, and impact of underreporting in this context. Supplemental studies, such as conducting interviews to understand the interpretation of this question, piloting of alternate wording, studying the fidelity in using the SDM,[132] and key informant interviews of child protection workers would advance this area of research. In the end, however, the needs of research may not be met by this data collected for its purposes in practice, and an entirely alternative approach may be the superior choice.

7.3. Cross-Systems Research as a Population-Level Surveillance Tool

Administrative records have the potential to address IMT as a public health issue. Administrative records contain information on entire populations of people who access services, use systems, and participate in activities.[53,133,134] Linkage between systems has the potential, then, to answer complex research questions at a population level, as was demonstrated by this project and similar others.[7,10,35,44] Projects such as Minn-LInK, the data source for this dissertation, rely on matching children based upon names and birthdates between systems (e.g., connecting DHS and MDE data) and potentially using identification variables within systems (e.g., linking CPS data to OHP data). Rather than a true population-level denominator, the approach in this dissertation identified a population that had contact with the systems from which data is drawn.

However, there is no universal ID available in Minnesota to link records across all systems and the process of creating data sharing agreements and cost of conducting this linkage are both barriers to progress. In addition, timing in which records are stored is a barrier, as not all records have been kept systematically from the same time periods.

Statewide data became available for both MARSS and CPS in 2000; fifteen years is a narrow window with which to study multiple generations. Another important aspect of timing is the timing in which subjects have first contact with the systems; a cohort of study of child maltreatment would ideally collect data from birth, rather than first CPS contact. Incorporating data from vital statistics would allow surveillance from birth, for example.[10] Linking records between more than two agencies with the methodology used for this dissertation, however, would require substantial resources; this would mean matching names and birth dates between multiple generations from several agencies. In addition, as inclusion requires contact with a social service system, the study population becomes more and more specific with a greater number of systems, and generalizability of results to the general population thus becomes limited.

The level in which data is kept and organized is an important limitation to work, as well. While records in this dissertation were analyzed at the state level, they are first collected within school districts or counties, and then submitted to the state level for entry and aggregation.[38,73] Thus, using data from multiple agencies also becomes limited by the level at which it is organized. National studies and reports of maltreatment often rely upon the National Child Abuse and Neglect Data System, which is a voluntary data collection system from participating states, the District of Columbia, and Puerto Rico.[2,56] Such agreements with multiple states are uncommon and require data sharing policy; interstate sharing of records from schools and CPS often are restricted to use in practice.[73,135] National studies are possible and in the U.S. can highlight important differences in policies between states, as well as identify people who migrate between

states. Countries such as Denmark, which have a universal ID and registry system, have demonstrated the potential of registries and data sharing between multiple agencies to advance research.[58]

In addition to restricting the study population, using administrative records limits the scope of scientific questions. As administrative records are not entered with the intention of being used for research purposes, constructing analytic variables requires an investment of time and creativity on the part of the researcher. Advancing research using administrative data will require inter-agency collaboration, understanding which variables are in which datasets, and tracking changing definitions of variables over time. Such mapping between agencies could inform the study design of cross-systems research and allow design of studies that incorporate more variables. The Meaningful Use standards and guidelines for EHR data present a useful template for how to advance the utility of administrative records for research purposes.[136] Last, study questions are limited by the policies for which data is governed and linkages of multiple systems should be informed with balancing the ethical challenges with maintaining privacy, particularly of vulnerable populations.[137,138]

The challenges highlighted above primarily focus on general issues of advancing surveillance using cross-systems research. Population-level surveillance of IMT could involve a more complex approach. Combining data for more than one generation would likely require a greater number of years and data sources. To better answer these questions, more infrastructure for collecting and storing records is needed, and informative data are also necessary. In this era of big data, it is entirely possible to collect

enough data to answer these complex questions, but this effort would require an investment of resources and commitment to long-term thinking. While viewed with issues of selection, identification of risk factors would be more systematically possible with multiple decades of administrative data, could reduce participant attrition found in cohort studies, and may prevent potential response and recall bias from retrospective studies.

7.4. Future Studies and Recommendations

A public health approach to addressing IMT focuses on four stages: surveillance, risk factor identification, intervention development and then implementation (see Figure 2.1). An epidemiologic perspective stands to inform and improve each of these. As demonstrated by findings from manuscript 1, cross-systems research and utilization of administrative records have potential to advance surveillance of child maltreatment. The public health emphasis on prevention could serve as an important complement to CPS, which is constrained to focus more on response to arising cases.

The public health approach could advance surveillance by integrating multiple measures of maltreatment to compute population-level estimates of prevalence and incidence. Combining reports from CPS and self-reports from systems such as BRFSS, as well as using ICD codes to conduct surveillance with electronic health records would provide a plausible range of estimates and potentially identify gaps in detection. By identifying risk factors at a population level, as was done in this study, advances could be made in prevention of IMT and provision of targeted resources.

While a number of demographic variables, such as age, race, and ethnicity are not mutable, and are likely to be indicative of contact with CPS rather than propensity for risk,[29,61] a number of mutable risk factors have been identified in the literature. Caregiver knowledge about parenting and child development, a caregiver's educational attainment, caregiver's substance use and mental health, and a caregiver experiencing intimate partner violence are all associated with higher risk of perpetrating maltreatment.[12] Timing of maltreatment in the life course, the caregiver's social isolation, parenting styles and attitudes, inconsistent discipline, and intimate partner violence are all associated with higher likelihood of IMT.[12]

Each of these risk factors can be addressed by a public health approach. Several of these (i.e., social isolation, educational attainment) are associated with fundamental social determinants of health,[139] and it is possible that interventions and strategies that address these could have an impact on IMT. Surveillance efforts would benefit by incorporating these risk factors into data collection. Prevention of intimate partner violence, and education about child development and discipline are interventions that have been tested and developed and currently are active areas of research. Rigorous evaluation of such interventions could inform a public health approach to address IMT. Additionally, two-generation interventions are a growing area of research (e.g., providing education to children and economic support to caregivers.[140]

One protective factor with strong evidence as having potential to interrupt the cycle of IMT is a safe, stable, nurturing relationship (SSNR).[12,141–143] While it is unlikely that an intervention could feasibly or ethically assign people to SSNRs, other approaches

may have potential. For example, education about healthy relationships and providing other forms of social support are potential approaches in line with SSNRs.[12] This recommendation is also consistent with intervention strategies that have shown promise, such as home visitation.[12,144–146] Other intervention strategies that have shown promise focus more on community-level supports, including provision of financial support.[12] An educational and support intervention implemented county-wide called the "Positive Parenting Program," has demonstrated efficacy and implementation would require a social epidemiologic perspective in evaluation and community assignment.[12,145,146]

7.5. Conclusions

This dissertation demonstrated that while there was evidence of IMT in Minnesota, the majority of people who experienced maltreatment did not perpetrate it. Additionally, there was no evidence of an additional cumulative impact of a caregiver's history of maltreatment on a child's academic achievement, among children experiencing maltreatment. Examining self-report data on perpetrators' history of maltreatment identified variability between caregivers with and without prior CPS contact as victims, inconsistency of self-reports when compared to prior records, and important barriers to conclusive studies using this data source. While the findings from this dissertation show the potential of cross-systems research to advance a public health approach to address IMT and bolster the work of child welfare, the questions raised also highlight the need for more data and further study, and the inability of this dissertation to incorporate theory using this data highlight the limitations of administrative records between siloed systems

and the potential for interdisciplinary collaboration to advance population health and change the trajectories of disadvantaged families.

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