FLORIDA DEPARTMENT OF CHILDREN AND FAMILIES

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SECTION 1 EXECUTIVE SUMMARY

1.1 OBJECTIVE AND BACKGROUND

This analysis examined re-reporting and re-maltreatment dynamics of perpetrators and caregivers in the Florida child welfare system between 2004 and 2014, in an effort to assist the decision-making process of the Department of Children and Families (the Department) in alleviating chronic maltreatment. This follows the study on child maltreatment fatality conducted on behalf of the Department in FY14-15 and is an important advancement in the literature on analytical studies on chronic maltreatment, as it focuses on the chronicity of the perpetrator rather than of the child victim.

1.2 DATA AND METHODS

The analysis used four data sources available to the Department: Florida Safe Families Network (FSFN) data, the primary source of child welfare information; the birth and death records from Florida Vital Statistics, the data from Heathy Families Florida program, and the data from the Automated Community Connection to Economic Self Sufficiency (ACCESS) system containing information regarding public assistance program participation.

Building predictive risk models was the central methodological focus. Following a univariate analysis to explore the associations between various risk factors and re-reporting, a collection of risk models were built to predict the likelihood a subject (alleged perpetrator or caregiver) would reach chronicity. Based on preliminary analysis, chronicity was defined as having five or more maltreatment reports by the perpetrator. More than 400 variations of risk factors were considered for development of each chronic perpetration risk model, which were later reduced by predictive model techniques to about 20 per model. These risk factors were selected due to their strong relationship with the likelihood of reaching chronicity following the initial report and each subsequent re-report.

1.3 RESULTS

This is the first prospective study in the literature that examines a cohort of perpetrators over 10 years with multiple episodes of recurrence of maltreatment. Building predictive risk models to identify perpetrators with high risk of chronicity of maltreatment, it has many implications during the decision-making process regarding child safety, well-being, and permanency.

Focusing on perpetrator makes intuitive sense, since services should be directed toward the adults around the children to reduce the risk of harm to children; that is, it is not the behavior of the children but rather the behavior of the adults around the children that places the children at risk. Furthermore, children are by nature dependent on the adults around them, while the adults have control of their situation and can be voluntarily fluid with the situation in which they place themselves. This implies that the best opportunity to reduce risk and prevent child maltreatment rests in the child welfare community's ability to influence the would-be perpetrators.

The analysis considered several factors to estimate the risk of chronic maltreatment due to several types of factors: historical reports, placement and services, maltreatment characteristics, characteristics of the current report, subject demographics, intergenerational

risks, mental health and alcohol and substance abuse, and inter-report characteristics. Four separate risk models were built for each additional report received by child welfare system prior to the fifth, chronic, report. The initial report model included 20 risk factors, the second report model included 23 risk factors, the third report model included 16 risk factors, and the fourth report model included 12 risk factors. The number of risk factors was selected by data-driven predictive modeling methodologies. The list of important risk factors is shown in Table 1 below. Not every risk factor shown in Table 1 appeared in each risk model. The table also shows whether the risk factor increased or decreased risk with increasing value. For example, a decrease in chronicity risk (–) was seen with an increase in the subject age risk factor.

Table 1: Risk Factors for Chronic Maltreatment of Perpetrators/Caregivers

Factor Group	Increase/Decrease Risk (+/-)	Risk Factor
Historical report	–	Number of directly linked verified or some indicator reports in last year
	+	Number of verified or some indicator reports in last year
	+	Number of previous caregiver reports in last year
	–	Number of Level 1 caregiver reports in last two years
	–	Number of Level 1 caregiver reports in last five years
	–	Number of Level 1 perpetrator reports in last two years
	+	Number of Level 1 sibling reports in last five years
Placement	–	Number of Level 1 removals in last year
Maltreatment	+	Other neglect maltreatments in last six months
	+	Substance abuse maltreatments in last six months
Services	+	Number of services offered in last five years
	+	Perpetrator services offered in last five years
Current report characteristics	+	Missing or erroneous victim dates of birth
	+	Subject is parent to at least one victim in current post-initial report
	–	Report is verified
	–	Average age of victims
	–	Average age of victims and siblings
	–	Minimum age of victims
	+	Number of individuals in current report
	–	Number of verified or some indicator in current report
Subject demographics	–	Subject Age
	–	Subject Black ethnicity
	–	Subject Hispanic ethnicity
	–	Subject Other ethnicity
	+	Subject is female
Intergenerational risks	+	Number of intergenerational victim/sibling reports for Subject
	+	Number of directly linked network reports in last 20 years
	–	Number of directly linked verified reports in last 20 years
	+	Number of network reports in last 20 years (all levels)
	–	Number of verified reports in last 20 years
	+	Number of previous victim reports in last 20 years
Mental health	+	Mental health services provided in last six months
Inter-report characteristics	–	Subject assigned perpetrator role in last 10 years
	+	Subject is parent to at least one victim in some report (initial to current)
	+	Subject is parent of at least one victim in initial report
	–	Time since initial report
	–	Time since previous report
Geographic factors	+ and –	Geographic location

The models were interpreted in two different separate decision points: screening and dispositioning investigations. From a statistical perspective, the models separate the chronic and non-chronic cases well. More practically, the models can identify chronic perpetration years before the fifth report at which point the perpetrator reaches chronicity. Using risk cutoff ranging for the 90th to the 98th percentile, between 10% and 33% of chronic perpetrators could be identified using the initial report model, providing an average lead time of more than 5.4 years prior to reaching chronicity. The adjusted true discovery rate for these individuals ranged from

73.5% to 85.3%, meaning only a quarter or less of individuals with high risk scores had no additional interactions with the child welfare system. After the initial report, identification of chronic individuals was enhanced by the nature of their subsequent reports to the child welfare system. Half of all chronic individuals could be identified within 28 months from the initial report; 80% within 55 months from the initial report. Such ongoing detections would offer lead times in excess of three years on average for half of the chronic individuals and in excess of 1.9 years on average for 80% of the chronic individuals. Adjusted true discovery rates range from 70% to 77% for the 50% detection point and 68% to 75% for the 80% detection point.

The model could also be used as in the screening process. Depending on the tolerance level for misclassification, the application of the model on new reports may screen out between 2.9% and 13.6% (based on the 2004-05 perpetrator cohort) with extremely low likelihood of falsely screening out perpetrators that later become chronic. There are additional findings on re-reporting and re-maltreatment patterns:

- Approximately one in every five children born in Florida were reported at least once to the child welfare system within 60 months from birth, and approximately one in every 14 children born in Florida were reported at least once with verified maltreatment.
- 42% of perpetrators were reported multiple times over the ten-year study window. Approximately 10% of the study cohort of 291,499 perpetrators had five or more reports.
- The chronicity of maltreatment is a long-term phenomenon, with the median time to chronicity of 64 months. This suggests that perpetrators maltreat victims over a very long time period.
- By the fifth report, almost two-thirds of the perpetrators were had at least one substantiated (verified) report; over nine out of 10 had a report with either verified or some evidence (*some indicator*) of maltreatment. While the type of transition in disposition from one report to another does not explain the next disposition or chronicity, the likelihood of substantiation increases substantively over time as a perpetrator is re-reported multiple times.
- There is no evidence of consistency or pattern in terms of transitions from one maltreatment type to another for any family irrespective of the initial allegations contained in a maltreatment report. However, a substantive cross-level recidivism between maltreatment allegation types exists for maltreatment reports over time.
- In spite of the large increase in SNAP participation and poverty rates in Florida after the Great Recession, the study did not find a substantive impact of poverty on child maltreatment rates. Three-fourths of low-income families who received public assistance had no interaction with the child welfare system, while over 90% of the families with at least one maltreatment report participated in public assistance programs. This implies that, while a great majority of families in the child welfare system do indeed receive public assistance, there is no evidence that economic hardship leads to increased maltreatment rates.
- The fatality rate of children with an alleged maltreatment is nearly three times that of non-maltreated children in their first ten years of their life. Maltreated children have been shown to die sooner and for potentially preventable causes including accidental death and homicide.

1.4 RECOMMENDATIONS

The findings from this study leads to the conclusion that effective prevention of child maltreatment must be perpetrator-centric rather than child-centric. This conclusion, while intuitive, has transformational implications in child welfare.

The current practice at both national and state level is highly child-centric; therefore, the notion of perpetrator-centric policies and practices present a radically different approach to child welfare. This implies that the standards of policy and practice as well as the legislation require serious reconsideration. Second, because the perpetrators re-perpetrate over a long period of time, and because the path to perpetration often begins when the given perpetrator was a himself/herself a victim of child maltreatment, it requires consideration of a much longer timeframe than is currently defined for re-maltreatment; that is, breaking the cycle of maltreatment requires taking a five- to ten-year view or even longer in order to treat the cause of the problem rather than the symptom manifested as the current child maltreatment reports. While the impact of this approach is nearly impossible to measure in the relatively short time frame of 12 to 24 months widely considered, it is a necessary shift in order to transform child welfare.

The key recommendations to improve the decision-making process of the Department are:

- Fundamentally shift the child welfare approach from being child-centric to perpetrator-centric. This involves advocating policy and practice changes at the national level, as well as legislative changes at the state and local level, and changing some practices to focus on the adults around the children from re-perpetrating rather than forming policies and practices strictly based on protecting current children from relatively imminent maltreatment. This includes the following:
    - Considering practice changes around services that may prevent current child victims from becoming future perpetrators. This is necessary in order to break the cycle of maltreatment and especially chronic maltreatment.
    - Re-examining legislative mandate in child welfare that are child-centric; consider augmenting with perpetrator-centric actions. This includes supplementing the current “three-hit” rule with perpetrator-centric criteria, so that, as an example, a review is required when the number of unaccepted reports on a single *perpetrator* exceeds a certain threshold.
    - Apply response tactics appropriate for the given level of perpetrator risk for re-perpetration at the time of maltreatment report. The simplest form of this approach is to apply a more traditional response for high-risk cases or severe instances of maltreatment, while considering different sets of service options that targets low- and moderate-risk cases. Although some examples exist in other states, determining what tactics may ultimately work for Florida requires additional research.
- Identify perpetrator-centric policies and practices that may be promising for further study for evidence. While a survey of the literature has uncovered some promising ideas, it has not revealed evidence-based policies and practices that are perpetrator-centric; therefore, further research is needed.

- Adopt predictive risk models to identify perpetrators with high risk of chronic maltreatment to provide further insight into the screening process and during the disposition of investigations to target high risk families with intensive interventions.
- Conduct further research to understand how placements and services are associated with chronic maltreatment, why a large segment of families with chronic maltreatment histories do not appear to receive any services, and why some families show better outcomes while others showing deteriorating results.
- Extend the improvement in data structure and systems, including the adoption of network relationships with hierarchy among perpetrators, victims, and families for more accurate risk assessment and the extension of data linkages to other agencies to add other critical risk factors. Data quality topics such as entity resolution which has a strong impact on the validity of such network relationships, are discussed in detail in complementary reports: the report on Data Governance and Strategy, the report on Data Assessment, and the report on FSFN recommendations.

SECTION 2 PROJECT OVERVIEW AND DEFINITIONS

2.1 INTRODUCTION

Child maltreatment continues to be a major social problem in the United States, affecting millions of American children and their families. According to the most recent numbers available for 2014, approximately 3.6 million referrals to child protection service (CPS) agencies led to 2.2 million reports that received a disposition. A nationally estimated 3.2 million children received either an investigation or alternative response, and the number of children who received a CPS response increased by 7.4 percent from 2010 to 2014. There were approximately 702,000 victims of child abuse and neglect. Florida recorded 222,720 referrals and 162,550 reports in 2014, involving 288,551 children and 45,738 victims (USDHHS, 2016).

The approximate national victim rate of one in 106 (9.4 victims per 1,000 children) understates the true level of child maltreatment, because many incidences of child maltreatment are not reported to the CPS agencies; many unsubstantiated reports involve undetected maltreatment due to lack of observed evidence (Helie and Bouchard, 2010; Putnam-Hornstein, 2015a). The Fourth National Incidence Study (NIS-4) estimated the victim rates as one in 58 children (Sedlak et al., 2010). A recent study determined that one in eight children in the United States experience maltreatment severe enough to be substantiated by CPS between birth and age 18 (Wildeman et al., 2014).

Nationally in 2014, out of approximately 3.2 million children who were the subjects of at least one report, 12.6% were the subject of two reports, and less than four percent (3.7%) were the subject of three or more reports., with 72.6% of the victims were reported for the first time in 2014. In Florida, the proportion of first-time victims were much lower (48.3%), suggesting higher recidivism rates (USDHHS, 2016). The interim report on Florida data (NH and SAS, 2016a) revealed that 20.8% of all victims were re-reported during the first year, much higher than the national average of 16.3%; over 10 years, almost half of the victims were re-reported at least once. While some families are reported to the child welfare system only once, others become involved with the system repeatedly. This group of families with chronic maltreatment is the main focus of this report.

As defined below, two central concepts used in this report are *re-reporting* and *re-maltreatment*. Re-reporting includes multiple reports with any of the following investigation dispositions: *verified*, *some indicator*, or *no indicator*. Re-maltreatment merely refers to two consecutive reports with verified child maltreatment. Recurrence and recidivism are used interchangeably to refer repeated child maltreatment irrespective of the disposition of the report. Repeat reports and re-maltreatment pose serious concern for child welfare agencies, and studying children who experience repeated reports to child welfare system for suspected maltreatment is important for several reasons.

Firstly, chronicity of maltreatment has been shown to be related to several adverse long-term outcomes for the alleged child victims, their families, and society. There is strong evidence and growing body of research that link earlier childhood maltreatment to multiple domains of adulthood with negative long term effects on cognitive development, health, mental health, tendency to suicide, alcohol and substance use, juvenile delinquency and criminal behavior, becoming maltreatment perpetrators themselves in the future, low levels of education and

employment and earnings (Currie and Widom, 2010; Currie and Tekin, 2012; Dube et al., 2001; Gilbert et al., 2009; Johnson-Reid, Kohl and Drake, 2012; Lansford 2007; Lemon 2006; Springer et al., 2009; Widom et al., 2012). While exposure to maltreatment has been linked with negative outcomes, children exposed to chronic maltreatment tend to experience worse outcomes when compared with children who experience a single maltreatment incident (DePanfilis and Zuravin, 1999a; Éthier, Lemelin, and Lacharité, 2004; Jaffee and Maikovich-Fong, 2011). According to Graham et al. (2010), the dimension of chronicity is critical in understanding how maltreatment leads to psychosocial and behavioral problems that affect child development. Understanding the factors associated with repeated referrals can provide insight for intervention programs aimed at ameliorating these negative effects.

Secondly, re-reports demand disproportional amounts of child welfare resources, including additional time and expenses related to multiple investigations as well as higher costs associated with additional services. Each report requires a repeated procedure of intake, investigation, disposition, and placement and/or services if needed. The repetition of CPS procedures results in significant costs for agencies and creates a major burden on CPS workers, many of whom are already struggling with heavy caseloads (Bae et al., 2009, 2010). In most jurisdictions, agencies can barely meet demand, waiting lists of families in need of services are growing longer, and placement resources are becoming increasingly rare (Helie and Bouchard, 2010). Early identification of cases with high likelihood of re-reporting and re-maltreatment that may benefit from additional attention or services could prevent subsequent CPS involvement and improve efficiency in the child welfare system (Connell et al., 2007).

Thirdly, they indicate a persistent harm to children which may lead to extreme child maltreatment, including child maltreatment fatalities and therefore a priority for CPS agencies. One of the findings of the previous work by North Highland and SAS (*the North Highland team*), which examined child maltreatment fatalities in Florida between 2009 and 2014, was the critical link between the number of prior reports and maltreatment fatalities (NH and SAS, 2015a).

Fourthly, a core goal of child welfare investigation and intervention practices is preventing re-maltreatment; however, high re-report and re-victimization rates suggest that CPS agencies serve the same abused and neglected children repeatedly (Bae et al., 2010). Recurrence may mean that the circumstances threatening the child's safety or development were not eliminated by the initial post-investigation services, requiring a new level of CPS intervention (Helie et al., 2013). Tracking re-reports and re-maltreatment is critical in assessing the effectiveness of the child welfare system in ensuring child safety after intervention and removal.

Finally, re-reports place a tremendous burden on CPS financial resources. It has been estimated that cases with multiple referrals cost CPS seven times that of other cases (Loman and Siegel, 2004; Loman, 2006), and estimates suggest that child maltreatment costs the United States $124 billion annually, with per-person lifetime costs higher than or comparable to those of diseases such as a stroke or Type II diabetes (Fang et al., 2012).

Given the high costs, the pressure on child welfare resources and the long-term negative outcomes of child maltreatment recurrence, understanding which families return to CPS repeatedly is of serious concern to practitioners, so that they can promote child safety and well-being and attain effective and efficient child protection systems (Fluke et al., 2008; Proctor et al., 2012).

The need to identify families with re-maltreatment risks is well-recognized. However, this need is challenged by the difficulty of identifying at-risk families early on before patterns of maltreatment are already established. Risk-assessment tools have been implemented by several CPS agencies to assist with identifying children at the highest risk of maltreatment, with actuarial risk assessment deemed as more efficacious than consensus-based approaches (Coohey et al., 2013). While some agencies have started to apply actuarial tools such as Structural Decision Making (SDM), the availability of large-scale administrative databases and recent developments in data linkage and statistical modeling to analyze or mine vast amounts of data have led to the application known as predictive risk modeling (De Haan and Connely, 2014; Gillintgham, 2015; Keddell 2016; Russell, 2015; Shlonsky, 2015).

This report adopts the approach of predictive risk modeling together with other analytical techniques. The study relies on linking multiple databases to identify trends, relationships, and patterns within data that can be used to predict recurrence of maltreatment. Predictive analytics study historical data using algorithms to train models that can estimate the probability of a particular event such as re-maltreatment and assign ranking scores to individuals at risk. Many recent prospective studies have linked multiple databases and applied predictive risk modeling on child maltreatment or re-maltreatment while identifying the predictors of risk (Dubowitz et al., 2011; Moira et al., 2015; Needell and Putnam-Hornstein, 2011; Putnam-Hornstein, 2011, 2015c; Vaithianathan et al., 2013). However, these have primarily focused on recurrence from the perspective of the child victim and not from the perspective of the perpetrators and/or caregivers.

Predictive risk modeling has the potential to be a useful tool to assist with the targeting of resources to prevent child maltreatment when it is combined with effective early intervention programs. However, it is subject to certain limitations:

- It identifies families that may benefit from the interventions but would not re-maltreat their children—the *false positives*—which may lower the accuracy of these models (De Haan and Connoly, 2014; Keddell, 2016).
- It may also stigmatize and label families through profiling, which may further reinforce the risk paradigm, creating more risk-averse systems that struggle to be responsive to families (Dubowitz, 2011).
- The frequent use of substantiation data as the outcome variable is problematic (Gillingham, 2015; Keddell, 2016) as recognized in this report.

The critics of predictive risk modeling have recommended that predictive risk modeling be used as a complement to professional judgement, because, although it has value in identifying high-risk families, the models may not provide enough information (Dubowitz et al., 2011; Shlonsky, 2015).

An analytical approach to child re-maltreatment problem can help in the early identification of families and children who are more likely to be involved in maltreatment again and in the effective targeting of preventive services for them. The Department can use information about factors that increase the likelihood of repeated child maltreatment to direct time, interventions, and money where they are most needed. Additionally, the over- and under-inclusion of children in the system can be reduced through more informed decision-making, which can have a

positive impact on children and families unnecessarily exposed to the child welfare system and on those who are actually in need of help (Kahn and Schwalbe, 2010).

This report builds on two previous reports by the North Highland team. The first report, produced in FY14-15, examined alleged child maltreatment fatalities in Florida between 2009 and 2014, as a prospective study of maltreatment fatalities children directly or indirectly associated with a previous nonfatal report of maltreatment. The goal of the analysis was to identify high-risk children known to the child welfare system at the time of their birth, by developing analytical models with risk factors contributing to early child maltreatment fatalities. One of the findings of the report was the critical link between maltreatment fatalities and the number of prior reports in the extended family networks (NH and SAS, 2015a).

The second report, an interim report on re-maltreatment from FY15-16, extended this relationship by studying re-reporting and re-maltreatment rates, patterns and trends, and a limited analysis was presented using a small set of risk factors (NH and SAS, 2016a). The current report extends this analysis by adding several risk factors including network effects and applying predictive models to identify perpetrators with high risk of chronic maltreatment.

Studying the problem of re-reporting and re-maltreatment prospectively is expected to be instrumental in at least two decision-making points:

- The decision made by the child welfare workforce when reports are made by professional reporters (for example, school or medical personnel, or a family contact) which may focus more on the needs of the family: whether to investigate the validity of the report and the safety issues of the child, and whether an assessment is needed. The knowledge of re-maltreatment is beneficial in making decisions for screening and assessment strategies.
- The decision regarding whether the children in the report have been maltreated or are at risk of maltreatment, along with decisions regarding ongoing services. While making this decision, the knowledge of risk factors of re-maltreatment is beneficial for service planning and placement decisions.

2.2 Objective of the Report

The objective of this report is to study re-reporting and re-maltreatment, which refers to multiple reports with and/or without verified child maltreatment. The focus of the report is to develop analytical techniques and build predictive models to identify perpetrators and victims with high risks of chronic maltreatment.

In addition to the analysis of chronic maltreatment, the previous work on child maltreatment fatalities is extended with the addition of the birth and death records from Florida Vital Statistics. Specifically, the prevalence, the time-until-death, and the manner-of-death of maltreated children, including but not limited to deaths as a result of maltreatment, can be compared to children without a maltreated report. The effects of maltreatment chronicity on these aspects of childhood death is also explored.

2.3 LITERATURE REVIEW

The study of repeated reports to CPS and re-maltreatment and of contributing risk factors is a fairly new field of research. The number of papers on re-maltreatment using robust longitudinal analysis grew in the late 1990s (Helie and Bouchard, 2010). Majority of these papers have studied re-reporting and re-maltreatment rates and correlates of recurrence of maltreatment. Most of the papers have focused on the first instance of re-reporting and re-maltreatment, while a few others have studied multiple episodes. The majority of these studies used nationally representative data sets: National Survey of Child and Adolescent Well-Being (NSCAWII) and the National Child Abuse and Neglect Data System (NCANDS), while several others used state- or county-level data.

2.3.1 RATES OF RE-REPORTING AND RE-MALTREATMENT

Recurrence rates depend on the age of the child, length of the follow-up window, type of initial or subsequent maltreatment, services provided, and whether rates are calculated for all reports, or only for verified maltreatment. Many studies have examined rates of re-reporting and re-maltreatment for children and families. Three earlier studies presented quite different findings based on their disparate methodologies. Fluke et al. (1999) assessed re-maltreatment rates for children in 10 states showing that a child whose initial report was deemed substantiated or indicated had a 15% chance of being reported again (whether the maltreatment was substantiated or indicated) sometime in the following six months. The probability was estimated to be 20% in the following 12 months.

English et al. (1999) included both initial reports and subsequent reports that are deemed unsubstantiated, along with those that were substantiated. They studied rates at the family level producing a higher rate for families whose children were reported in the state of Washington in 1994: after 18 months, 29% of the families followed had at least one child in the family re-reported at least once. De Panfilis and Zuravin (1999a) studied substantiated investigations in Baltimore for families over five years and showed the highest rates. For a family whose child had a substantiated report, the risk that one of their children would be the subject of another substantiated report within the next five years was 43%.

Recent studies have shown different results based on their follow-up periods. Casanueva et al. (2015) showed 23% re-reporting and 7% re-maltreatment rates at the national level for children over 18 months. Connell et al. (2007) showed using national data that approximately 40% of cases were re-referred to CPS within 3.75 years of the initial event. Dakil et al. (2011) studied children remained in the home following a maltreatment report showing 44% re-reporting rate over five years. Fluke et al. (2008) presented a longitudinal analysis of multi-state data over two years showing 22% re-reporting and 7% re-maltreatment rates.

Another study at the national level found that 19.3% of the children with a confirmed report had a second confirmed maltreatment report within five years (Palusci, 2011). Proctor et al. (2012) extended the follow-up period to eight years, revealing that 67% of children were re-reported and a small (10%) high-risk subgroup received re-reports continuously across at least three of the four two-year periods.

Way et al. (2001) compared recidivism rates for alleged maltreatment perpetrators in Missouri with substantiated and not substantiated initial reports showing that, over 4.5 years, the overall re-reporting rate was 42.4%. A more recent study on perpetrators found that the rate of re-reporting including the same alleged perpetrator on a new report was 46.6% over 10 years. Nearly half of the first-time perpetrators in this study had at least two reports over time (Johnson-Reid et al., 2010b).

Johnson-Reid et al. (2010a) studied chronic maltreatment in a Midwestern metropolitan area finding that 57% of children had two reports or more over an observation period seven to 12 years depending on their initial ages. 26.3% (of total) had two reports; 17.9% (of total) had three reports; and 12.7% (of total) had four or more reports by the end of the follow-up period. An earlier study using the same data showed a re-reporting rate of 47.7% at the end of three years and 62.1% at 7.5 years (Drake et al., 2006). Zhang et al. (2013) displayed that in Illinois, among the cases with at least two reports, 60% of these cases encountered a subsequent maltreatment report during four years.

One study examined CPS recurrence among children exiting substitute care by estimating the risk of occurrence of a new substantiated report after the termination of services estimating a recurrence rate of 33% over five years (Helie et al., 2014). Finally, two recent papers used Florida data to estimate re-maltreatment rates. An earlier study showed 26% of the children encountered another substantiated report in two years (Lipien and Forthofer, 2004). A second paper studied the data from seven Florida counties covering 5.4 years showing that 86% of families had no recurrence, 11% had only one recurrence, and 3% had two or more recurrences (Bae et al., 2009).

Nationally, the highest rate of reported maltreatment occurs during infancy. Infants account for an increasing share of the population of victims substantiated for maltreatment (USDHHS, 2016). Not surprisingly, the highest rate of re-reporting is observed for the youngest children, which was confirmed by two recent studies. Thompson and Wiley (2009) showed that approximately 42% of infants substantiated as victims were re-reported to CPS when followed for the next 11 to 15 years with 19.5% re-reported within one year. Putnam-Hornstein et al. (2015a) demonstrated that of the 563,871 children born in California in 2006, 5.2% were reported for abuse or neglect before age one, and among the 82% of infants who remained in the home, the majority (60.7%) was re-reported within five years.

The literature confirms that re-reporting and re-maltreatment are long-term problems and younger children reveal higher risks of recurrence. The interim report on re-maltreatment of children of Florida supported these findings (NH and SAS, 2016a).

2.3.2 Single vs. Multiple Recurrences and Time to Recurrence of Maltreatment

Existing research regarding maltreatment recurrence has generally focused on observing two adjoined maltreatment incidents, without studying victims experiencing three or more maltreatment incidents (Casanueva et al., 2015; Dakil et al., 2011; De Panfilis and Zuravin, 1999a, 1999b; Drake et al., 2006; English et al., 1999; Fluke et al., 1999; Kahn and Schwalbe 2010; Lipien and Forthofer, 2004; Maguire-Jack and Font, 2014; Palusci 2011; Putnam-Hornstein et al., 2015a; Thompson and Wiley, 2009). The strength of the existing literature lies in the work presented to predict the first recurrence, but the research has been limited in the

area of chronic re-reporting (Helie and Bouchard, 2010; Johnson-Reid et al., 2010a; Zhang et al., 2013). However, observing the revealed difference between cases with multiple recurrences and cases with only one recurrence, there is a growing recognition that there are different mechanisms underlying these two types of recurrences (Bae et al., 2009; Chaffin et al., 2011; Jonson-Reid et al., 2010).

Bae et al. (2009) studied Florida families with multiple re-maltreatment reports comparing them against other families with single re-maltreatment incidences. Johnson-Reid et al. (2010a) studied which cases move from a first report to having five or more reports and how the influence of characteristics change for children who move from first to second report, second to third report, third to fourth report, and finally, fourth to fifth report. In another recent study, Proctor et al. (2012) identified four trajectory classes of maltreatment between ages four and 12 for children first reported to CPS prior to age four: no re-reports, continuous re-reports, intermittent re-reports and early re-reports. Finally, Zhang et al. (2013) analyzed how the interval between previous maltreatment incidents is associated with future maltreatment occurrences studying children with at least two maltreatment reports. All these studies have identified different risk factors contributing to chronic maltreatments as summarized in the next section.

One common finding among all research whether studied single or multiple recurrences was that a large proportion of maltreatment recurrence is concentrated very early after the initial report and the risk of recurrence declines steadily after this early period. The more time that passes, the lower the likelihood of a first recurrence at any moment in time (Casanueva et al., 2015; Helie and Bouchard, 2010). Lipien and Forthfoher (2004), using Florida data, showed that 27% of the recurrence occurred within the first six months following the initial incident, and a total of 85% of the recurrence occurred within the first 12 months.

Fluke et al. (2008) found that out of 22% of the children re-reported in 24 months, almost half were reported with six months and three-quarters within 12 months. Similarly, Connell et al. (2007) indicated that approximately 13% of cases experienced a recurrent allegation during the first six-month period; an additional 14% experienced a re-referral over the following 12-month period. De Panfilis and Zuravin (1999a) found that the highest risk period was within the first 30 days following the initial report to CPS and 66% of re-reported families experienced their first re-report within six months. The likelihood of recurrence after six months was substantively reduced. Kahn and Schwalbe (2010) showed that the probability of recurrence drops from 17% to less than 4% in 18 months.

Finally, the research has demonstrated that for cases with multiple recurrences, the likelihood of recurrence increases in a systematic and consistent fashion based upon the sequential ordering of recurrent maltreatment events and the mean time until first recurrence was longest for families with only one recurrence, and it was progressively shorter for families with each additional recurrence (De Panfilis and Zuravin, 1999a; Fluke et al., 1999). Bae et al. (2009) presented that the time to recurrence steadily decreased with an increasing number of recurrences until the fifth recurrence suggesting that families might accelerate child maltreatments while they move on to higher recurrence order. A study of intervals between maltreatment recurrences found a negative linear relationship between the elapsed time among preceding maltreatment incidents and the likelihood of re-maltreatment in the future. The shorter the interval was, the higher the risk a child would experience a subsequent re-report (Zhang et al., 2013).

2.3.3 RISK FACTORS FOR RE-MALTREATMENT

Researchers have examined a broad range of risk factors associated with maltreatment recurrence. A brief summary of these factors is shown below, and more detailed references are also available (See Hindley et al., 2006; White et al., 2014). The studies considered a variety of child, caregiver, and family, case, and societal or community factors associated with re-reporting and re-maltreatment. However, the effects of such factors on recurrence are often mixed across different studies, possibly due to the variance in the studied populations, units of analysis, maltreatment definitions, and the length of observational periods. Despite of a lack of uniformity, there are some consistent findings (Helie et al., 2013; White et al., 2014). Almost all of these studies conducted child (victim) level analysis revealing which factors contribute to child re-reporting and re-maltreatment.

The child, family, and community factors that contribute to the risk of maltreatment are likely to affect the probability of recurrent maltreatment. However, the latter adds a new dimension: the interaction with the child welfare system. It may be the case that the families who experience recurrent involvement have different initial risk factors, but the interaction between the family and the CPS system may also affect the probability that subsequent maltreatment will occur (Maguire-Jack and Font, 2014).

The child's age appears to be a major predictor of recurrence, with younger children more likely to be reported more than once (Bae et al., 2007, 2009, 2010; Connell et al., 2007; Drake et al., 2006; English et al., 1999; Fluke et al., 2008; Fuller and Nieto 2009; Helie et al., 2013; Lipien and Forthofer, 2004; Zhang et al., 2013), which is attributable to the greater vulnerability of younger children and their reliance on their parents for meeting their basic needs. However, a few studies have found no association with age (Cheng and Lo, 2015; Dorsey et al., 2008; Kohl et al., 2009; Thompson and Wiley, 2009). Palusci (2011) noted that children under the age of five are different from those who are older, both in terms of risk factors for recurrence and the effect of the protective services they receive. He demonstrated that infants and young children received more services and had less recurrence than did older children.

While Fluke et al. (2008) and Zhang et al. (2013) found girls to be more likely than boys to be involved in substantiated re-report, other research determined re-reports were not significantly associated with gender (Bae et al., 2009, 2010; Connell et al., 2007; Fuller and Nieto, 2009; Jonson-Reid et al., 2009).

The majority of studies have suggested that African-American and Hispanic children have lower rates of maltreatment recurrence than white children (Casanueva et al., 2015; Connell et al., 2007; Drake et al., 2006; English et al., 1999; Fluke et al., 2008; Fuller and Nieto, 2009; Kahn and Schwalbe, 2010; Lipien and Forthofer, 2004; Solomon and Asberg, 2012; Zhang et al., 2013). Some other studies found no significant finding with respect to child's ethnicity (Bae et al., 2009, 2010; Dorsey et al., 2008; Drake et al., 2006; Johnson-Reid et al., 2003; Kohl et al., 2009). Racial and ethnic disparities in the risk of child maltreatment recurrence also might be associated with maltreatment type, since African-American families were more likely to be reported for neglect and least likely to be reported for sexual abuse, which was strongly associated with the lower rates of recurrences (Bae et al., 2009).

Various studies have found that disabilities of children (physical, emotional, behavioral problems, and learning difficulties) increase the risk of maltreatment recurrence (Connell et al., 2007; Drake et al., 2006; English et al., 1999; Fluke et al., 2008; Kahn and Schwalbe, 2010; Kohl et al., 2009). Loman (2006) found that families receiving four or more re-referrals or re-reports were more likely to have an emotionally disturbed, mentally ill, or developmentally disabled child. Dakill et al. (2011) showed three higher-risk groups in terms of risk of re-maltreatment, which all included children with behavior problems.

In addition to child's characteristics, various characteristics of parent/caregiver and family have been found to be associated with re-reporting and re-maltreatment. If a caregiver and a parent have certain impairments and disadvantages, these problems may challenge their personal resources to meet the needs of the child, which may lead to the recurrence of maltreatment. Caregiver or parental history of alcohol and substance use was found to be a consistent risk factor for re-reporting and re-maltreatment (Cheng and Lo, 2015; Connell et al., 2007; De Panfilis and Zuravin, 1999b; Dorsey et al., 2008; Fluke et al., 2008; Johnson-Reid et al., 2010a; Proctor et al., 2012). In addition, caregiver history of mental health problems (Casanueva et al., 2015; De Panfilis and Zuravin, 1999b; Dorsey et al., 2008; Drake et al., 2006; Johnson-Reid et al., 2010a) and domestic violence in the household (Casanueva et al., 2015; De Panfilis and Zuravin, 1999b; English et al., 1999; Kahn and Schwalbe, 2010) were found to contribute to higher risk of recurrence.

A higher likelihood of recurrence has been associated with household size and more children in home (Bae et al., 2009, 2010; DePanfilis and Zuravin, 1999b; Drake et al., 2006; Fuller and Nieto, 2009; Proctor et al., 2012; Zhang et al., 2013), single parent households (Bae et al., 2009, 2010; Kahn and Schwalbe, 2010), younger age of parent or caregiver (Dakill et al., 2011; Loman, 2006), and when perpetrators are female (Johnson-Reid et al., 2010b; Way et al., 2001) and younger (Johnson-Reid et al., 2010b).

Research has suggested that a parental history of maltreatment has consequences for children, with heightened rates of maltreatment often observed among the children of maltreated parents. Any maltreatment statistically increases the odds of becoming a perpetrator of maltreatment (Berlin, Appleyard, and Dodge, 2011; Putnam-Hornstein et al., 2015b; Thornberry and Henry, 2013). Caregivers or parents who experienced physical abuse or neglect as children are more likely to repeatedly maltreat children compared to parents who were not exposed to physical abuse or neglect (Dorsey et al., 2008; Drake et al., 2006; English et al., 1999; Kahn and Schwalbe, 2010).

Poverty and financial difficulties are related to first occurrence of child maltreatment and risk of foster care placements (Pelton, 2015). However, in terms of risk of re-maltreatment, the role of poverty is not well established. While the majority of the risk factors contributing to maltreatment is somehow intertwined with poverty, the exact pathway between poverty and chronic maltreatment has proven to be elusive (Johnson-Reid et al., 2010a). Several studies found that family poverty (often using Aid to Families with Dependent Children (AFDC)/Temporary Assistance for Needy Families (TANF) receipt as a proxy for poverty) was associated with a higher risk of maltreatment recurrence (Connell et al., 2007; Kahn and Schwalbe, 2010; Kohl et al., 2009). For perpetrators, Way et al. (2001) revealed that higher neighborhood mean income is associated with lower risk of recidivism. Drake et al. (2006) found that children with caregivers with a permanent exit from a first spell on AFDC/TANF had about half the risk of recurrence as children with ongoing AFDC/TANF participation. However, Johnson-Reid et al. (2010a) found a

weak association between TANF receipt and chronic maltreatment and Proctor et al. (2012) suggested that AFDC receipt does not differentially predict short-term versus chronic re-reporting. Thompson and Wiley (2009) identified no association between low income and recurrence of maltreatment.

Type of maltreatment and case factors are also analyzed as potential risk factors of maltreatment recurrence. One consistent finding is that the highest risk of future maltreatment is observed when the maltreatment in the first report was for neglect. Physical abuse showed the next most significant association and sexual abuse was least associated with maltreatment (Bae et al., 2009; Connell et al., 2007; De Panfilis and Zuravin, 1999b; Drake et al., 2006; English et al., 1999; Fuller and Nieto, 2009; Lipien and Forthofer, 2004; Kahn and Schwalbe, 2010; Putnam-Hornstein et al., 2015a). Way et al. (2001) showed similar findings for perpetrators. Zhang et al. (2013) determined that when compared with the category of other neglect, physical abuse and supervision neglect, they were at higher risk of experiencing a subsequent re-report. Proctor et al. (2012) showed that physical abuse linked to a more chronic pattern of maltreatment re-reporting. Moreover, research demonstrated that the likelihood of a re-report increases if there was a prior substantiated physical or sexual abuse case (Fuller and Nieto, 2009; Proctor et al., 2012; Thompson and Wiley, 2009) or when there was an initial report for two or more types of maltreatment (Fuller and Nieto, 2009).

Maltreatment type substantially changes from initial report to the subsequent report. Although a majority of maltreatment incidents recurs as the same type of maltreatment at subsequent report, not all cases have the same type in the subsequent reports (Bae et al., 2007). Cross-type recurrence (defined as recidivism event of a different type from the initial report) intensifies under chronic maltreatment. The more times a case is re-reported, the more likely it is that cross-type recidivism will have occurred and the majority of recidivism events involve cross-type recidivism (Johnson-Reid et al., 2003). Based on these findings, Johnson-Reid et al., (2010a) concluded that it was unclear whether maltreatment type would predict chronic re-reporting.

The most consistent risk factor for re-reporting and re-maltreatment is the child's history of maltreatment. Across studies, if a family, child, or perpetrator was already known to CPS, there was consistently a greater likelihood of subsequent reports and maltreatments. Hindley et al. (2006) concluded that children maltreated previously were approximately six times more likely to experience recurrent maltreatment than children who had not previously been maltreated. Several studies found that reports of maltreatment prior to the initial report (indicating chronicity) were associated with higher rates of maltreatment recurrence (Casanueva et al., 2015; Connell et al., 2007; De Panfilis and Zuravin, 1999b; Dorsey et al., 2008; English et al., 1999; Fluke et al., 2008; Kahn and Schwalbe, 2010; Putnam-Hornstein et al., 2015a; Zhang et al., 2013).

More than any other single factor, prior maltreatment history or being known to the child protective system, was found to be a very strong predictor of re-reporting. Therefore, it is argued that in addition to the continuing problems of these families, once the child and family are brought to the attention of the child protective system, they are subjected to a greater degree of observation and inspection. As such, this increased child protective surveillance may be related to a higher risk of child maltreatment re-reporting (Bae et al., 2010). The investigation is particularly affected by the child protective history; cases with previous maltreatment reports are more likely to be investigated with intensity than the cases without previous reports, which contributes to higher rates of recurrence (Bae et al., 2009). Helie et al. (2014) showed that

having been investigated at least once prior to the initial intervention increased the risk significantly.

There is controversy over whether the provision of services by child welfare agencies increases or decreases the risk for maltreatment recurrence. Although they vary in content and intensity among child welfare agencies, child welfare services typically consist of case management plus a variety of clinical and concrete services for family preservation and support, while children stay at home. Several studies found that receiving these services raises the likelihood of re-reporting and re-maltreatment (Bae, et al., 2009; Casanueva et al., 2015; Drake et al., 2006; Fluke et al., 1999, 2008; Lipien and Forthofer, 2004; Putnam-Hornstein et al., 2015a). Several other studies found no significant impact on re-maltreatment arising from services (Bae et al., 2010; Cheng and Lo, 2015; Palusci and Ondersma, 2012; Palusci et al., 2005).

A few studies have stated that recurrent maltreatment is less likely under certain conditions:

- the family receives mental health treatment or the child receives special education services (Johnson-Reid et al., 2010b)
- caregivers receive therapy (Solomon and Asberg, 2012)
- medical or legal services are provided (Bae et al., 2009; Fuller and Nieto, 2009)
- collaborative engagement with caseworkers exists (Cheng and Lo, 2015)
- families attend sessions (De Panfilis and Zuravin, 2002)

Johnson-Reid et al. (2010a) suggested that after the second report, the effect of services was not statistically significant in deterring recurrence. This seems to point toward the ineffectiveness of services for chronically maltreated.

There is an extensive discussion on the effect of services on re-maltreatment to explain these paradoxical findings. Fuller and Nieto (2013) claimed that existing studies have failed to adequately account for pre-existing differences in families who receive services and those who do not, which leads to selection bias. However, after using propensity score matching to control for the selection bias, results did not change. This suggests that child welfare services may lack a sufficient level of effectiveness in achieving their stated goal of preventing recurrence of maltreatment. Another study concluded that the insignificant impact of services may be due to misaligned services or other caseworker error (Cheng and Lo, 2015).

The association between the risk of re-maltreatment and post-investigation services are explained in different ways. First, the CPS system may respond differently to the families who are chronically reported to CPS agencies, such as providing more intensive services. Specifically, workers offer in-home services to families that are at higher risk due to greater child, parent, or family needs. Also, families with higher levels of intrinsic risk are more likely to experience additional maltreatment reports than those with lower intrinsic risk (Fluke et al., 2008). Additionally, families may be under increasing surveillance by the CPS system while they have multiple child maltreatment recurrences; this is called *surveillance bias* (Fuller and Nieto, 2013).

Finally, it is argued that general CPS services might be ineffective in reducing the risk of future child maltreatment recurrence. Decisions of service delivery are being made within highly

complex systems, where risks may not be accurate at first assessment or screening. Furthermore, decisions are frequently made by inexperienced and poorly trained practitioners, with inadequate supervision. Observing all these complications, the interaction between service provision and recurrence requires further study (Helie and Bouchard, 2010; White et al., 2014).

A few papers have also studied the association between future maltreatment and foster care placements. The majority of these studies found that foster care placements increase the likelihood of re-maltreatment (Bae et al., 2009; Casanueva et al., 2015; Drake et al., 2006; Fluke et al., 2008), while one study found that placement in foster care with relatives to be protective (Lipien and Forthofer, 2004). The increased risks for children placed in foster care may be related to the length of time that children spend in foster care placements, particularly if the placements are very short term (Jonson-Reid, 2003). Solomon and Asberg (2012) found that cases in which children were temporarily taken from their caregivers' custody are the strongest predictor of recidivism because children are usually only removed from their parents in more severe cases, and may therefore simply reflect case severity.

2.3.4 SUBSTANTIATION

The national data showed that in 2014, approximately one-fifth of children (17.8%) were found to be victims with dispositions of substantiated and the rate of substantiation in Florida is the same as the national rate (USDHHS, 2016). Substantiation or verification, by definition, is assumed to represent a CPS statement about the validity of a report of child maltreatment. However, there has been a significant debate around the utility of using substantiation both in research and practice, which suggests that its use as a reliable index of whether a child has suffered significant harm may be misguided (White et al., 2014).

Several challenges to using substantiation as a proxy for child maltreatment incidence has been shown in the literature. First, the current research underscores the failure of substantiation as a predictor of children’s future risk of maltreatment or outcomes (Drake et al., 2003, 2006; English et al., 1999; Kohl et al., 2009). Some research has shown that the risk of recurrence for children with unsubstantiated reports was not statistically different from those whose reports were substantiated with similar factors predicting any recurrence of any kind (Bae et al., 2007).

Also, poor child protection decision-making (with underestimation of substantiated cases) has been noted by several authors. Cross and Casanueva (2009) found that in nine out of 100 cases, reports were not substantiated despite moderate to severe harm, suggesting substantiation is a flawed measure of child maltreatment. Research has also suggested that some children are substantiated for reasons other than even a broad definition of maltreatment, such as behavioral problems, lack of a caregiver (Gillingham, 2015), specificity of sites or agencies and availability of resources (Maguire-Jack and Font, 2014) or the level of proof available to the investigators (Drake et al., 2003). Extremely divergent rates of substantiation suggest that factors other than objective similarities at different threshold points are driving substantiation decisions such as structural and institutional factors, rather than child and family characteristics (Gillingham, 2015; Keddell, 2016).

Furthermore, child maltreatment incidents may change substantiation status between the initial report and subsequent reports. A substantial number of child abuse and neglect cases are re-reported to CPS agencies regardless of substantiation status at the initial report. Bae et al.

(2007, 2010) revealed that a significant proportion of all cases (over one out of five cases) represent unsubstantiated-to-substantiated reports and 44% of the family reports changed their substantiation status at subsequent report, suggesting that the substantiation status at the initial report is not a sufficient predictor of the substantiation status of the subsequent reports. Way et al. (2001) also demonstrated that more than 10% of those whose initial report of perpetrators was not substantiated were substantiated at the second report. Similarly, Drake et al. (2003) found that 17.6% of the initially unsubstantiated neglect reports resulted in substantiated re-reports.

There is a large number of re-reporting when an unsubstantiated report is followed by a substantiated report. This suggests that children are overlooked by reporters and go unreported, even though their family situation continues to place them at risk of future maltreatment (Bae et al., 2007). All of these findings imply that not only focusing merely on substantiated reports would exclude a large number of children and families at risk of future maltreatment exposure, but also re-reporting possibly results in the subsequent identification of re-maltreatment (Bae et al., 2010). Based on these findings, almost all recent papers studied recidivism at the report level, not at the substantiation level, including all reports irrespective of their dispositions (Bae et al., 2009, 2010; Casanueva et al., 2015; Connell et al., 2007; Dakill et al., 2011; Drake et al., 2003, 2006; Fluke et al., 2008; Johnson-Reid et al., 2003, 2010a; Kohl et al., 2009; Proctor et al., 2012; Putnam-Hornstein et al., 2015a; Zhang et al., 2013). It was recognized that unsubstantiated events are a significant concern both due to the future risk for children and because of their sheer volume.

However, a few studies exist that have shown the association between the substantiation status and the risk of re-reporting (Fluke et al., 2009; Fuller and Nieto, 2009; Thompson and Wiley, 2009). These studies showed that children in initially substantiated maltreatment investigations return to the child welfare system, as either re-reports or re-maltreatments, at moderately higher rates than initially unsubstantiated cases, suggesting meaningful predictive validity for initial substantiation. Other studies either showed that there were slight differences in recidivism at the bivariate level which became non-significant when other factors were introduced (Drake et al., 2003; Lipien and Forthofer, 2004), that differences were very small (Putnam-Hornstein et al., 2015a), or that the magnitude of association declined in higher number of re-reporting (Johnson-Reid et al., 2010a).

In addition to these shortcomings, the use of substantiation as an outcome variable for prediction has been challenged. It was argued that the reliability of the outcome variable, namely substantiation, is crucial to the predictive accuracy or effectiveness of the predictive model or algorithm. However, since substantiation as a label to signify maltreatment is highly unreliable and does not represent incidence of maltreatment, an algorithm to predict it may be biased (Gillingham 2015).

Another problem is that while many cases are not notified, some populations are under hyper-surveillance so that even minor incidents of maltreatment are identified and reported in some groups (Lopez et al., 2015). The diversity of this group means predictive models may fail to identify reliable risk predictors, and instead use spurious risk factors, such as contact with administrative systems or earlier substantiations, which are likely to over-identify those with these properties while not identifying others for whom abuse is occurring (Keddell 2016).

2.4 POPULATIONS OF INTEREST AND DEFINITION OF RE-MALTREATMENT

This study formed its research design and adopted its central themes around the guidance provided by the literature on maltreatment recidivism as listed above:

- It is recognized that recurrence of maltreatment is a long-term phenomenon and a long observation window was selected (8-10 years depending on the initial report date).
- Given the potentially unique nature of multiple recurrences and the lack of knowledge in this area, the study focused on the chronically maltreated for policy and practice concerns.
- The complex dynamics of recurrence is recognized and large networks of maltreatment relations are studied using network effects on perpetrators and victims in their ecosystems.
- The study analyzed both re-reporting and re-maltreatment and measured chronic maltreatment by the number of re-reports given the problems of substantiation in measuring the real harm to children.

2.4.1 POPULATIONS OF INTEREST

In this study, the main population of interest is all perpetrators known to the child welfare system. In addition, for different research questions, additional populations of interest were selected, which are all children born who were born in Florida, all children who died in Florida, and all children known to the child welfare system.

One area of divergence between this study and the earlier research is the unit of analysis. Virtually all of the analyses of child maltreatment recurrence have used child-level data (Casanueva et al., 2015; Connell et al., 2007; Drake et al., 2003; Fluke et al., 1999, 2008; Fuller and Nieto, 2009; Johnson-Reid et al., 2010a, Kahn and Schwalbe 2010, Kohl et al., 2009; Lipien and Forthofer, 2004; Palusci 2011, Proctor et al., 2012; Thompson and Wiley, 2009; Yampolskaya et al., 2015; Zhang et al., 2013). Relatively few studies have examined this phenomenon at the family level (Bae et al., 2007, 2009, 2010; Cheng and Lo, 2015; De Panfilis and Zuravin, 1999b; English et al., 1999; Fuller and Nieto, 2013), which have included some perpetrator characteristics. While one study covered both child and perpetrator-level data (Johnson-Reid et al., 2003), only a few recent studies have looked into the recurrence of maltreatment at the perpetrator level (Johnson-Reid et al., 2010b; Way et al., 2001).

This study selected the *perpetrator* as the unit of analysis in analyzing chronic maltreatment for several reasons:

- The perpetrators were understudied in the literature of recurrence of maltreatment as noted above. This report aims to contribute to the knowledge of re-maltreatment by providing further insight around the central role of perpetrators.
- Perpetrator recidivism is of particular interest to practitioners and researchers, because child welfare interventions and programs generally designed to produce changes in the behavior of the perpetrator/caregiver rather than the child so that adequate care can be provided to children (Johnson-Reid et al., 2010b; Way et al., 2001).

- Recidivism is not confined to maltreatment of the same children in a family or household. An adult may leave one home and enter another relationship that exposes them to other children, or children in a family may be placed into foster care following a report of maltreatment while others remain in the home (Johnson-Reid et al., 2003). Nearly half of recidivism cases involved at least one new victim not listed on a prior report and about 14% had two or more new victims (English et al., 1999; Johnson-Reid et al., 2010b). Hence, over a long observation period, not only the adult caregivers in a family change (Loman, 2006), but also perpetrators may maltreat other children in the family not maltreated in the earlier report or new children joining the family unit. Siblings may not be named as victims on a report but may still be exposed to maltreatment (Hamilton-Giachritis and Browne, 2005). Under these circumstances, recidivism rates calculated solely on child-level data would underestimate the proportion of perpetrators who re-offend by targeting a different child within the family.
- Unlike at the child or family level where recidivism can be only measured until maltreated children turn 18, recidivism measured at the perpetrator level can extend throughout a much longer time, namely for the life of the perpetrator. Research has shown that some perpetrators return to the child welfare system at a high rate even if the initial event was not substantiated. (Way et al., 2001). Since the recurrence of maltreatment is a long-term phenomenon, it is critical to determine to what extent alleged perpetrators remain at risk to re-offend. This implies that it would be necessary to know how to identify high-risk perpetrators in order to develop and provide voluntary services to this group as early as possible (Way et al., 2001).
- Intergenerational maltreatment is an influential factor for adverse outcomes such as maltreatment fatalities and chronic maltreatment. Selecting the *perpetrator* as the unit analysis enables the prediction of the recurrence of maltreatment more effectively by integrating intergenerational maltreatment directly to the model as a covariate of the perpetrator.
- The preliminary data analysis showed that chronic maltreatment is more closely associated with a perpetrator rather than a victim. It is observed more often when a perpetrator comes back to the child welfare system repeatedly with the same or different victims. Over time, repeat perpetrators can be tracked more accurately, because their behavior seldom changes, if not deteriorates. On the other hand, the circumstances of the child change more often (new families, placements), and those conditions conducive to maltreatment may disappear. Predicting recurrence of maltreatment for a perpetrator and linking this risk to the risks of victims connected to this perpetrator was found to be a more effective approach of the analysis.

2.4.2 Definition of Re-Maltreatment

Recurrence rates vary heavily based on length of the follow-up window and whether rates are calculated for all reports or only for substantiated or verified maltreatment. In the context of the federal child welfare performance measurement system, re-maltreatment refers to circumstances in which children that have previously been substantiated as victims of maltreatment experience another incident of substantiated maltreatment. Recurrence of maltreatment is now a well-established indicator of child welfare system effectiveness; in the United States, forming part of the ongoing Federal Child and Family Services Review (CFSR) process (Carnochan, 2013). Annual reports by the federal government document six-month

recurrence rates for each state. For Round two of the CFSR, established the national standard for the absence of maltreatment recurrence as 94.6 percent, defined as: “Of all children who were victims of substantiated or indicated abuse or neglect during the first six months of the reporting year, what percent [sic] did not experience another incident of substantiated or indicated abuse or neglect within a six-month period?” (Federal Register, 2006).

However, in child welfare literature, as presented in the previous section, re-maltreatment has been defined and studied in ways that go beyond the federal definition. The primary complication in the studies of re-maltreatment is the method by which it is measured. In many states, two basic categories of maltreatment reporting exist: *substantiated* and *unsubstantiated*.

- *Substantiated* or *verified* refers to cases in which it has been determined that sufficient evidence of abuse or significant risk of abuse exists.
- In contrast, unsubstantiated or no-indicator cases refer to those in which evidence is determined to be insufficient but are nonetheless reported to the child welfare system.

In Florida, there is a third category of disposition: *some indicator*, used to identify unsubstantiated cases in which there is reason to believe that maltreatment occurred or risk exists without meeting the evidentiary requirements for verification.

These categories of case disposition are important given the consequences of using verification as a gate-keeping mechanism relative to services and placement. Section 2.3.4 presents the complications regarding the substantiation issue and suggests that a narrow focus only on children identified as verified victims of maltreatment may be overly restrictive, preventing an understanding of chronic child protection involvement over time. Based on the analysis conducted in the interim report (NH-SAS, 2016) and the findings from research literature, this report adopted the following modes of analysis:

- All maltreatment reports, regardless of their dispositions, are studied to analyze chronic maltreatment, examining all transitions: from unverified to verified, from verified to unverified and from verified to verified.
- *Perpetrator* was selected as the unit of analysis to study recurrence of maltreatment, while complex dynamics of recurrence in terms of single/multiple perpetrator and victim relationships are examined in networks.
- The re-reporting or study period of 8-10 years was selected to capture the long-term nature of the chronic maltreatment problem.
- This study covered not only the first re-report, but also multiple recurrences to analyze the chronic maltreatment problem. The chronic maltreatment is defined as five or more reports (or four or more recurrences) during the study period following the definition adopted by (Johnson-Reid et al., 2010a, Loman, 2006) for *frequently encountered* families. Moreover, the distribution of the cumulative number of reports shows that approximately 10% of the cohort represents the chronically maltreated group, which is an appropriate proportion to predict. It is a common practice in predictive analytics to target the top decile of the population to identify high-risk individuals.

Considering the above, the following definitions were used in this report:

A **report** is a screened-in report that has been accepted for investigation or assessment.

The **initial report** is the first report of maltreatment of a perpetrator or caregiver with no prior report regardless of disposition (or verification) of the alleged maltreatment.

A **re-report** refers to any subsequent maltreatment report for a perpetrator, regardless of verification of the alleged maltreatment.

Re-maltreatment refers to subsequent, verified maltreatment reports for a perpetrator, following a previously verified report.

The **re-reporting (**or **study) period** refers to the period between the initial report date and the end of 2014.

Chronic maltreatment refers to five or more re-reports during the study period.

A **maltreatment fatality** is defined as a fatality from abuse or neglect, because either (a) the injury from the abuse or neglect was the cause of death, or (b) the abuse and/or neglect was a contributing factor to the cause of death.

SECTION 3 DATA ANALYZED

3.1 DATA SOURCES

The following data sources were used in this study:

- Florida Safe Families Network (FSFN)
- Florida Vital Statistics Birth Records
- Florida Vital Statistics Death Records
- ACCESS Data
- Healthy Families Data

3.1.1 FLORIDA SAFE FAMILIES NETWORK (FSFN) DATA

FSFN was the main source of data for this report, containing rich information on several child maltreatment activities and services going back to the 1980s. FSFN contains information on hotline reports, intakes, allegations, assessments, investigations, services, and placements. In addition, demographics, relationships, and addresses of persons in reports and cases—victims, perpetrators, siblings, and caregivers were used in the study. FSFN data was used to define the study cohorts as well as most of the risk factors generated to predict child re-reporting and re-maltreatment.

3.1.2 FLORIDA VITAL STATISTICS BIRTH RECORDS

Florida Vital Statistics Birth Records used for this study consist of all the birth information on children who were born in Florida between 1990 and 2014, inclusive, with over 5.2 million birth records. The data elements included information on the birth, the child, the mother, and the father.

3.1.3 FLORIDA VITAL STATISTICS DEATH RECORDS

Florida Vital Statistics Death Records used in this study contain all the fatalities recorded in Florida between 1975 and 2014, inclusive, with over 6.2 million death records. The data elements include information on the fatality, the deceased, and manner of death.

3.1.4 ACCESS DATA

ACCESS houses public assistance data for several benefit programs such as Medicaid, Temporary Assistance to Needy Families (TANF), and Supplemental Nutrition Assistance Program (SNAP). ACCESS data included four primary files on participant demographics, addresses, relationships, and participation details between 2010 and 2014. Eligibility files had over seven million records by the end of 2014. In this analysis, the ACCESS data was used as a proxy for socioeconomic status.

3.1.5 *HEALTHY FAMILIES DATA*

Healthy Families Florida is a voluntary home visiting program for expectant parents and parents of newborns with certain risk factors that would indicate the need for home visiting services and lasts up to five years. The assessment information and demographics of families (children and parents) are used in this study. The data includes historical information on 65,264 unique families and 115,614 children. The analysis included both the target children (the child mother is pregnant with or just gave birth to when she scored into the program) and non-target children (siblings, older or subsequent) who may or may not be the primary focus of program services.

3.2 OVERVIEW OF ENTITY RESOLUTION

The entity resolution process is central to any longitudinal analysis and network studies. Entity resolution involves identifying multiple and varying references that should belong to the same person or entity and reconciling them so that they are recognized as belonging to the same person or entity. This involves matching of the personally identifiable information (PII) at different combinations across records. SAS's entity resolution methodology, which uses a multi-step approach and fuzzy matching algorithms with match keys generated by SAS® DataFlux® technology was presented in detail in the final analytics report from FY14-15 (NH and SAS, 2015a). The detailed steps of the entity resolution specific to this study is presented in the Data Assessment report from FY15-16 (NH and SAS, 2016b). Each person is assigned a Key ID (KID) that uniquely identifies a true person, regardless of identifier assignment by the source system.

It is argued that although some studies have been conducted with extensive controls to account for duplicate counts of children, many scientific studies of maltreatment based on administrative data from CPS agencies have not taken into account multiple identities included in the data (Helie and Bouchard, 2010). Because, in general, the PII is not available to researchers who work with de-identified data, the extent of duplication within CPS data sets remains unknown. The implications of this shortcoming are severe. The current study estimated that one out of every five unique individuals have a history in FSFN under two or more different FSFN person identifiers. This means that there is 20% chance that a person's maltreatment history would be incomplete, which would introduce significant bias and measurement error into the analysis of re-reporting and re-maltreatment. Assuming a case has three to four participants on average, a typical case has a 50% to 61% chance that some information is missing due to the existence of multiple identities for the same person over time (NH and SAS, 2016b).

The entity resolution process provided major advantages:

- Tracking the same person over time enabled accurate counting of the previous reports. Since the history of previous reports is a critical risk factor for recurrence of maltreatment, the model performance would be adversely impacted.
- The intergenerational child maltreatment is also a key risk factor in the analysis of re-maltreatment. Without an entity resolution process, it would be very challenging to identify perpetrators who were victims of maltreatment themselves in the past, since their FSFN Person IDs could be different in another case many years earlier.

- By resolving every person with a unique identifier, correct values are assigned to each individual, which substantially improves the internal validity of the research. Otherwise, a person may appear in the data multiple times with different values, introducing measurement errors. This is critical, since the victim cohort for the base period of 2004-05 in this study excluded children with prior maltreatment reports. Applying the unique identifiers provided by the entity resolution process, approximately 215,000 victims had no prior reports for this period. In contrast, without the entity resolution as many as 90,000 records would have been erroneously included as victims with no prior history as different identities would have gone undetected. Having nearly one-third of the cohort represented with multiple identities would have diminished the internal validity of the research.
- The entity resolution process enabled accurate and complete network relationships to be built between children and adults at different levels as described below. The network of these relationships played a critical role in identifying high-risk individuals and families for the recurrence of maltreatment.

3.3 Construction of the Analytic Data Sets

Several analytic data sets were generated for this study. While some of these data sets were generated for the entity resolution process, others were built for cohort analysis and predictive models. The study cohorts were built after the entity resolution process, using the KID as the person identifier as follows. Table 2 demonstrates the sizes of all cohorts and populations used in this study for reference.

Table 2: Study Cohorts and Populations

Cohort/Population	Number of Records
2004-2005 Perpetrator/Caregiver Cohort	
All Individuals	291,499
with one Report (Single Occurrence)	169,760
with two Reports (Single Recurrence)	52,204
with three Reports (Two Recurrences)	26,315
with four Reports (Three Recurrences)	14,777
with five or more Reports (Chronic Maltreatment)	28,443
2004-2005 Victim Cohort	215,506
2009 Victim Cohort	53,252
2012 Victim Cohort	198,058
2005 Birth Cohort	226,776
2009 Birth Cohort	221,638
ACCESS 2010-2014 Data	10,165,184
Health Families Population	
Children	115,614
Families	65,264

3.3.1 FSFN Cohorts

In this study, several FSFN cohorts were generated for different analysis purposes:

- 2004-05 perpetrator cohort
- 2004-05 victim cohort
- 2009 victim cohort
- 2012 victim cohort

For the main analysis, the years 2004 and 2005 were selected as the base period for several reasons:

- Investigation records, which contain the critical disposition information, are not available prior to this period.

- Choosing 2004-2005 as the starting period provides an adequate length of time to track re-maltreatment episodes over multiple years.
- The 2004-2005 period allows for the inclusion of the impact of intergenerational child maltreatment for perpetrators who were victims during the 1990s.

Two cohorts were selected using 2004-2005 as the initial or base period: a *perpetrator cohort* and a *victim cohort*. The perpetrator cohort file was formed including all adults with either a perpetrator or a caregiver role in a screened-in report during these two years. Most of the adults involved in alleged maltreatments appeared switching roles between caregiver and perpetrator repeatedly over time. By selecting any initial report with any of these two roles avoided undercounting of perpetrators, many of whom may appear in their initial reports as caregivers. The recidivism rates of individuals with caregiver or perpetrator roles in their initial reports were almost identical, at 42%.

The distribution of individuals with chronic maltreatment histories showed that 35% (9,872 perpetrators) had a caregiver role in their initial reports. Of them, 95% had at least one eventual allegation as a perpetrator and two-thirds eventually became alleged perpetrators two or more times. Hence, including subjects with a caregiver role in their initial reports more correctly reflected the reality and improved the model in predicting chronic maltreatment substantively. Moreover, the predictive models controlled for the role so that including caregivers with no future perpetrator roles would not introduce a bias.

The perpetrator cohort file had 291,499 individuals with an initial report in the base period. Of those, 62% (180,062) entered the system as an alleged perpetrator, while the remaining 111,437 entered as caregivers, majority of whom eventually became perpetrators. Of this cohort, 47% was due to their first reports in 2004, while 53% was due to the initial report in 2005.

The 2004-2005 victim cohort comprised of all victims with their initial report during the 2004-2005 period, containing 215,506 unique children. Similar to the perpetrator cohort, almost half of them (48%) were due to initial reports in 2004.

The core analytic data sets were built by combining the two cohorts and selecting all relevant reports for perpetrators and victims between their initial reports (in 2004 or 2005) and 2014. A victim report file included report dates, investigation disposition status, and maltreatment types. If a victim had more than one maltreatment types, they were all retained in the record.

Two critical exclusions were applied, which are common practices in the literature (English et al., 1999; Fuller and Nieto, 2009; Helie et al., 2013; Johnson-Reid et al. 2003, 2010a; Kohl et al., 2009; Putnam-Hornstein et al., 2015a). Victims and perpetrators with reports prior to the base period (2004-2005) were excluded so that complete re-maltreatment histories could be tracked up to 10 years starting from the initial report. By applying this exclusion, baseline differences due to prior reports are eliminated and report histories contribute to the cumulative risk as new reports were added. Moreover, this was important from an analytical perspective; since the number of prior reports has been identified as a powerful predictor in the literature and prior studies, not applying this exclusion would have masked the influence of other potential predictors.

All reports within 14 days were combined and treated as a single report. This coincides with the Federal definition. Moreover, this consolidation is justified due to the concern that same victims and/or perpetrators may be re-reported about the same situation in the initial report. For example, there is the possibility that a subsequent report may be made by a different person for the same incident. If there were multiple maltreatment types among multiple reports within 14 days, all types were retained in the record. If the level of substantiation was different, the most serious disposition was retained—*verified* being the most serious, followed by *some indicator* and finally *no indicator*. The resulting cohort files contained 503,413 reports for victims and 390,195 reports for perpetrators. In addition to the cohort report files, several other tables were generated to include all potential covariates or predictors for the predictive models, such as demographics, geography, household characteristics, family relationships, services, and placements.

Two other FSFN cohorts were built for additional analysis. A second victim cohort of 53,252 children was built containing all children born in 2009 and with one or more maltreatment reports between 2009 and 2014 but with no reports prior to 2009. This cohort was generated with three objectives. The first was to compare the 2009 birth cohort against the 2005 birth cohort to assess if any differences were observed over time in prevalence of child maltreatment, particularly to compare between periods prior to and after the economic crisis in 2008. The second was to match the 2009 cohort against the ACCESS data to study the role of economic hardship and poverty in the recurrence of maltreatment. Since the ACCESS data was not available for years before 2010, this analysis could not be performed with the 2004-05 cohort. The third was to match this cohort against the Healthy Families population to understand the extent to which the two different but complementary systems serve children in common.

Yet another victim cohort was built consisting of 198,058 children with at least one screened-in or screened-out maltreatment report during 2012 to compare the recurrence of maltreatment between children who were screened in and children who were screened out. Since the FSFN data did not include all screened-out reports prior to 2012, this analysis could be conducted only for the last three years of the study period—between 2012 and 2014. The first reports of almost 35% (68,928) of the children in this cohort were screened out, while the first reports of the remaining 65% were screened in. It should be noted that this cohort included all victims with a report in 2012, irrespective of their report histories.

3.3.2 Birth Cohorts and Other Populations

Two birth cohorts and two other populations were generated to be linked to the analysis cohorts from FSFN as follows:

- 2005 birth cohort
- 2009 birth cohort
- 2010-14 ACCESS population
- Healthy Families population

The 2005 birth cohort contained 226,776 children, while the 2009 birth cohort consisted of 221,638 children. These birth cohorts were used to estimate the prevalence of maltreatment for children born in 2005 and 2009 over the five-year period following the respective year. These

estimates were made by matching each birth cohort against the respective victim cohorts by year, which then identified children born in 2005 or 2009 with at least one report over the respective five-year period.

The 2010-14 ACCESS population was used to match against the 2009 FSFN cohort to assess the extent of overlap between families receiving social services such as TANF, SNAP or Medicaid and those who had contact with the child welfare system. The ACCESS population file included 10,165,184 individuals by FLORIDA PIN (may include duplicate individuals since no entity resolution process was conducted to resolve ACCESS IDs), who received public social services at least once between 2010 and 2014.

As noted earlier, the 2009 FSFN cohort was also matched against the Healthy Families population to assess the extent of overlap between FSFN and Healthy Families. The Healthy Families population, which consisted of 115,614 children, was also matched against the 2009 birth cohort to estimate the proportion of children born in a year that participated in the Healthy Families program over the five years following birth.

3.3.3 Report Histories and Networks

The earlier study on alleged child maltreatment fatalities presented a new approach, which included multi-level report histories and family networks (NH and SAS, 2015a). This approach was shown to be quite effective in explaining the likelihood of alleged child maltreatment fatalities and was also adopted in this study. A summary of this methodology is given below; a more detailed description is available in the earlier report.

A specific relationship hierarchy was defined between a given perpetrator and others in the perpetrator's event history. This hierarchy was built to better understand the complex relationships between the networks of perpetrators, victims, siblings, and caregivers. It proved to be effective in predicting chronic child maltreatment, allowing the analysis to capture network effects among individuals and families.

The primary role of the relationship hierarchy was to provide a layered methodology to enable counting of all previous referrals and reports in the network of a reference perpetrator. The hierarchy consisted of three levels, each built for a given reference perpetrator:

- A Level 0 relationship is based on the direct mapping of the reference KID to its own previous reports in which the reference KID was a perpetrator. By definition, all Level 0 reports occurred after the initial report.
- Level 1 reports were defined as previous reports of maltreatment involving the reference perpetrator, of other person-roles directly connected via the initial allegation report of the reference perpetrator. Furthermore, if the perpetrator was previously involved in one or more reports as a child victim, these reports were considered Level 1 report histories.
- Level 2 reports were defined as previous reports of maltreatment, not involving the reference perpetrator, of other person-roles indirectly connected via initial allegation report of the reference perpetrator. A given perpetrator may be related to other maltreatment allegations via shared perpetrators, victims, caregivers and others, and it

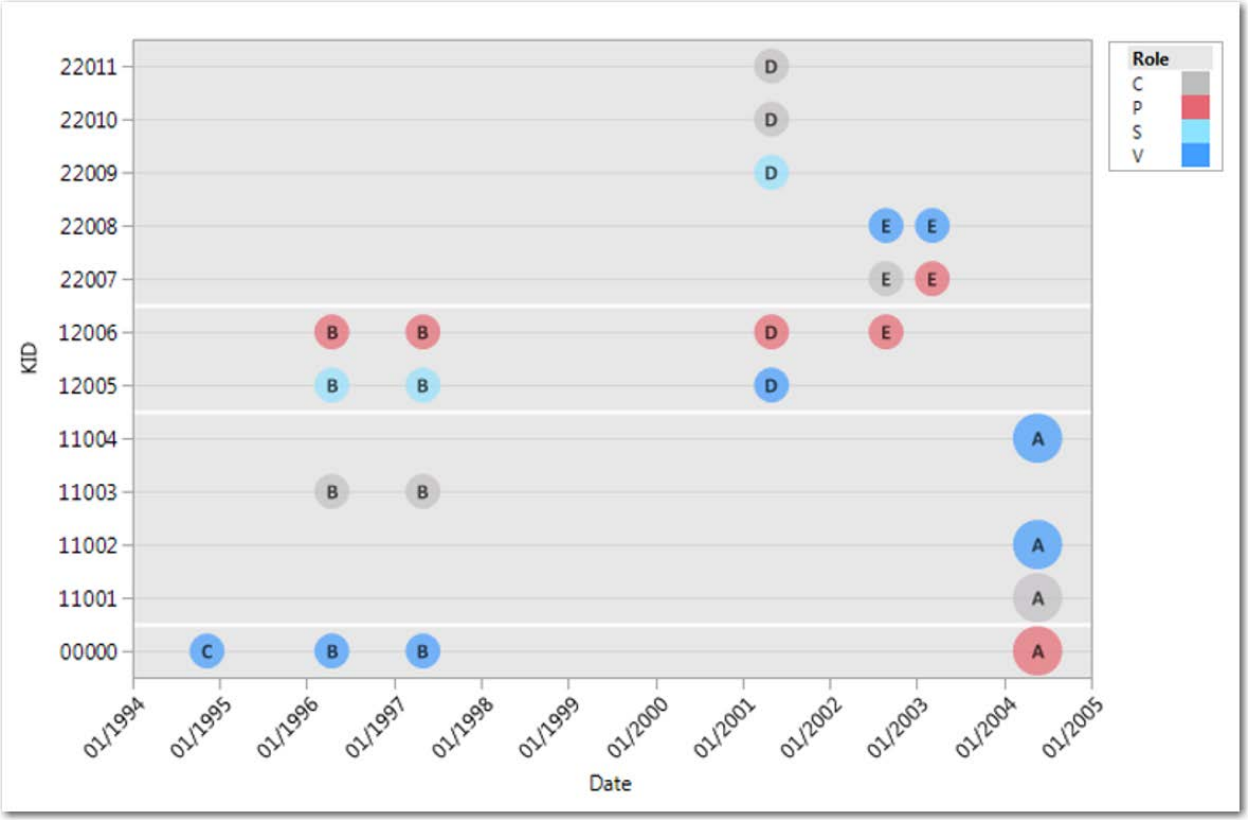
is this concept that prompts the definition of Level 2 as it offers insight into indirect risks for a given perpetrator. For example, a partner of the reference perpetrator may have a history as a perpetrator in other maltreatment allegations not involving the reference perpetrator.

In this classification, the roles of a person within a maltreatment allegation were taken into account. These roles, retrieved from the maltreatment allegation reports or the investigation records, were aggregated into four classes—*perpetrator*, *victim*, *caregiver* and *other non-victim siblings*. A person could have multiple roles in a case, and multiple persons could have the same role in a case, such as in the case of multiple victims or multiple perpetrators.

Different levels of report histories and the relationships within a network are illustrated with an example in Figure 1. The colors show the roles—perpetrators in *red*, victims in *blue*, caregivers in *grey* and non-victim children in *light blue*. The larger size of the bubbles indicates a report with verified maltreatment. Level 1/2 refers to cases in which both Level 1 and Level 2 relationships were observed. Finally, the letters in the bubbles identify the different cases. Each row represents a distinct individual with changing roles over time.

In this example, Case A is the initial report for the reference perpetrator, with another caregiver and two victims. It can be seen that multiple previous reports existed at the time of this report. The perpetrator of Case A was maltreated in the past in Cases B and C, showing a case of intergenerational maltreatment. Case B, eight years earlier, included another perpetrator and a sibling from the family of the reference perpetrator. The perpetrator of Case B continued to be a perpetrator in Cases D and E maltreating other children. The maltreated child in Case D was the sibling of the perpetrator in Case B. As can be seen, properly understanding the network is important in assessing risk of repeated maltreatment. All these networks were connected with the help of the entity resolution process, which resolved the multiple identities of persons over time.

Figure 1: Report History Levels and Networks



*KID identifies a unique person.

SECTION 4 DATA EXPLORATION AND ANALYSIS

4.1 DESCRIPTION OF THE METHODOLOGY FOR ANALYTIC APPROACH

This section describes the methodology used in exploratory data analysis and predictive modeling. The dependent and independent variables are described, and findings from univariate analysis of key characteristics are discussed.

4.1.1 DESCRIPTION OF THE EXPLORATORY ANALYSIS

The purpose of exploratory data analysis is to present descriptive findings of re-reporting and re-maltreatment behavior of perpetrators. Recurrence of maltreatment occurs in stages; first recurrence stage (between the first report and second report), second recurrence stage (between the second report and third report), and so on. The chronic maltreatment was defined as five or more reports (or more than three recurrences). It was shown in the interim report that approximately 60% of all 2004-05 cohort perpetrators had no recurrence, with no report subsequent to the initial report over the study period of 8-10 years, and approximately 10% of the perpetrator cohort had more than four reports over the study period (NH and SAS, 2016a). The latter the target analysis group for this study.

The exploratory data analysis is made up of the following areas:

- In Section 4.3, a univariate analysis identified potential correlates based on the literature review above to contrast the chronic and single-report perpetrators. The main research questions were:
  - Does the risk of recidivism (of alleged maltreatment as captured by re-reporting) among perpetrators vary by perpetrator, child, household/family, and/or report/case and community characteristics?
  - What are the network effects of perpetrators with chronic maltreatment? What priors were observed at different report history levels? What is the extent of intergenerational maltreatment for this group?
  - Are multiple perpetrators and victims included in the child maltreatment recurrence? What are the relationship between the perpetrator and victim(s) for chronic maltreatment cases?
  - Is the type of maltreatment at the initial report associated with chronicity? What is the probability of different maltreatment types by the time a perpetrator becomes chronic? How do maltreatment types evolve for a perpetrator?
- In Section 5.1, a three-part cohort analysis is presented to address the following research questions:
  - What is the probability of having a maltreatment report for all children born in Florida? What is the probability of having a verified report for all children born in Florida? Are there any shifts between 2005 and 2009?
  - What is the probability of participating in both public assistance and having a child maltreatment report for all children born in Florida?

- What is the probability of participating in the Healthy Families programs for children who had a maltreatment report before and/or after participating in the program?
- What are the differences between a child in Healthy Families program who has a maltreatment report and a child who does not in terms of the child's characteristics, the mother's characteristics, and family risk factors?

- In Section 5.2.1, the prevalence rates and the time to re-reporting and to chronic maltreatment is examined to address the following main research questions:
  - What is the prevalence rate of chronic maltreatment?
  - How long does it take to move across re-reporting stages and how long does it take to reach chronic maltreatment (the fifth report) from the initial report?
- In Section 5.2.2, the substantiation issue is explored with the following research questions:
  - Is the verification status of the initial report associated with chronicity? What is the probability of verification by the time a perpetrator becomes chronic?
  - How does the verification status of a report evolve for a perpetrator?
  - What are the proportions of different transitions types between the initial and last reports?
- In Section 5.2.3, screened-in and screened-out reports are compared with respect to chronicity to address the following research question:
  - What is the probability of becoming a repeat perpetrator whose first report was screened in? What is this probability for perpetrators whose initial report was screened out?
- In Section 5.5, maltreatment reporting trajectories of children are studied using longitudinal clustering technique to address the following research questions:
  - What are the common patterns, or trajectories, of maltreatment reporting?
  - What proportion of the population belongs to each trajectory?
  - What covariates are associated with children in the different trajectory patterns?
  - Does the substantiation status of reports affect these trajectory patterns?
- In Section 5.6, child fatalities were studied using Vital Statistics Death Records to address the following research questions:
  - How do the fatality rates of children with a history of alleged maltreatment compare to the general childhood fatality rates? Are there differences in the causes of death? Is the degree of chronicity of a known perpetrator a factor for the fatality rate and causes of death?

4.1.2 PREDICTIVE MODELING

A collection of models was built to predict the likelihood that a subject (alleged perpetrator or caregiver) would accumulate enough child maltreatment reports to be considered chronic. As defined, maltreatment was considered chronic when a subject accumulated five or more maltreatment reports. Initial exploratory analysis suggested separate chronicity models to be fit for subjects with one, two, three, and four reports. Each model used information available at the completion of the investigation of the corresponding report count.

The model for subjects with one initial report was of special interest. The ability to identify individuals likely to become chronic could be used to make service and intervention decisions at the earliest opportunity. Appropriately chosen, these services or actions could reduce risk to the most vulnerable children and diminish the chances of repeat contact with the child welfare system.

The discussion of the chronic perpetration risk models covers five topics.

- Section 5.3.1 presents an initial overview of the models and the underlying data.
- More than 400 potential risk factors were examined for each of the chronic perpetration risk model. Section 5.3.2 describes the categories of these risk factors and the different variations considered within each category.
- Approximately 20 risk factors were chosen from the 400 candidate risk factors by applying predictive modeling techniques. The final risk factors were selected due to their strong relationship to chronicity. Section 5.3.3 discusses the relative importance of the selected risk factors in predicting chronic perpetration.
- The performance of the fitted models was assessed from both the statistical and the practical point of view. The results of this assessment are found in Section 5.3.4.
- Finally, while many risk factors were captured in the chronic perpetration risk models, it was not obvious from the model itself as to which were the most important in differentiating a chronic perpetrator from a non-chronic individual. Likewise, whether the models could help differentiate the individuals with no re-report after the initial report was examined. These model interpretation concepts are presented in Section 5.3.5.

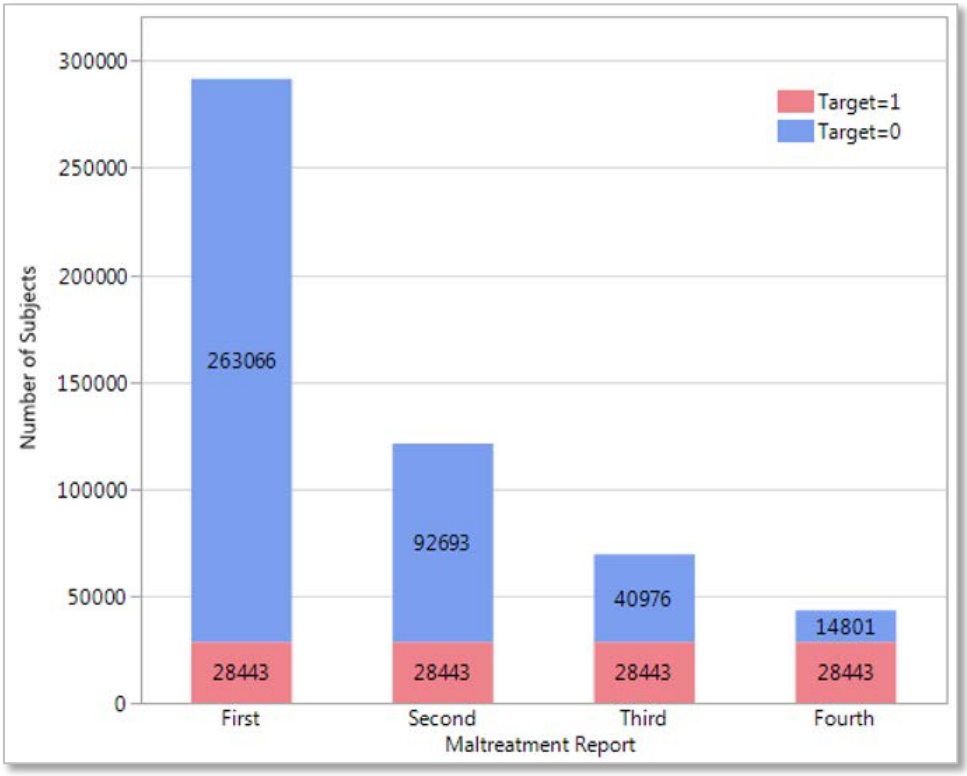
4.2 DEPENDENT VARIABLES

The dependent variables for the chronic perpetration risk models were defined for the 2004-05 perpetrators cohort described in Section 3.3.1. For each member of the cohort, up to four binary dependent variables ($target_1$ for the initial report looking forward to the second report, $target_2$ for the second report looking forward to the third report, and similarly $target_3$, $target_4$) were created to correspond with the four chronicity models. Starting with the initial report, the dependent variables took on the value 0 if there were no subsequent reports and the value **1** if there were ultimately five reports for the subject. If a subject did not have a report for the model (for example a second report for the second report model), that subject was excluded from the analysis for that model. Figure 2 summarizes the distribution of dependent variable.

Associated with each dependent variable and each subject was a time origin. This was the date on which a subject's report (corresponding to the model number) came to the child welfare

system. For example, for the first-report model, this was the day the subject's first report came to the child welfare system. The time origins were critical because a subject's case-history-based independent variables could only use information known before the time origin.

Figure 2: Dependent Variable Distribution



4.3 Independent Variables Considered for the Re-Maltreatment Analysis

Several child and family characteristics have emerged as statistically significant risk factors in the literature. These factors were assessed in this study to determine which were likely to contribute to recurrence of maltreatment. Some of these factors were included in the final models, while other variables were excluded either because they were not statistically significant or the data for these factors were incomplete.

Table 3 shows the descriptive statistics of single-occurrence (SO) and chronically maltreating (CM) perpetrators, comparing those who had no subsequent report after the initial report and those with more than four reports to understand the contrast between the extremes. The SO group had 170,288 perpetrators and CM group had 28,443. While the remaining, 93,296 perpetrators with two to four reports are not included in Table 3, they were included in the development of the final models. This analysis assumed that the association between covariates and chronicity was constant across reporting stages. However, as shown in the literature, these relationships may change. These associations simply display the relationship between a risk factor and chronicity at the time of the initial report for two comparison groups to provide this insight to the model variable selection as described in the next section. While

almost all variables were measured at the initial report, a few were measured at the fifth report. Report histories were shown for both first and fifth reports. Post services and placements display cumulative counts after the initial report through the end of the study period.

The chi-square (for categorical variables) test and the t-test (for numeric/continuous variables) were used to assess statistical differences in the distribution of child and family characteristics between these two groups. The difference across columns (groups) was considered statistically significant if the p-value was less than 5%. [1]. The intent was to identify risk factors with statistically significant differences between the two groups that would be strong candidates in the predictive models.

In addition, the table shows the odds ratios for the covariates to demonstrate the impact of the class or increment in value of each covariate on chronicity[2]. An odds ratio is a measure of how likely a person with a certain attribute (for example, female) is to have the outcome (for example, chronic maltreatment), relative to another person without the attribute (male, or non-female). An odds ratio of **1** indicates that there is no impact; an odds ratio **< 1** decreases the odds, and an odds ratio **> 1** increases the odds. The odds ratio is useful in assessing the likelihood of a particular outcome (for example, being a chronically maltreating perpetrator) if a certain factor (for example, the perpetrator's gender) is present.

Table 3: Characteristics of Perpetrators of the SO and CM Groups

Covariate Values at the First Report[a]	SO Group (N=169,760)	CM Group (N=28,443)	Odds Ratio
Perpetrator Gender			
Female*	53%	64%	2.07
Male (Ref)	47%	36%	
Perpetrator Age* (Median)	35	27	.94
Perpetrator Ethnicity			
Black*	23%	24%	.92
Hispanic*	25%	14%	.45
White (Ref)	51%	61%	

[1] Chi-square tests are often used to assess statistically whether the row proportions of a categorical (for example, male or female) are different across columns (SO and CM), while t-tests are used to test statistically whether the means of a numeric variable (for example, the perpetrator's age) are different across the two groups. The chi-square test is used to identify whether or not the distributions of categorical variables are different across groups to assess if the tested variable contributes to a group difference. It is a test of independence comparing the actual observations with those would expect if two categories of the selected variable were equally likely in both groups. A t-test is a useful test when there are two samples and the goal is to determine whether the differences between the means are significant. Comparing it to the selected significance level, the null hypothesis (that two group means are the same) is accepted or rejected. If the t-statistic is less than the significance level, the difference between two groups' means most likely reflects a *genuine* difference in the population from which the groups were sampled. Significance level refers to the likelihood that the probability of mistakenly rejecting a null hypothesis (such as the equality of means across groups) and must be lower than 5%.

[2] The odds ratio is the ratio of the odds of an event occurring in one group to the odds of it occurring in another group such as the SO group vs. CM group. If the probabilities of the event in each of the groups are p1 (first group) and p2 (second group), then the odds ratio is: (p1/(1-p1))/(p2/(1-p2))

Covariate Values at the First Report[a]	SO Group (N=169,760)	CM Group (N=28,443)	Odds Ratio
Victim Gender			
Female*	50%	50%	.97
Male (Ref)	49%	51%	
Victim Age in Years* (Median)	6.7	3.3	.90
Alcohol and Substance Abuse*	19%	28%	1.70
Mental Health*	14%	19%	1.45
Family Violence*	23%	30%	1.38
Household Size* (Mean)	4.4	4.3	.98
Number of Victims* (Mean)	1.6	1.8	1.1
Perpetrator-Victim Relationship			
Perpetrated by Parent(s)*	66%	80%	2.1
Perpetrated by Non-Parent(s) (Ref)	34%	20%	
Caregiver vs. Perpetrator Role in the Initial Report			
Perpetrator*	61%	65%	1.15
Caregiver (Ref)	39%	35%	
In-Home Services			
Prior Services*	2%	5%	3.7
Post Services*	8%	37%	7.1
No Services (Ref)	90%	58%	
Placements			
Maltreatment before placement*	5%	8%	2.3
Maltreatment after placement*	2%	22%	7.3
No Placement (Ref)	93%	70%	
Alleged Maltreatment Types			
Family Violence* (Ref=No)	23%	30%	1.38
Other Neglect*(Ref=No)	28%	32%	1.21
Physical Abuse*(Ref=No)	40%	33%	.73
Physical Neglect*(Ref=No)	29%	31%	1.09
Sexual Abuse*(Ref=No)	14%	7%	.53
Substance Abuse* (Ref=No)	18%	27%	1.69
Verification Status			
Verified*	21%	25%	1.37
Some Indicator*	29%	33%	1.34
No Indicator (Ref)	47%	40%	
Missing*	3%	2%	.64
Report Histories			
Level 0* (mean)	1.1	1.6(5.5)[b]	
Level 1* (mean)	4.3	7.3(23.2)[b]	
Level 2* (mean)	21.5	33.7(102)[b]	
Number of Report Histories > 10			
Yes*	35%	48%	1.72
No (Ref)	65%	52%	

Covariate Values at the First Report[a]	SO Group (N=169,760)	CM Group (N=28,443)	Odds Ratio
Intergenerational Maltreatment			
Yes*	4%	21%	7.3
No (Ref)	96%	79%	

* Statistically significant at 1%

a In Table 3, for categorical variables such as gender one of the categories is selected as the reference category and shown with a "(Ref)" label. In the calculation of odds ratios, all other categories (such as male) are contrasted against the reference category (such as female). In other words, the odds ratio show the ratio of the odds of another category to the odds of the reference group.

b The values in parentheses represent the number of historical reports at the fifth report that is, by the time the maltreatment becomes chronic.

4.3.1 Perpetrator, Victim and Family and Household Characteristics

4.3.1.1 Perpetrator Gender

Existing research has shown that female perpetrators have a greater likelihood of being re-reported than male perpetrators. This is supported in Table 3. While the gender distribution was almost even between male and female for the SO group (47% vs. 53%), almost two-thirds of the CM group was comprised of female perpetrators. This is also consistent with the national data which reports a slightly higher proportion (54%) of female perpetrators (USDHHS 2016). The odds ratio of 2.07 indicates that the odds of chronicity doubles when the perpetrator is female compared to when the perpetrator is male. The difference was statistically significant, and the perpetrator gender was included in the final models.

4.3.1.2 Perpetrator Age

The interim report explained that the recidivism rates of younger perpetrators were much higher than older perpetrators (NH and SAS, 2016a), which is also supported by existing research. The national data indicated that 41% of perpetrators were in the 25-34 age bracket in 2014 (USDHSS 2016). It can be seen in Table 3 that single-occurrence perpetrators were indeed older than chronic perpetrators, with the median ages of 35 for the SO group and 27 for the CM group. However, since it takes approximately five years to reach chronicity[3], the median age of the CM perpetrators rises to almost 33 by the time they reach the chronic status. The odds ratio for this variable was .94, meaning chronic maltreatment decreases by 6% for every year of perpetrator age. This was statistically significant, and the perpetrator age was included in the final models.

4.3.1.3 Race and Ethnicity[4]

Since the race/ethnicity information in FSFN is partial, birth records were used to supplement. Supporting the existing research, the findings showed that both black and Hispanic perpetrator are less likely than whites to be in the CM group. While the black perpetrators are closer to the

[3] See Section 5.2.1 which shows that the estimated median time to chronicity was 64 months.

[4] Even though race and ethnicity are two separate concepts, following the common practice in the research, four separate race/ethnic categories were used in this report: *black*, *Hispanic*, *other* and *white*. Black and White Hispanics were categorized as Hispanic. If there was a conflict between the race/ethnicity fields of FSFN and birth records, the latter was set as the standard.

white perpetrators in terms of chronicity risk, Hispanic perpetrators are half as likely to become chronical, with an odds ratio of .45. This is reflected in the fact that the proportion of Hispanics was 25% in the SO group but only 14% in the CM group. The proportion of white perpetrators, in contrast, was 10% higher in the CM group than in the SO group (61% in the CM group compared to 50% in the SO group). The difference was statistically significant, and perpetrator ethnicity was included in the final models. 2010 Census showed that, in Florida the proportion of the population with Hispanic or Latino origin was 22.5%. The proportions of black or African American origin was 16% and white alone (not Hispanic or Latino) was 57.9% in 2010.

4.3.1.4 VICTIM GENDER

In general, research has found that re-reports were not significantly associated with gender of the victim. This is supported in Table 3 in which it can be seen that the gender distribution was almost even between male and female for both SO and CM groups, with an odds ratio of .97. Even though the difference was statistically significant when the gender of the victim was examined on its own, the factor was not included in the final models since it was no longer significant when other variables were included in the multivariate analysis.

4.3.1.5 VICTIM AGE

The interim report explained that the recidivism rates of younger victims were much higher than those of the older victims (NH and SAS, 2016a). This is also supported by existing research and national data that have shown approximately 70% of victims were younger than five in 2014 (USDHSS 2016). It can be seen in the results in Table 3 as the victims of the SO perpetrators are older than victims of the CM perpetrators. The median age of victims was 6.7 years for the SO group and 3.3 years for the CM group, with an odds ratio of .90., indicating that the odds for chronic maltreatment decreases by 10% for every year of age of the victim. This was statistically significant, and the victim age was included in the final models.

4.3.1.6 ALCOHOL AND SUBSTANCE ABUSE, MENTAL HEALTH AND FAMILY VIOLENCE PROBLEMS

FSFN data contains information on family problems in two different ways. First, alcohol and substance abuse and family violence problems can be indicated as maltreatment allegation codes. Second, assessment results at the time of disposition may include flags for alcohol and substance abuse and mental health services. Using these fields, potential differences in the prevalence of these problems in the initial reports were examined between chronic perpetrators and perpetrators with only single reports. The literature suggests that these problems are associated with recurrence of maltreatment. These findings were supported in this study as shown in Table 3.

The three problems examined—*alcohol and substance abuse*, *mental health*, and *family violence*—exhibited similar results. While 20% of perpetrators in the CM group had indications of alcohol and substance abuse problem, this rate was only 13% for the SO group. Similarly, for the CM group, the prevalence of mental health and family violence problems (19% and 18%) was 5% higher compared to the SO group. By the odds ratio, the presence of alcohol and substance abuse problem of the perpetrator increased the likelihood of chronicity by a factor of 1.76 compared to perpetrators with no such problems. Similar effects were seen for the two other problems, mental health, and family violence, with the odds ratios of approximately 1.4 for

each problem. All group differences were statistically significant. Alcohol and substance abuse and mental health covariates were included in the final models; however, the effect of the family violence became insignificant in the presence of other variables in the model and was excluded.

4.3.1.7 HOUSEHOLD SIZE AND NUMBER OF VICTIMS

In the existing research, the size of the household and the number of victims have been found to be associated with the recurrence of child maltreatment. This study found a weak association between household size and chronic maltreatment, which also turned out to be a protective factor. The odds ratio indicates that one additional member in the household decreases the odds of becoming a chronic maltreater for the perpetrator by 2%. Household size was calculated as the total number of persons in an intake, which might include non-household members. The association with the number of victims was stronger. The odds ratio of 1.1 means that for each additional victim related to the perpetrator, the risk of becoming chronic maltreater increases by 10%. All group differences were statistically significant. The size of the household and number of victims are included in the final models indirectly through network effects such as the number of victim reports.

4.3.1.8 PERPETRATOR RELATIONSHIP TO THE VICTIM

The literature has shown that single parent households have higher risk of recurrence of maltreatment. This suggests that single mothers are the most likely perpetrators observed with repeated maltreatment. The national data demonstrates that almost half of the victims are perpetrated by single mothers (USDHSS, 2016). Because the marital status field is not reliable in FSFN, the relationship of the victim to the perpetrator is used to compare parents against non-parents. The results showed a strong association between chronicity and the relationship between victims and the perpetrators. This relationship had two categories: *parents* (mother, father, or both father and mother) and *non-parents* (other than father and mother). While 34% of the victims were perpetrated by non-parent individuals in the SO group, this rate was only 20% for the CM group. The odds ratio was 2.1, indicating that the odds of chronicity doubles when the perpetrator is a parent. The difference was statistically significant, and perpetrator relationship (parent vs. non-parent) was included in the final models.

In addition to the relationship between the perpetrator and the victim, the initial role of the perpetrator (caregiver or perpetrator) was examined, since the study included individuals whose role in the initial report was as a caregiver. Table 3 shows that, while 39% of the subjects in the SO group had a caregiver role in their first report, this proportion was slightly lower, 35% for the CM group. The association was statistically significant but weak, with an odds ratio of 1.15.

4.3.1.9 POVERTY

The literature has shown that poverty and economic hardship contribute to the recurrence of maltreatment. However, this association is often mediated through other risk factors, and the existing research has not demonstrated the relationship within the context of chronic maltreatment. Since the ACCESS data was not available for the complete study period (only available after 2010), this study could not include a proxy for poverty as a risk factor for chronic maltreatment. However, a brief analysis in Section 5.1.2 on child maltreatment in the low-income population shows that over 90% of families with maltreatment reports were participating

in public assistance programs between 2010 and 2014. This suggests that economic hardships experienced by the families are unlikely to be associated with the recurrence of maltreatment, since almost all families reported for child maltreatment are receiving public assistance.

4.3.2 Case and System Characteristics and Network Effects

4.3.2.1 Maltreatment Types

In the existing research, the association between maltreatment types and the recurrence of maltreatment has generally focused on the first recurrence (between first and second reports). The interim report from this project found that overall rates of the occurrence and co-occurrences of various maltreatment types were stable throughout the different number of reports. However, reported maltreatment types often varied from report to report for the individual. This study assessed whether the maltreatment type shown in the allegation of the initial report is an effective risk factor for chronic maltreatment. Maltreatment types were grouped into the following categories from a much larger collection of allegation codes as follows:

- Substance abuse (SA)
- Family violence (FV)
- Physical abuse (PA)
- Physical neglect (PN)
- Sexual abuse (S)
- Other neglect (O)

The specific definition of each maltreatment type based on the allegation codes is found in the Appendix, Table16.

Table 3 shows that all maltreatment types show group differences. These differences were quantified at the initial report of perpetrators. Since there are multiple victims maltreated by a perpetrator and often these maltreatments show multiple maltreatment types, column totals exceed 100% for each given group. While sexual abuse and physical abuse were also observed at a higher rate among the perpetrators of the SO group, other maltreatment types contributes to the higher odds of chronicity. The largest difference was observed for sexual abuse, with an odds ratio of .53, indicating that odds for chronicity is almost half for perpetrators who sexually abuse victims in their first report. In the CM group, the proportion of perpetrators with sexual abuse allegation in their first report was 7%, one-half of the 14% observed for the SO group. Substance abuse also had a strong effect as already noted earlier among the family characteristics. The other three maltreatment types had weaker (but statistically significant) differences with odds ratios ranging between 1.09 and 1.38.

Even though all differences were statistically significant, only substance abuse was included in the final models, and one of the models included “other neglect” as a factor. The effects of other maltreatment types became statistically insignificant due to their correlation with stronger predictors.

4.3.2.2 VERIFICATION STATUS

Most of the recent studies have not found significant differences in the recidivism rates between substantiated and non-substantiated maltreatments, while some studies have found that if the initial report is substantiated, it contributes to higher rate of recurrence. Following the existing research, this study used all reports rather than limiting to only reports with verified maltreatment, while using the verification status of the disposition as a covariate. Table 3 shows that the group differences were statistically significant, and this variable was added to the final models.

For the SO group, 21% of the initial reports resulted in verified maltreatment, 29% had a report disposition of *some indicator*, and almost half (47%) had a disposition of *no indicator*. In contrast, for the CM group these rates were 25%, 33%, and 40% respectively. The odds ratios for *verified* and *some indicator* dispositions are approximately 1.3, meaning that the odds that a perpetrator becomes a chronic maltreater is 1.3 times higher if his/her first report was determined to have verified or some evidence of maltreatment. This variable was used in the final models.

4.3.2.3 IN-HOME SERVICES

The controversy surrounding the association between in-home services (such as family preservation and case management services) and the recurrence of maltreatment has been demonstrated in Section 2.3. The findings of this study added to this controversy by showing a strong univariate association between delivery of services and chronic maltreatment, which however disappeared in the multivariate analysis. It can be seen in Table 3 that among the perpetrators with single report, 90% of victims and families received no services, while 8% had been offered services either prior to their initial report or they were reported during the service delivery. A very small fraction (2%) had services delivered after the report. In stark contrast, 37% of the perpetrators in the CM group had been connected to victims who received services after investigations. On the other hand, victims of the 58% of perpetrators with maltreatment chronicity did not receive any services. The odds ratio for post services of 7.1 means that the odds for chronicity is seven times higher for perpetrators connected to victims receiving services after their first reports.[5]

The study assumed that in-home services provided by the Department are consumed and used by families because there is no data available to show the actual utilization of services. Services may be partially used by some families, which would affect the outcomes. Further research is necessary to assess service utilization rates.

It is beyond the scope of this report to assess the effectiveness of in-home services on the recurrence of maltreatment. Instead, an attempt was made to evaluate whether or not services appear to be a risk factor for recidivism. While the univariate analysis showed a very strong association, in the multivariate analysis the effect was not as strong due to possible correlations with other factors. Service variables were used in the final models.

[5] The Living Arrangement table of the FSFN data was used to derive the services covariate for victims and perpetrators in this study. A small number of perpetrators were provided services as well but not shown in Table 3, because they accounted for less than 2% of all persons who have received services.

A closer look at the relationship between chronicity and services explains why the association does not exist at the multivariate level. This is because services are more likely to be the consequence rather than the cause. Higher number of reports (chronicity) triggers more services over time, because these cases involve families with high needs, as has been demonstrated by the existing research. Even though the association is very strong and positive in isolation, suggesting that more services tend to fail in lowering the recurrence rates, it is more likely that high risks of families prompt the increased delivery of services. When other strong predictors of risk are present in multivariate analysis that is, once adjusted for other predictors of risk the relationship between services and chronicity becomes statistically insignificant, because the delivery of services is associated with other high-risk predictors.

Finally, a separate analysis on the victims demonstrated that 17% of the victims in the 2004-05 cohort received in-home services with an average duration of 300 days. While 7% of the group with no services had been reported more than four times, 35% of the group that received services was reported chronically. Similar to the findings for perpetrators, almost half of the victims with five or more reports did not receive any services over time.

A deeper look into the group into those who received services identified two distinct sub-groups: 47% had lower number of reports after the services delivery (the average number of reports dropped from 2.8 to 0.6 per victim), while the remaining 53% had increased number of reports following the completion of services (the average number of reports rose from 1.3 to 3.7 per victim). The net effect of services may have also weakened in the multivariate analysis, because of these two opposite effects in addition to their correlation to other stronger factors. Further research is needed to assess the association between services and the recurrence of maltreatment.

4.3.2.4 PLACEMENTS

Similar to the services, there were no consistent findings on the association between placements and the recurrence of maltreatment. Victims who were placed in foster care were usually left out from the analysis in many studies because of its different dynamics. The justification was that the likelihood the window in which they could have been exposed to conditions leading to multiple reports of maltreatment was different than for children who remained at home (Putnam-Hornstein et al., 2015a).

The association of placements with chronicity is similar to the results for services. Table 3 demonstrates that, among the perpetrators with a single report, 93% did not have any victims who were placed and 5% had maltreated victims prior to their placement. On the other hand, 22% of the perpetrators with chronic maltreatment history had been connected to victims who were allegedly maltreated after they were placed in foster care, and victims of 70% of perpetrators with maltreatment chronicity were not placed in foster care over time. The odds ratio for maltreatment after placements (7.3) means that the odds of chronicity for perpetrators connected to victims who were placed in the foster care are over seven times higher than those otherwise.

As was the case for services, it is beyond the scope of this report to assess the effectiveness of placements on the recurrence of maltreatment. Several variables related to placements were tested in the final models; however, their effects were not significant and thus not included in the

final models, with the exception of the last model predicting the recurrence from the fourth to the fifth report[6].

Also as was the case for services, placement covariate may be also a consequence rather than the cause. A higher number of reports led to more placements over time, because these cases included high-need children need to be placed in a safe environment. The correlation of placements with high risk and stronger predictors of high risk makes the association between placements and chronicity in isolation to become statistically insignificant in the multivariate scenario.

A separate analysis of the victims with placements revealed that approximately 13% of the victims in the 2004-05 cohort were placed during the study period with an average of 4.3 placements. 8% of victims with no placements were been reported more than four times with an average of 2.3 placements. In stark contrast, 36% of victims who were placed at least once were reported more than four times with an average of 7.3 placements. Almost 40% of the victims with chronic maltreatment history were placed at least once.

Similar to the analysis presented for the services, two distinct strata were identified among victims with placements: 35% had a reduced number of reports after placements (the average number of reports dropped from 4.1 to 0.9 per victim), while the remaining 40% had increase in the number of reports following placement (the average number of reports rose from one to four per victim). The net effect of placements weakened in the multivariate analysis, because of the two opposite trends and because of their correlation with other stronger factors. The relationship of the recurrence of maltreatment with placements requires further research as well.

4.3.2.5 REPORT HISTORIES AT LEVELS 0, 1 AND 2

The earlier study on child maltreatment fatalities showed that the number of report histories at all levels was the strongest risk factor for alleged maltreatment fatalities. Existing research has also demonstrated that report histories contribute to the recurrence of maltreatment substantively. Table 3 supports these findings, showing substantive group differences for all three levels. All differences are statistically significant, and several network effect variables were used in the final models as described in the next section. Report history numbers indicate the average number of reports at the time of the initial report, and the numbers in parentheses for the CM group indicate the average cumulative number of reports at the fifth report.

Table 3 shows that at the initial report, perpetrators with single reports had an average of approximately 1.1 Level 0 report history for the SO group and 1.6 for the CM group. Level 0 reports at the first report are the maltreatment reports of the perpetrators when they were maltreated during their childhood. The average number of Level 0 report histories rose to 5.5 for the CM group at the fifth report. The real differences are observed at Levels 1 and 2. The average of the Level 1 report histories for the SO group was 4.6 at the initial report, while this number was 7.3 for the CM group and rose to 23.2 by the fifth report. The differences for Level 2 report histories were even more pronounced, with the number for the CM group increasing from approximately 34 to 102.

[6] The episode table of FSFN data was used to derive the placements covariates for this study.

Table 3 also shows the distribution of perpetrators of both groups by the size (more or less than 10 reports) of the total number of report histories at all levels. While almost two-thirds (65%) of perpetrators had less than 10 reports at the time of their initial reports in the SO group, almost half (48%) of the perpetrators had more than 10 reports in the CM group. The odds ratio of 1.7 means that odds of chronicity increases by 1.7 times for perpetrators with more than 10 report histories at the time of their initial report. It should be noted that, even for the SO group, the average number of report histories is quite high, at approximately 27. These numbers show that perpetrators are already connected to child maltreatment eco-systems, with vast amount of child maltreatment at different levels, as they are entering to the child welfare system for the first time. Several report histories variables were used in the final models.

4.3.2.6 INTERGENERATIONAL MALTREATMENT

The earlier study on child maltreatment fatalities found that, after the number of report histories, intergenerational maltreatment was the second strongest predictor. The existing research has also discussed that a positive and strong association exists between intergenerational maltreatment and the recurrence of maltreatment. These findings were supported by this study as shown in Table 3.

While only 4% of the perpetrators of the SO group had been maltreated during their childhood, this number was more than five times higher at 21% for the perpetrators of the CM group. The odds ratio is very high at 7.3, meaning that the odds for chronicity increases by more than seven times for perpetrators exposed to intergenerational maltreatment. The difference was statistically significant, and the intergenerational maltreatment covariate was used in the final models.

4.3.3 ADDITIONAL INDEPENDENT VARIABLES

4.3.3.1 TIME

The existing research studying children with at least two maltreatment reports has shown that the interval between previous maltreatment incidents is associated with future maltreatment occurrences. The final models incorporated two time interval variables to predict chronicity, as the time between the current and initial report and as the time between the current and the last report. Since the single occurrence group does not have a recurrence, this variable was not included in Table 3. The time factor was implicitly integrated in various network, service, and maltreatment type and verification status factors as described in Section 5.3.

4.3.3.2 GEOGRAPHY

A perpetrator's county of residence was considered as an independent variable and included in the final models. Its effect is described in the next section. The geography was not added to the Table 3 because of the sheer number of counties that makes this variable impractical for such table.

SECTION 5 FINAL RESULTS

5.1 COHORT ANALYSIS

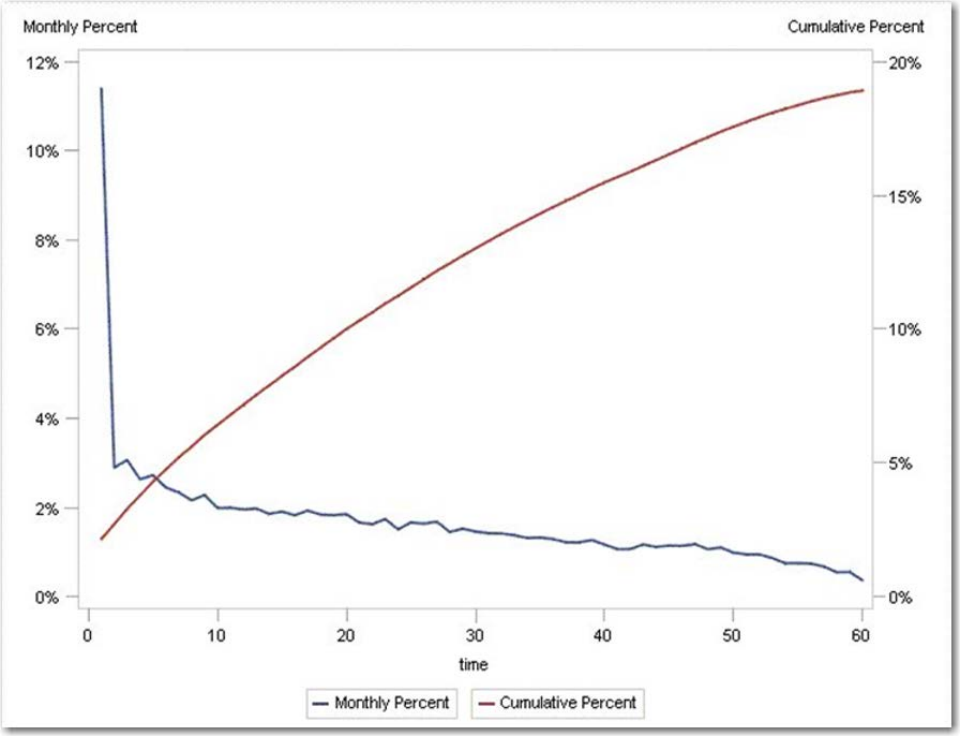
5.1.1 BIRTH COHORTS

An initial step to understand re-reporting and re-maltreatment is studying the prevalence of reporting and maltreatment in the context of the population of Florida. This section extends the analysis presented in the interim report for the 2005 birth cohort, which showed that 24.1% of children (over 54,800 out of 226,776) had at least one FSFN report and 9.5% (over 21,600 out of 226,776) had at least one report with verified maltreatment over eight years.

Two birth cohorts were used in this analysis from 2005 and 2009 to compare prevalence rates of alleged maltreatment over five years. The 2009 birth cohort had a slightly lower number of children (221,635). The findings of this analysis were also helpful for the analysis of child maltreatment in the low-income population as presented in the next section.

Merging the Florida Vital Statistics data with FSFN data allowed insight into the magnitude of the child welfare system's interactions with the entirety of the Florida population. Since 2005 and 2009 overlaps with periods prior to and after the economic crisis in 2008, it would be helpful to find out if there was a shift in the prevalence rate of alleged child maltreatment for Florida children born in 2005 and 2009. Figure 3 illustrates the re-reporting rates for the 2009 birth cohort, demonstrating the ages at which these reports occurred. The left scale shows the fraction of reports occurring in each month over a 60-month time span (birth to fifth birthday); the right scale shows the cumulative fraction of reports in the same time range.

Figure 3: All Reports by Age as a Percentage of All 2009 Births in Florida

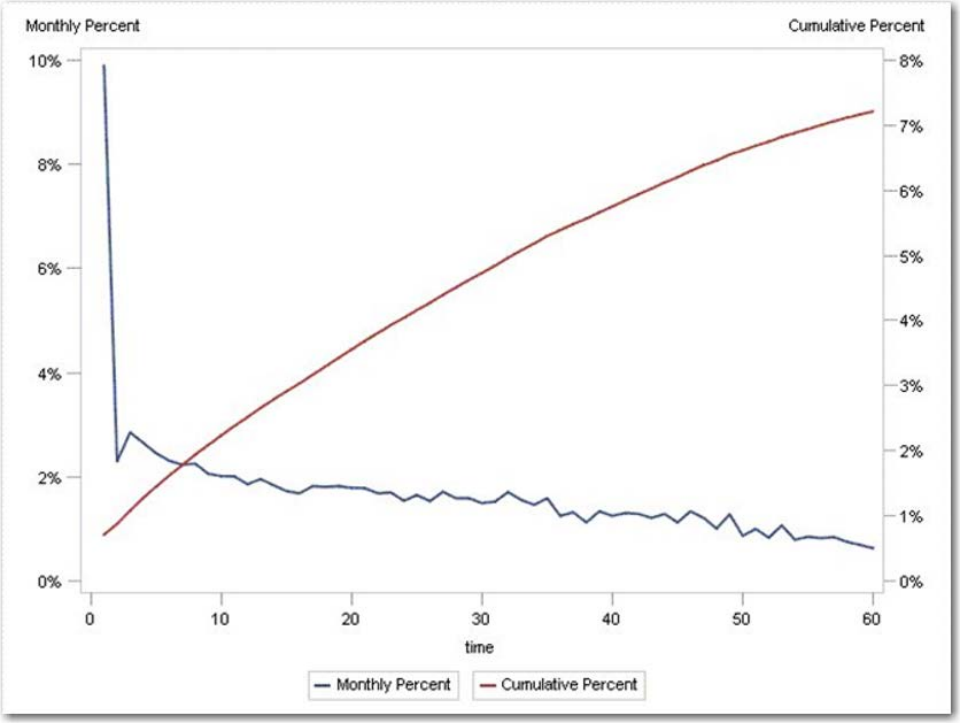


Looking at the left scale, it is observed that the month with the highest number of reports (2% of 2005 live births, or 4,779 children) was the first month after birth, amassing 11.4% of all reports. This means that more than one out of 10 children with a maltreatment report in the first five years of their lives were reported during the initial month of life. The rates dropped substantially in the following month to 2% of all reports and continuously declined over five years, eventually reaching 0.4% by the 60th month. Looking at the right scale, it is possible to see how these monthly initial reports accumulate as the cohort ages. By age 60 months, or five years, 18.9% (41,933 children) of the children born in 2005 had been reported to the child welfare system, which is approximately one in every five children born in Florida.

Figure 4 shows the re-maltreatment rates for the 2009 birth cohort. The chart is similar to Figure 1, with the left scale showing the fraction of reports with *verified* maltreatment occurring in each month and the right scale showing the cumulative fraction of reports with *verified* maltreatment.

The left vertical axis shows that the month with the highest number of reports with verified maltreatment (10% of all reports) was again the first month after birth. This means that one out of 10 children with a report with verified maltreatment was reported during the initial month of life. In a similar fashion to the pattern for all reports, this rate continuously decreased over five years, eventually reaching 0.6%. The right vertical axis shows how these monthly initial reports accumulate as the cohort ages. By the end of the 60th month, 7.2% of the children born in 2005 had been reported to the child welfare system with verified maltreatment, or approximately one in every 14 children born in Florida.

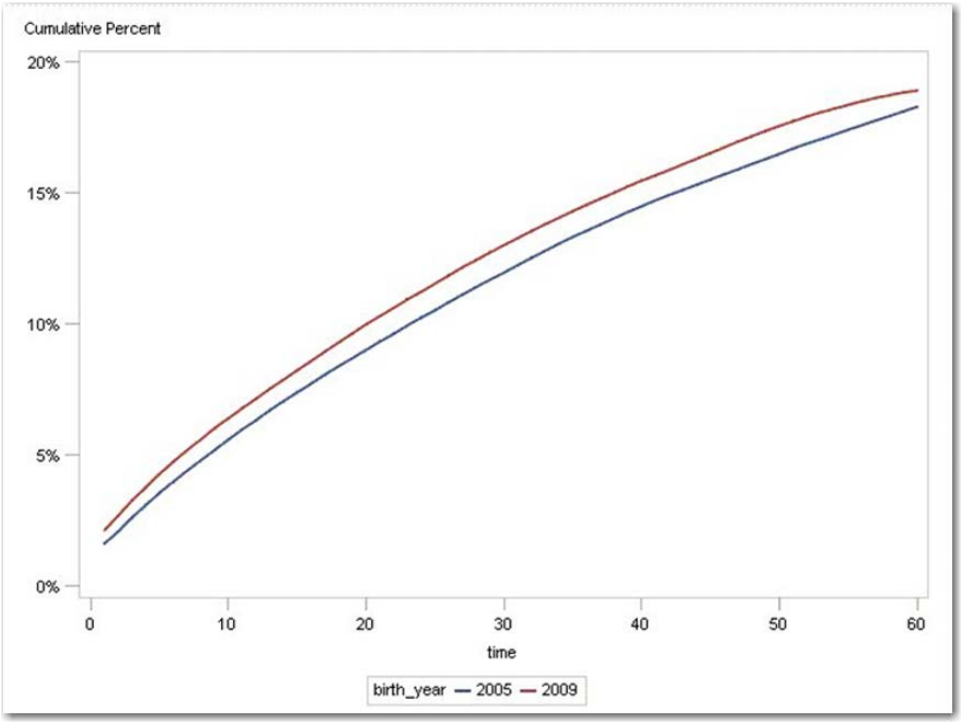
Figure 4: Verified Reports by Age as a Percentage of All 2009 Births in Florida



It should also be noted that these reporting and maltreatment rates are likely to be understated, since individuals in the 2009 cohort who move out of state and are subsequently reported or maltreated elsewhere cannot be tracked using the data currently available. This analysis was presented in the interim report, estimating that the percent of children in the 2005 birth cohort with at least one FSFN report was actually around 30% over the first eight years of life. This estimate was under a zero-net migration hypothesis, in which it is assumed the counts of non-Florida-born reporting mirror the part of the population that moved away from Florida. More accurate results would require incorporation of migration patterns, which was beyond the scope of the study (NH and SAS, 2016a).

The comparison of 2005 and 2009 birth cohorts for all reports is illustrated in Figure 5. The plots show that the prevalence rates of re-reporting for both cohorts are very close. The rates are approximately 1% higher for the 2009 cohort and the final cumulative rate for the 2005 cohort (18.3%) is 0.6% lower. The breakdown of number of reports by cohort was also very similar; more than half had only one report, and approximately 25% of children had three or more reports over five years in both cohorts.

Figure 5: All Reports by Age as a Percentage of All 2005 and 2009 Births in Florida



This analysis showed that a considerable fraction of Florida's children had contact with the child welfare system over their first few years of life. In addition, this analysis suggested that no significant shift in the prevalence of re-reporting and re-maltreatment was observed between 2005 and 2009. This finding is discussed further in the next section, with implications for the dynamics of child maltreatment within the low-income population.

5.1.2 Low-Income Population with Child Maltreatment

The existing research has discussed that poverty and economic hardship contribute to the recurrence of maltreatment. However, this association is often intertwined with other risk factors, and the exact pathway between poverty and chronic maltreatment has not been well-explained. This section aims to provide insight into this relationship by studying linkages among birth cohorts, FSFN data, and ACCESS data. This insight is expected to be useful, since the comparison covers 2005 and 2009, corresponding to the years before and after the Great Recession of 2008.

From late 2007 through late 2009, the US economy suffered the longest and deepest downturn since the Great Depression, triggered by the bursting of a housing bubble. The effect of the crisis was well-documented: it led to a severe housing crisis with soaring foreclosures, a significant rise in unemployment rates and severe economic hardship for many American families. As more people fell into poverty, another consequence of the Great Recession was record-high levels of participation in the Supplemental Nutrition Assistance Program (SNAP) as well as in other public assistance programs. While millions of people were added to the SNAP program, the impact was geographically uneven. Based on the numbers available from the

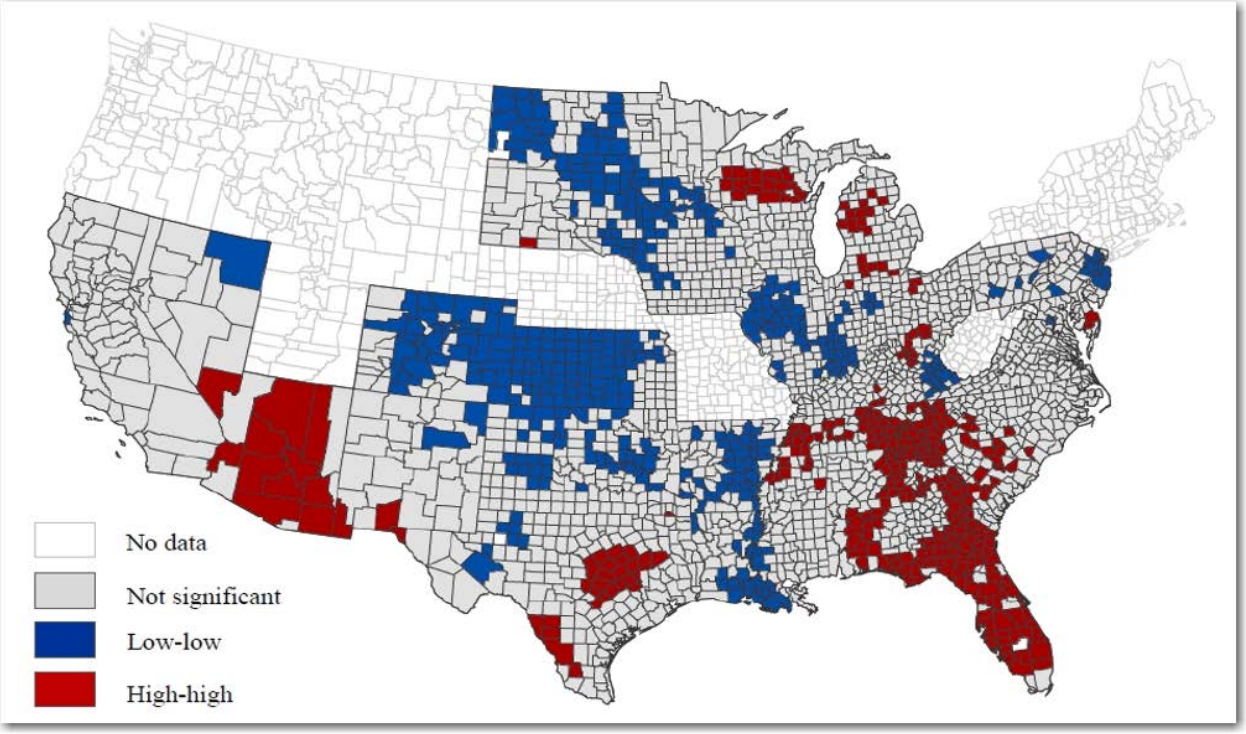
Bureau of Labor Statistics, the unemployment rate in Florida increased from 3.5% in January 2007 to 11.2% in December 2009, one of the states most severely impacted by the economic downturn.

In addition, Florida was in the center of the housing crisis as one of the five states in the country in which the median home values fell more than 30%. Housing prices dropped by 38% in Florida, the second highest drop after Nevada (Taylor et al., 2011). Consequently, the number of persons who fell into poverty and joined the SNAP program grew substantially in Florida, increasing from 1,216,090 in January 2007 to 2,497,511 in January 2010 and reaching 3,686,064 by November 2014 (FRAC, 2010, 2012, 2014).

The unevenness of the geographic impact of the economic downturn is illustrated in Figure 6, showing a clustering effect on a map. Slack and Meyers (2014) showed in this map the change in county level SNAP receipt between 2007 and 2009, where “low-low” refers to counties at the center of geographic clusters with significantly lower change in food stamp receipt than would be expected at random and “high-high” refers to counties at the center of geographic clusters with significantly higher change in food stamp receipt than would be expected at random. The significant clustering of high-SNAP change is evident in Florida.

SNAP is heavily focused on the poor, since about 93 percent of SNAP benefits go to households with incomes below the poverty line and 58 percent to households below half of the poverty line (CBBP, 2016). Slack and Meyers (2014) verifies this relationship by showing the association between SNAP participation and increases in poverty, unemployment, and home foreclosures, which was particularly evident in Florida.

Figure 6: Map of Change in County-Level SNAP Receipts, 2007-2009



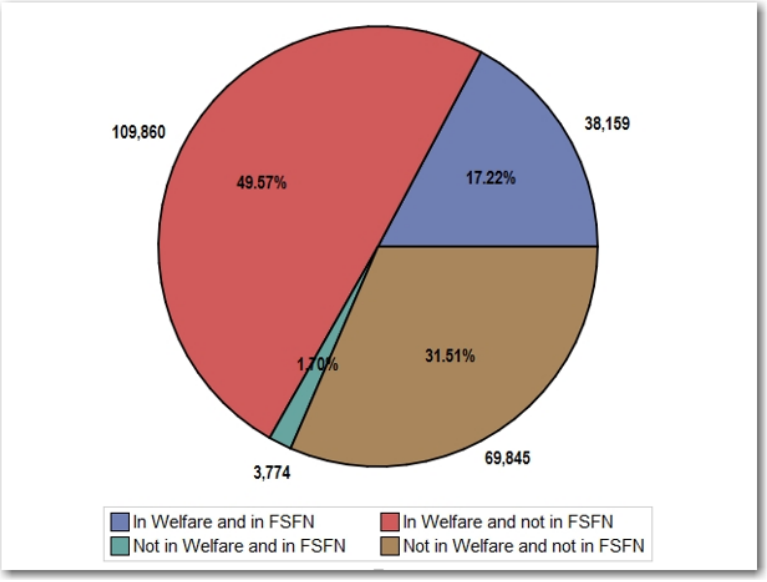
Participation in SNAP was studied by linking the 2009 birth cohort with the ACCESS data. Out of 221,638 children born at Florida in 2009, approximately two-thirds (67.3%) participated in a public assistance program such as SNAP, Medicaid, and/or TANF between 2010 and 2014. The linked data also showed that over 90% of the children were already in welfare by 2010, suggesting that they were born into families already receiving public assistance

If the association between poverty and child maltreatment is strong, there would have been an impact on maltreatment rates given the gigantic increase in the SNAP participation after 2007, which lasted till 2014. However, comparing 2005 and 2009 cohorts, no significant jump on the rate of children with maltreatment reports was evident. Moreover, the rate of increase in the prevalence rate for alleged maltreatment for the 2005 cohort was steady with no indication of a spike after the recession. If poverty impacted child maltreatment, there would have been a noticeable increase after 2007.

Figure 7 shows the extent of overlap between public assistance program participation and the child welfare system. For the children born in 2009, four groups are observed. The largest group, almost half (49.6%) of the 2009 birth cohort, were children who received public assistance but were not reported for child maltreatment. The second largest group, almost one-third (31.5%) of the cohort were children who did not participate in public assistance and did not have contact with the child welfare system.

The remaining 19% is composed of two sub-groups. The larger sub-group (17.2%) consisted of all children who participated in both welfare systems, receiving public assistance and also reported for maltreatment at least once. The smaller sub-group (1.7%), on the other hand, consisted of children who were reported for alleged maltreatment but stayed outside of the public assistance program. These children are likely to come from families with higher income or low-income families who were not eligible for public assistance.

Figure 7: 2009 Birth Cohort, FSFN, and ACCESS (Welfare) Populations



A comparison of these groups showed that, among children who had contact with the child welfare system, a very large majority (91%) came from low-income families receiving public assistance. On the other hand, among children not reported for maltreatment, only 61% participated in public assistance programs. Finally, it was found that among children reported for maltreatment, those receiving public assistance had higher numbers of re-reporting relative to the small group of children not receiving any public aid. While 26% of children whose families participate in public assistance programs had been reported at least once to the child welfare system, the number was only 5% for those who did not receive public assistance.

The findings suggest that overall, the large increase in SNAP participation which mirrored the increase in poverty in Florida after the Great Recession did not have a substantive impact on child maltreatment. However, for families maltreating their children, economic hardship was a common problem, since almost all participated in public assistance. Moreover, child maltreatment rate among families with economic hardship is much higher, at over five times that of families who did not receive public assistance.

While almost all families with a child reported for alleged maltreatment participated in public assistance programs, three-quarters of the population receiving public assistance had no contact with the child welfare system. Hence, the association between poverty and child maltreatment may be indirect. Poverty may not trigger child maltreatment directly but rather may coexist with other problems these families experience. Other problems such as substance abuse, mental health issues, disability, or intergenerational maltreatment may cause child maltreatment and economic hardships, simultaneously making these families dysfunctional with fewer resources. Another interpretation may be that the effect of poverty may be observed in the long run. If families stay in persistent poverty over many years, the likelihood of child maltreatment increases. The long-run relationship needs to be studied further when the public assistance participation data is available for a longer period of time.

5.1.3 HEALTHY FAMILIES PROGRAM

Data from the Healthy Families Florida program, a nationally accredited home visiting program for expectant parents and parents of newborns experiencing stressful life situations, was available for the analysis. Each of the 221,638 live births in Florida in the year 2009 was tracked through the end of 2014. During this time, 3% (approximately 6,000 out of 221,638) of these children participated the Healthy Families program. As described in the Healthy Families program, families who had an open case in the Child Welfare System were not eligible for Healthy Families Florida. Nevertheless, about 1.8% of the families (1,149 out of 65,264) had an open child protection case at the time of enrollment. This may be due to case fragmentation: HFF was unable to accurately match these children to open DCF cases.

The Healthy Families population was also matched against all children who have been reported for maltreatment at least once during 2004-2015. The matched population was Healthy Families children who had one or more maltreatment reports during the 2004-2015 period. They were both served by Healthy Families program and reported to Florida Department of Children and Families (HF+DCF). However, HF+DCF does not mean that both HFF and DCF were providing services to these children at the same time. Children were involved in a maltreatment report to DCF sometime prior to their enrollment in HFF or after their enrollment ended. The non-matched population were children only served by Healthy Families program (HF only). An analysis was conducted to determine if, among those assessed by the Healthy Families

program, the factors such pre- and perinatal factors, socio-economic and demographic factors, program participation factors, family risk factors, and family assessment scores could distinguish children with maltreatment reports (HF+DCF) from those with no maltreatment reports (HF ONLY). Maltreatment reports included all reports irrespective of findings of the investigations.

The analysis included both the target children (the child mother is pregnant with or just gave birth to when she scored into the program) and non-target children (siblings, older or subsequent) who may or may not be the primary focus of program services.

5.1.3.1 PRENATAL AND PERINATAL FACTORS

- Not keeping regular prenatal visits increased the odds of a maltreatment report by 20%.
- Children born with a positive drug addiction status increased the odds of having at least one maltreatment report by 41%.

5.1.3.2 SOCIO-ECONOMIC AND DEMOGRAPHIC FACTORS

- Parental unemployment recorded in Healthy Families data increased the odds of a maltreatment report by 24%.
- Healthy Families mothers with maltreatment-reported children were, on the average, two years younger than those of non-reported children.
- Single mothers had a higher risk of maltreatment reports compared to married or cohabitating mothers. Being a single Healthy Families mother increased the odds of a maltreatment report by 92%.

5.1.3.3 PROGRAM PARTICIPATION FACTORS

- Among those assessed by the Healthy Families program, mothers who are first-time participants in the program had a lower risk of maltreatment report. The odds that a first-time Healthy Families mother had a maltreatment report were 33% lower than a non-first time mother.
- The odds of a maltreatment report was 43% lower for first-time participants in the program compared to those recorded to have multiple participations in the program.

5.1.3.4 FAMILY RISK FACTORS

- The odds of a maltreatment report for Healthy Families participants with substance abuse concerns were 13% higher than those without substance abuse concerns.
- The odds of a maltreatment report for Healthy Families participants with domestic violence concerns were 26% higher than those without domestic violence concerns.
- Among the Healthy Families participants, those with disabled children in the house had 32% higher odds of a maltreatment report than those without disabled children in the house.

- When a Healthy Families parent were determined to have impairments that might challenge personal resources to meet the needs of a child, the odds of a maltreatment report increased by 38%.
- There appeared to be no statistically significant difference in maltreatment reporting risk between Healthy Family households found to have mental health concerns.
- There appeared to be no statistically significant difference in maltreatment reporting risk between Healthy Family households found to have developmental delay concerns.

5.1.3.5 FAMILY ASSESSMENT SCORES

The association between assessment scores and the occurrence of maltreatment reports for Healthy Family children was also studied in the analysis. In general, the maltreatment reporting rates were in line with expectations of the family assessment risk scores.

- The Ages & Stages Questionnaires: Social Emotional (ASQ:SE) is a first level screening tool that is designed to identify children who may be at risk for social or emotional difficulties. High scores on ASQ:SE indicate high social or emotional risk. The maltreatment reporting rates were significantly higher for children with higher ASQ:SE scores compared to those with lower ASQ:SE scores.
- The Healthy Families Parenting Inventory (HFPI) is a 63-item outcome measure that was designed to examine change in nine parenting domains: Social Support, Problem Solving, Depression, Personal Care, Mobilizing Resources, Role Satisfaction, Parent/Child Interaction, Home Environment, and Parenting Efficacy. The factors are worded positively in that a high score in a domain is considered a strength and a low score is considered a weakness. The risk of a maltreatment report was higher for individuals with lower HFPI scores in each of the nine domains.

The Healthy Families Florida Assessment Tool (HFFAT) is an interview instrument that identifies a combination of factors associated with increased risk of child maltreatment. High HFFAT are supposed to indicate increased maltreatment risk. The analysis of HFFAT scores between the HF+DCF group and the HF only group confirmed this supposition: children with higher HFFAT scores had a higher risk for maltreatment report.

5.2 CHRONIC MALTREATMENT

5.2.1 PREVALENCE RATES AND TIME TO CHRONICITY

The findings of the existing research have been summarized in terms of prevalence rates of re-reporting and time to recurrence of maltreatment. Many studies have shown significant prevalence rates when victims or perpetrators are followed for at least five years. Another common finding was that a large proportion of maltreatment recurrence is concentrated very early after the initial report and the risk of recurrence declines steadily after this early period. Moreover, for those with multiple reports, the time to the next recurrence steadily decreased with an increasing number of recurrences. A number of papers studying perpetrators showed over 40% re-reporting rate for perpetrators over the period of 5-10 years (Way et al., 2001 and Johnson-Reid et al., 2003), and another study on multiple recurrences showed that 12.7% of families had more than four reports (Johnson-Reid et al., 2010a). The findings of this study were in agreement with the existing research.

The interim report presented prevalence rates for re-reporting and re-maltreatment for perpetrators. It showed that over 10 years, nearly 40% of perpetrators were re-reported and the risk of re-reporting and re-maltreatment increased successively with each report on the same child, and re-reports and recurrence occurred faster for victims with prior reports (NH and SAS, 2016a).

Figure 8 shows the distribution of 291,499 perpetrators included in the study cohort. 58% of all perpetrators had just one report (169,760 perpetrators), and 28,443 perpetrators (9.8%) had five or more reports, forming the chronic maltreatment group. In this section, the focus was on the prevalence rates of chronic maltreatment and time to chronicity for this group of 28,443 perpetrators.

Figure 8: Distribution of 2004-2005 Cohort Perpetrators by the Number of Reports

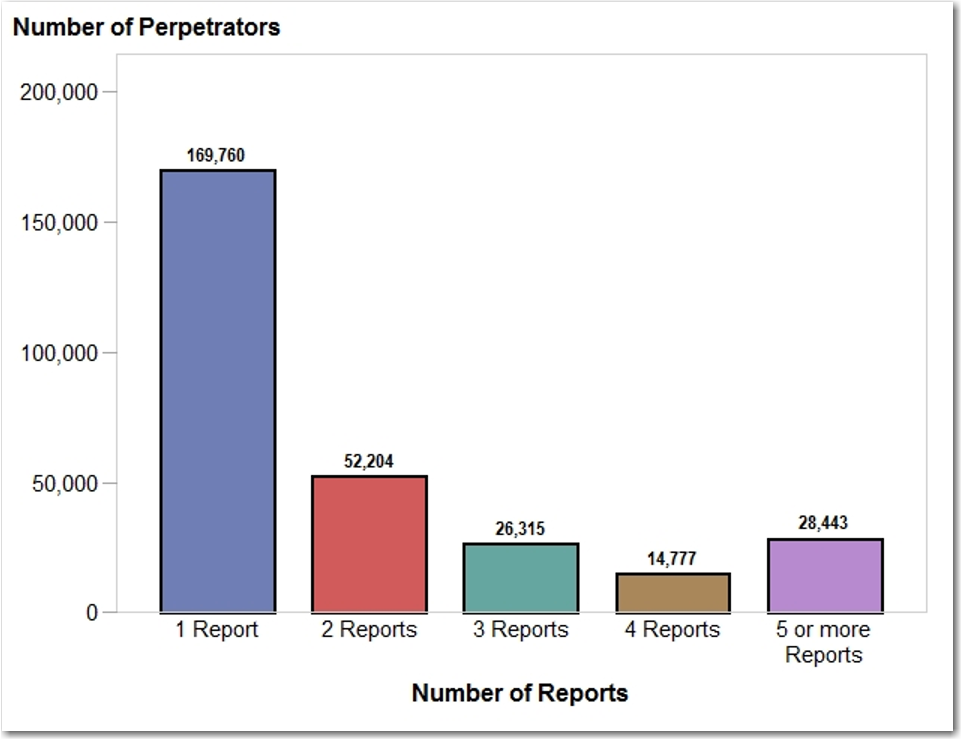
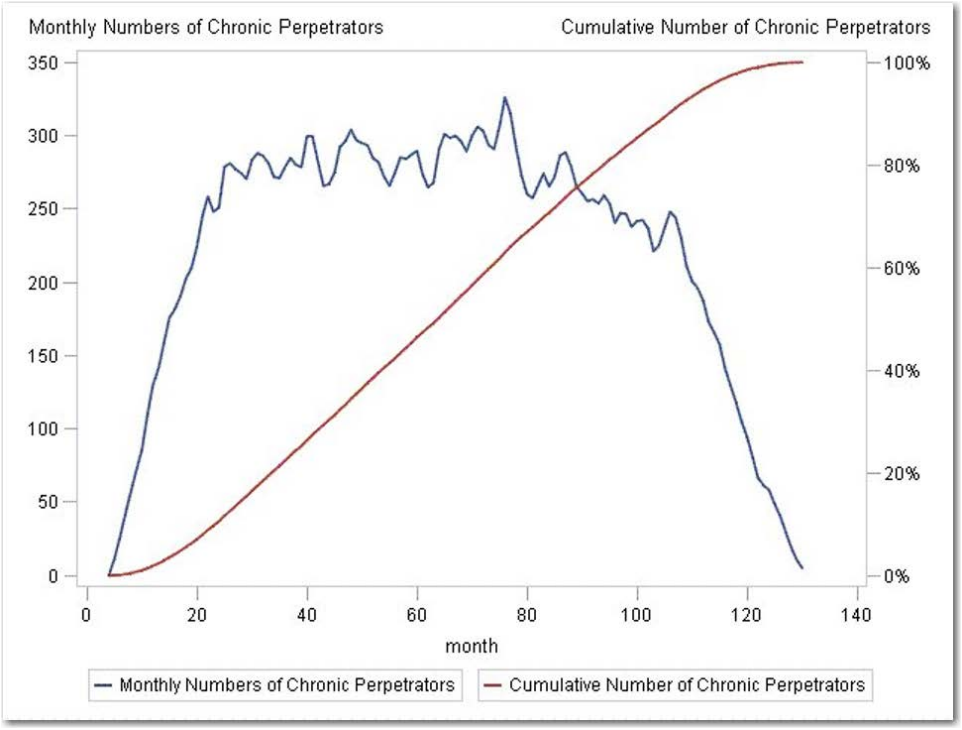


Figure 9 shows the time to chronicity for perpetrators with five or more reports. The time period considered for the time difference between the initial report date and the fifth report date (time of chronicity) in months covers up to 130 months. The left scale refers to the number of perpetrators that become chronic (being re-reported for the fifth time). The right scale refers to the cumulative percent of chronicity (how long it takes to reach chronicity for all cohort perpetrators).

The cumulative function on the right scale of Figure 9 reveals a monotonous progression. This implies that the proportion of perpetrators becoming chronic is constant after the first year. Out of all 28,443 perpetrators, only a small fraction, or 541 individuals, reached the level of chronicity by the end of the first year. Over 10% were re-reported for the fifth time by the end of second year. It took more than five years (64 months) for a half of this group to become chronic

and eight years for 80% to become chronic. Almost every year after the initial 12 months, an additional 10% became chronic perpetrators until the ninth year. After the ninth year, this growth slows down, implying that most of the chronicity is observed between the second and ninth years over a 96-month period. It is a steady and very long process, suggesting that these perpetrators are continuously high-risk maltreaters and that their children are under the risk of further harm for a very long time.

Figure 9: Time to Chronicity for Perpetrators with Five or More Reports



Looking at the left scale of Figure 9, another dimension of the same picture emerges. Monthly additions to chronic perpetrators were low (below 100) during the first 10 months and then started to rise, reaching 200 net-new chronic perpetrators monthly by the second year. Then the monthly numbers stayed in the range of 250 to 350 between the third and the ninth years. It began to decline after the ninth year, falling below 100 by the tenth year.

The average times in month to chronicity are tabulated in Table 4. The median time for all perpetrators was 64 months. Table 4 also exhibits the average times to chronicity by age of the perpetrator, gender, and ethnicity. There are no substantive differences by demographic categories. Averages by gender were the same. Older perpetrators became chronic 10 months quicker than the younger perpetrators, even though younger parents are more likely to be chronic. White perpetrators also became chronic more rapidly-by almost six months compared to black and Hispanic perpetrators.

Table 4: Time to Chronicity by Demographics of Perpetrators

Category	Median Time to Chronicity (Months)
All	64
Age Group	
16-24	67
25-34	65
35 and Over	57
Gender	
Female	64
Male	64
Ethnicity	
Black	68
Hispanic	67
White	61

5.2.2 Chronicity and Substantiation

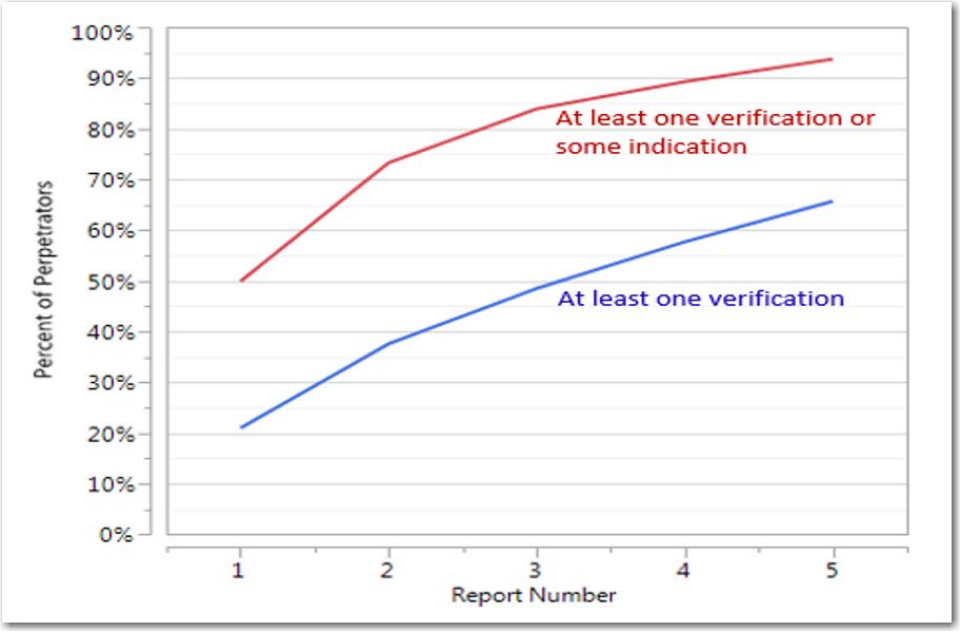
Section 4.3.2.2 demonstrated that there was an association between the verification status of the first report and the recurrence of maltreatment. Some of the existing studies have also suggested that re-reporting may result in the subsequent identification of verification of maltreatment (Bae et al., 2010; Dorsey et al., 2008; Drake et al., 2003; Helie and Bouchard 2010; Way et al., 2001). In this section, the analysis is extended to examine the dynamics of substantiation over time for chronically abusing perpetrators.

Figure 10 reveals plots the percent of perpetrators with at least one report with verified maltreatment (blue line) and the percent of perpetrators with at least one report with verified maltreatment or some indication of maltreatment (red line) over five reports, as a perpetrator reaching the level of chronicity. The blue line illustrates that, as a perpetrator is reported multiple times, the percentage of perpetrators with at least one verified report increases. While only 21% of perpetrators were reported with verified disposition in their initial reports, this proportion increased to almost 38% in the second report and reached 65.7% at the fifth report. This means that almost two-thirds of the perpetrators with more than four reports were substantiated at least once by their fifth reports.

Including reports with some indication results in much higher rates as seen by the red line. In their initial reports, half of the perpetrators were reported with *verified* or *some indicator* disposition. This rate exceeded 93% at their fifth report. That is, more than nine out of 10 perpetrators with more than four reports were either substantiated or reported with some evidence of maltreatment at least once by the time they return to the child welfare system for the fifth time.

Similar findings were presented for young victims in the interim report, showing an association between chronic maltreatment and verification over time. 80% of victims in the 0-5 age group with more than five reports were reported with verified maltreatment at least once (NH and SAS, 2016a).

Figure 10: Proportion of Perpetrators with at Least One Verification or Some Indication



When the dynamics of verification status was examined further, it was observed that transitions between different types of report dispositions were very similar for perpetrators with chronic maltreatment histories and perpetrators with single recurrence (only two reports). These two groups were compared for the following different transition categories according to prior and subsequent substantiation sequence, following the typology offered by Bae et al. (2010):

- not verified (no indicator) re-reports, which included not verified to not verified reports
- verified/some indicator to not verified reports
- verified/some indicator re-reports, which included not verified to verified/some indicator reports
- recurrence reports, which included verified/some indicator to verified/some indicator reports (20.9%)

For this analysis, reports with verified maltreatment were classified together with reports with some indication of maltreatment as practiced by a recent research using the Florida data (Yampolskaya et al., 2015). The results showed no significant differences in transition dynamics of single-recurrence perpetrators and chronic perpetrators with more than four reports. The proportions for the transitions listed above were 26%, 27%, 20% and 29% for the single-recurrence group and 27%, 25%, 18% and 28% for the chronic maltreatment group.

These findings suggest that there is a tendency to be re-reported with verified and/or some indication of maltreatment as perpetrators are re-reported multiple times. They also show that the type of transition of report disposition from one report to another does not explain the type of next disposition and chronicity of maltreatment. The transitions should be assessed as a whole over a longer period of time to identify perpetrators with higher likelihood of re-reporting and re-maltreatment.

5.2.3 Recurrence of Maltreatment and Screening Process

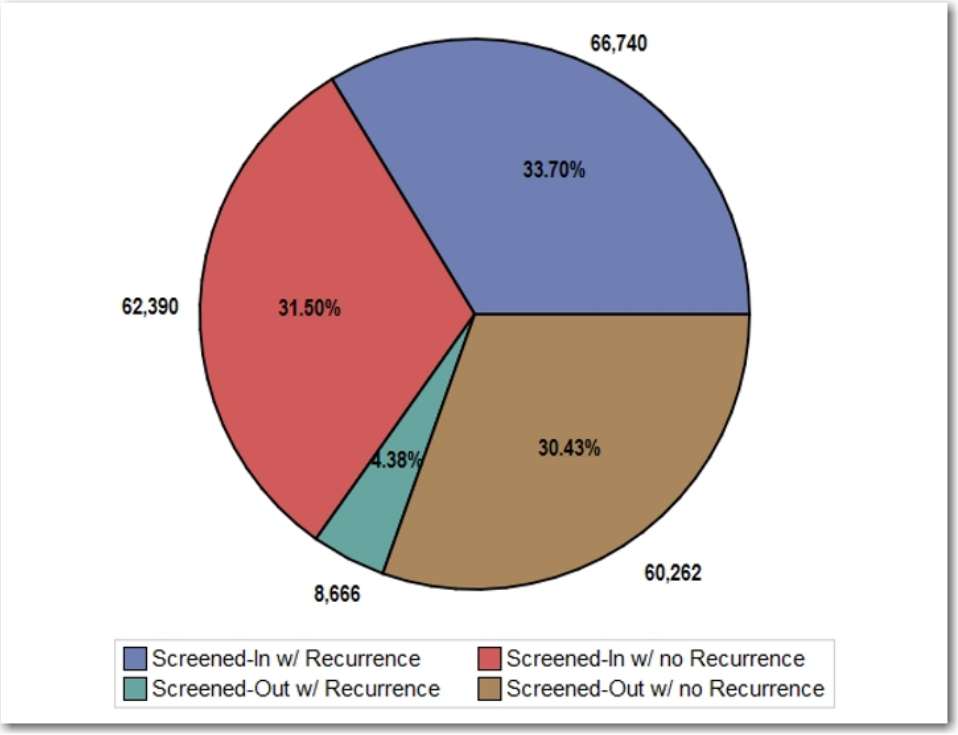
One of the objectives of this study was to provide insights to the Department on the risk of recurrence of maltreatment at the screening process. Florida recorded 222,720 referrals and 162,550 reports in 2014 (USDHHS, 2016). Since each report requires a repeated procedure of intake, investigation, and disposition, the identification of cases with high and low likelihood of re-reporting and re-maltreatment early on would improve efficiency and effectiveness in the child welfare system. Effectiveness would be improved by targeting families with high risk of recurrence of maltreatment and high need of services. Efficiency would be enhanced by identifying and screening out cases with very low risk of re-reporting and re-maltreatment.

The predictive models described in the next section were developed to assist the Department in these two areas by predicting perpetrators with high and low risk of chronic maltreatment. In this section, an exploratory analysis is presented to assess the recurrence of maltreatment at the screening process.

Since the FSFN data did not include all screened-out reports prior to 2012, this analysis could be conducted only for the last three years of the study period—between 2012 and 2014. The first reports of almost 35% (68,928) of the children in this cohort were screened out, while the first reports of the remaining 65% were screened in. It should be noted that this cohort included all victims with a report in 2012, irrespective of their report histories.

The purpose of this analysis was to compare the recidivism rates of groups with screened-in and screened-out reports in 2012. Among 129,130 victims with a screened-in initial report in 2012, more than half (52%) had a subsequent report through 2014. Figure 11 shows the distribution of the victims by whether their initial reports were screened in or screened out and by whether they had subsequent reports or not. Overall, one-third (33.7%) of the cohort had a screened-in initial report with subsequent reports, and 31.5% of the victims had a screened-in initial report but not re-reported.

Figure 11: Screened-In and Screened-Out Victims in 2012 by Recurrence



The proportion of victims with subsequent reports from the group with screened-out initial reports was only 4.3% of the entire cohort. There were only 8,666 victims with re-reports who were screened out in 2012, and 75% had only one recurrence. Overall, 12.6% of all victims with an initial screened-out report had a recurrence (8,666 out of 60,262+8,666).

These findings suggest that the current screening-out procedure identifies victims with low risk-of recurrence of maltreatment relatively effectively. However, among the screened-in victims, nearly half were still investigated, even though they had a low risk of recidivism. The predictive models described in the next section can identify this population accurately and may be used to assist the Department to improve the efficiency in the screening process.

5.3 Predictive Models for Chronic Maltreatment

As discussed in Section 5.2.2, there is a close connection between the concept of substantiation and chronicity. By the time the fifth report is received and decisioned by the child welfare system, the probability that at least one report has a disposition of verified or some indication of maltreatment is just under 94%. While not a certainty, a presence of multiple reports is highly suggestive of an environment of risk. The goal of this analysis is to understand factors associated with sustained risk to children. This risk comes for those responsible for the child's safety: the parents and/or the caregiver. Hence, a set of models was developed to understand the risk posed by parents or caregivers to their children. This model characterized the prospect of chronic re-reporting of alleged perpetrators as their interactions with the child welfare system evolved over time.

The risk score generated by the models could be thought of as a statistical summary of the information known to the child welfare system with respect to perpetrator chronicity and, indirectly, substantiation. By providing caseworkers with information about the long-term risk potential of alleged perpetrators and caregivers, better informed decisions can be made regarding appropriate services and actions within a case.

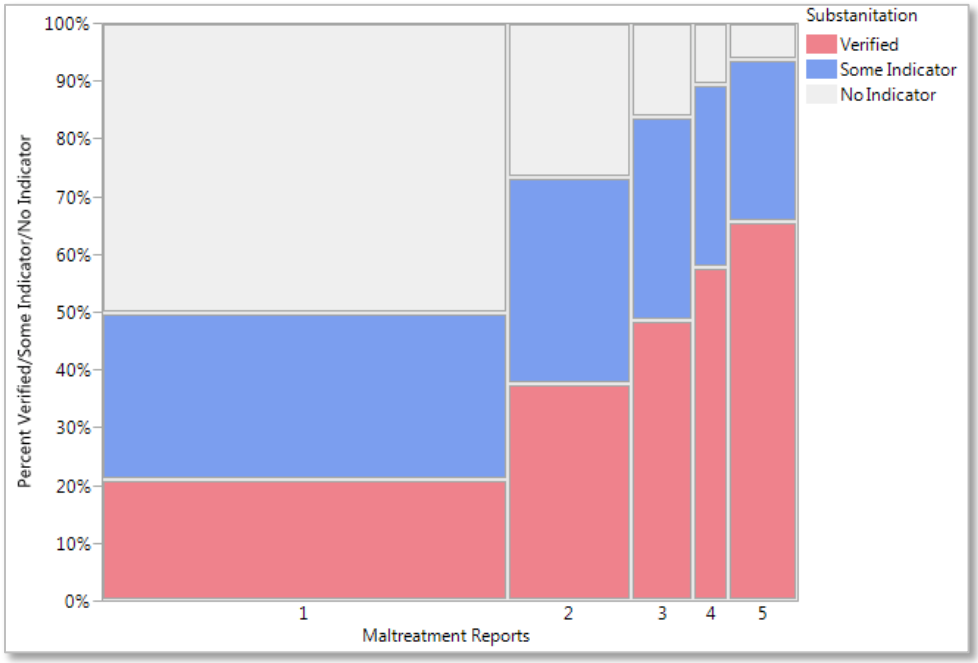
5.3.1 Modeling Overview and Data and Baseline Risk

Models for predicting perpetrator re-report were built from the 2004-05 perpetrators cohort. As explained in Section 3.3.1, the perpetrator cohort file had 291,499 individuals with an initial report in the base period. Over 60% (171,007) came in to the system for the first time as an alleged perpetrator, while the remaining 40% (112,492) were caregivers in their initial reports.

The goal of the modeling process was to identify individual caregivers and perpetrators in the child welfare system population likely to reach a state of chronicity. For the analysis, the chronicity was defined as having at least five reports to the child welfare system over a 10-year timespan. Under this definition, about 10% of the individuals in the cohort (28,433 out of 291,499) reached the level of chronic perpetration.

This definition of chronicity was based on the analysis shown in Figure 12. The proportion of verified and some indication reports was plotted against the number of reports for that individual. The width of the bars indicates the relative proportion of individuals with one through five-or-more reports to the child welfare system. For the five-or-more-report (chronic) group, nearly 94% had at least one report with a substantiation level of *some indicator* or *verified*. This suggested a high frequency of re-reporting was equivalent to strong evidence of maltreatment risk.

Figure 12: Substantiation vs. Number of Reports to the Child Welfare System

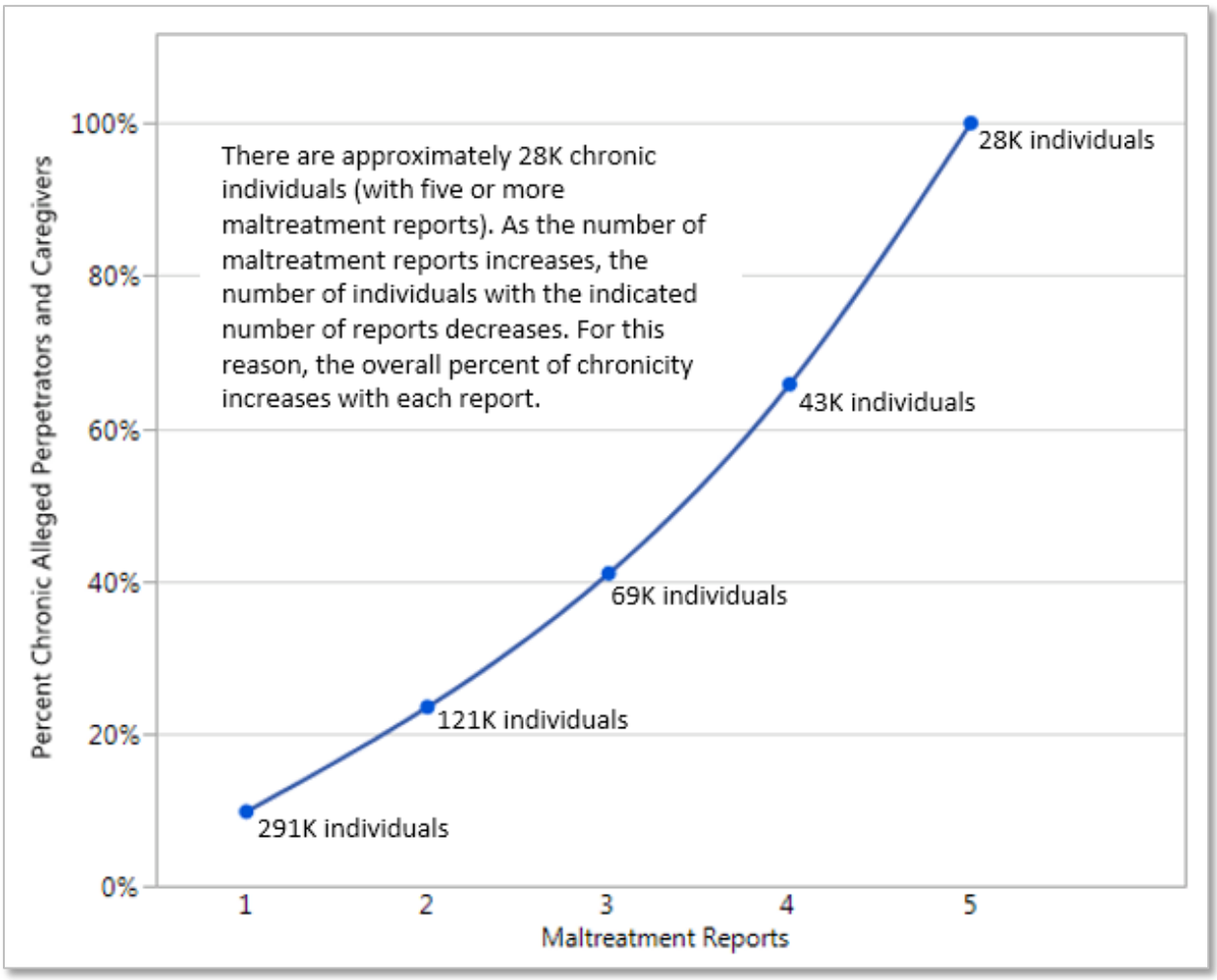


With this modeling target, the question became: *how quickly could a potential chronic perpetrator be identified from data available to the Department?* Each new report to the child welfare system brought additional information that could be used to measure chronic perpetration risk for an individual. Unfortunately, each new report also surfaced another episode of alleged maltreatment for the children in the care of that individual. In light of these trade-offs, the risk modeling process was customized for each step in the re-reporting process.

- An initial-report model was built using all 291,499 alleged perpetrators and caregivers, using the information known to the child welfare system at the close of the initial report investigation. The risk factors were statistically weighted to generate a risk metric for chronic perpetration—four additional reports—over the next decade.
- A second-report model was built using approximately 121,000 individuals in the cohort with two or more reports to the child welfare system, using the information known to the child welfare system at the time of the second report. In addition to the risk factors used in the initial-report model (updated to reflect any changes at the time of the second report), a critical time-since-first-report variable was included.
- A third-report model was built using approximately 69,000 individuals in the cohort with three or more reports to the child welfare system. In addition to the risk factors used in the second-report model (again updated to reflect any changes at the time of the third report), a time-since-previous report was included.
- Finally, a fourth-report model was built using approximately 43,000 individuals with four or more reports with similar risk factors as in the third-report model.

Figure 13 shows the progression of the overall probability to chronicity. The number of chronic individuals remained constant for each of these model, while the number of individuals for whom the model applied decreased; therefore, the overall probability of chronicity (called the baseline risk) naturally increases with the number of reports received by the child welfare system.

Figure 13: Percent Chronic vs. Number of Reports to the Child Welfare System



5.3.2 Model Risk Factors

The chronic risk models created for this analysis mathematically combined information known about an alleged perpetrator or caregiver to generate a score—the probability this person would eventually have five or more reports to the child welfare system. The process of creating this mathematical relationship was an iterative application of the techniques of predictive modeling and machine learning (SAS Institute, 2014). This section describes the types of risks considered and how they were transformed into measurements usable for estimating risk.

Starting with the exploratory analysis described in Section 4.3, interesting or potentially predictive risk factors were characterized in a multitude of ways in a modeling data set (one modeling data set for each model built). For this analysis, the number of characterized risk factors exceeded more than 500 at the close of the exploratory phase. The risk modeling algorithm selected and weighted these 500 potential risk factors to create the chronicity risk scoring model. Risk factors omitted from the final models were either because they were not predictive of chronic perpetration or because another risk factor provided the same information about chronic perpetration as the omitted factor.

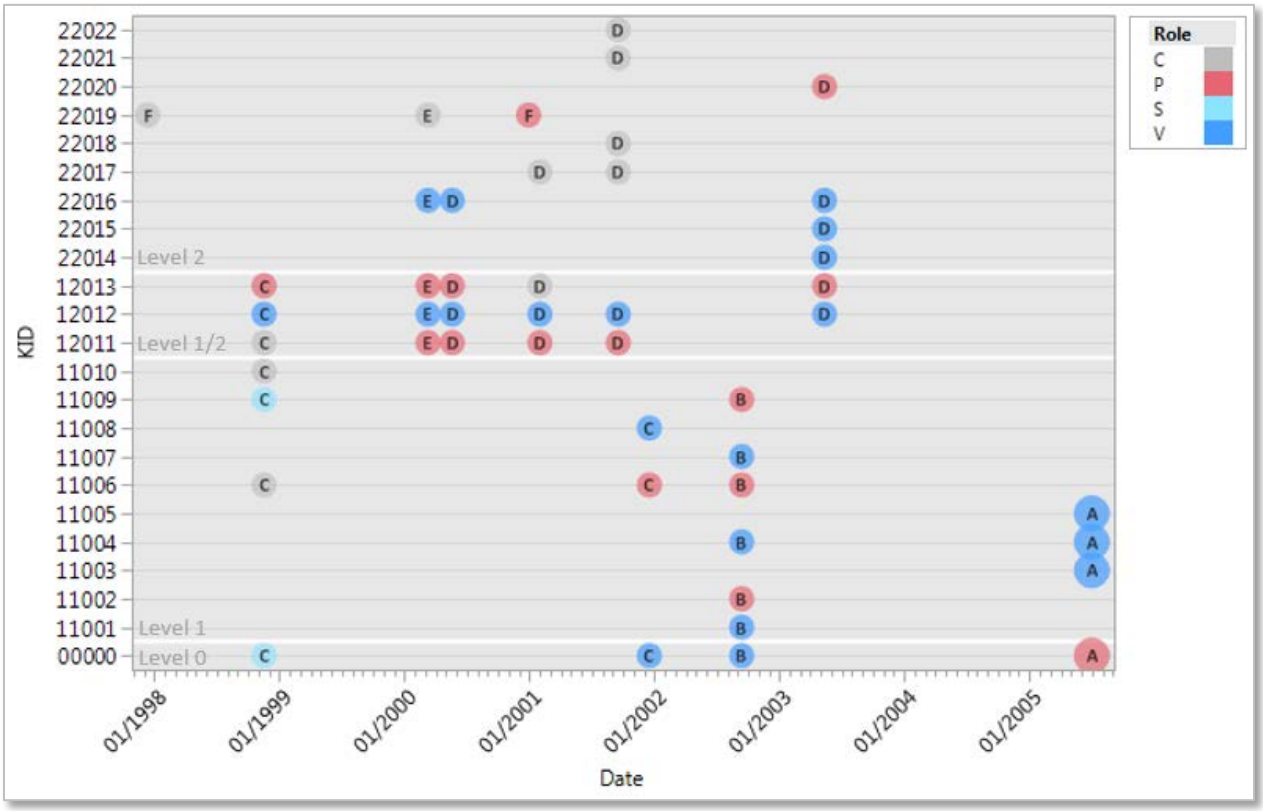
5.3.2.1 HISTORICAL REPORT CHARACTERISTICS

The historical report characteristics were the largest group of risk factors available for modeling, due to the large number of features available to characterize a report. These features included:

- Verification status (any, verified, some indicator, no indicator)
- Role of individual in a report (any, victim, perpetrator, caregiver, sibling, other*; note: individuals with a report role of other were not included in the historical report characteristic inputs*)
- Level of network relationship (any, 0, 1, 2; *see Section 3.3.3*)
- Connection (any, direct, indirect; *this factor applied to Level 2 relationships. A direct connection existed if the individual in the Level 2 relationship had at least one shared case with the perpetrator, a Level 1 relationship. Otherwise, the Level 2 relationship was deemed an indirect connection.)*
- Time window (2 weeks, 3 months, 6 months, 1 year, 2 years, 5 years)

Historical report characteristics were constructed by counting the number of reports falling into a combination of these report features. For example, a risk factor was created by counting the number of historical perpetrator reports in Level 0, 1, or 2 relationships with the subject in the 20 years prior to the risk estimation date, excluding the current report. Figure 14 shows how this looked from a historical report and network perspective. The number of reports meeting the criteria for the subject in Figure 14 was equal to 44 and spanned five separate cases (labeled B-F in the diagram).

Figure 14: Historical Report Factors: Example



Approximately 1,300 of the 1,680 combinations of historical report characteristics were excluded from consideration by statistical redundancy or non-applicability (for example there were no indirect Level 0 or Level 1 relationships). In addition, for certain combinations, the count of reports was replaced by a 0/1 indicator of the presence of absence of reports satisfying the features of the combination. In all, there were about 380 historical report characteristics available for predicting chronicity in each of the four risk models.

5.3.2.2 HISTORICAL PLACEMENT CHARACTERISTICS

The second largest group of risk factors were those characterizing historical placements. As in the case of historical report characteristics, the placement variables indicated the presence or absence of certain types of placements as well as the counts of placements over particular time ranges. Removals were also tracked with historical placement characteristic risk factors. The features tracked in placement risk factors included:

- Placement type (any, adoption, foster care relative, foster care non-relative, group home, relative)
- Action (removal, return)
- Level (any, 0, 1; *note: Level 2 removals were included in the any group*)
- Time window (2 weeks, 3 months, 6 months, 1 year, 2 years, 5 years)

Historical placement characteristic risk factors were constructed by indicating or counting the number of placements events satisfying combinations of the above features. For example, one risk factor considered foster care placements (with relative or otherwise) over the previous two years. Another counted the number of removals for Level 1 relationships over a six-month time window.

Characterizing the duration of a removal/placement was considered in addition to the above counts and indicator variables. Because removals and placements only applied to a small fraction of the victims in the cohort, an existential issue arose in measuring the removal or placement duration of an individual without a removal or placement. Although there are methods in risk modeling to handle such issues, it was determined that virtually the same information about a removal would be conveyed by simply indicating whether or not a removal or placement occurred rather than characterizing its duration. Therefore, the duration factors were omitted from the risk factor selection process.

In all, about 60 feature combinations were made available for the risk model generation.

5.3.2.3 HISTORICAL MALTREATMENT CHARACTERISTICS

Maltreatment risk factors were restricted to Level 1 victims of the alleged perpetrators and caregivers. The types of maltreatment and time windows included:

- Maltreatment type (physical neglect, physical abuse, family violence, substance abuse, sexual abuse, other neglect)
- Time window (6 months, 1 year, 5 years)

Historical maltreatment risk factors counted the number of or indicated the presence of a specific maltreatment type within a specific time window. For example, one factor considered the number of Level 1 victim reports with substance abuse maltreatments in a five-year window. A similar risk factor considered if there were *any* such reports in the five-year window.

Historical maltreatment type was characterized by a total of 36 distinct risk factors.

5.3.2.4 HISTORICAL SERVICES CHARACTERISTICS

Services were characterized in the risk model by counting the number provided historically to victims, perpetrators, the subject, and overall[7]. The time windows considered were two weeks, three months, six months, one year, two years, and five years. This resulted in 24 distinct services-related risk factors available for modeling. For example, one factor considered the number services provided to the subject, presumably while still a minor over the previous five years.

[7] The study assumed that in-home services provided by the Department are consumed and used by families because there is no data available to show the actual utilization of services. Services may be partially used by some families, which would affect the outcomes.

5.3.2.5 CURRENT REPORT CHARACTERISTICS

There were nine risk factors generated characterizing the current report.

- An indicator of role assigned to the subject in the current report (**1** if perpetrator, **0** if caregiver). For the modeling cohort, this role can change on each report.
- An indicator if the subject is a parent to one of the victims.
- An indicator of the report's substantiation status (**1** verified, **0** otherwise).
- The minimum, average, and maximum age of the report victims.
- The minimum, average, and maximum age of the report victims and siblings.
- An indicator if the victim dates of birth are missing.

5.3.2.6 ALLEGED PERPETRATOR OR CAREGIVER DEMOGRAPHIC CHARACTERISTICS

There were four demographic characteristics of the alleged perpetrator or caregiver considered as risk factors for modeling.

- Age of the alleged perpetrator or caregiver at the time of the current report
- Ethnicity of the alleged perpetrator or caregiver (white, black, Hispanic, other)
- Gender of the alleged perpetrator or caregiver (M, F)
- Indicator of the alleged perpetrator or caregiver's date of birth is missing

5.3.2.7 INTERGENERATIONAL MALTREATMENT CHARACTERISTICS

Intergenerational maltreatment was characterized in several ways.

- The number of historical reports with the alleged perpetrator or caregiver as a victim or sibling. The time windows for these counts were two weeks, three months, six months, one year, two years, five years, and 20 years.
- More generally, historical report, placement, and service characteristics over a 20-year time window were considered as intergenerational risk factors if they were included in the model with higher weight than their shorter time window counterparts.
- Intergenerational maltreatment characteristics were *not* included, as there was no such data available prior to 2004.

5.3.2.8 HISTORICAL MENTAL HEALTH CHARACTERISTICS

Risk factors were generated by counting the number of mental health services provided historically for Level 0 and Level 1 relationships and separately for Level 1 victims. The time windows for these counts were six months, one year and five years. This yielded six distinct risk factors.

5.3.2.9 PHYSICAL PROBLEM CHARACTERISTICS

Risk factors were generated by counting the number of individuals with significant physical problems historically for Level 0 and Level 1 relationships and separately for Level 1 victims. The time windows for these counts were six months, one year and five years. This yielded six distinct risk factors.

5.3.2.10 INTER-REPORT CHARACTERISTICS

Five risk factors characterizing the relationship between the report at hand and previous reports were generated. The following applied to Reports 2, 3 and 4:

- Time since the initial report of the alleged perpetrator or caregiver
- Indicator of whether or not the alleged perpetrator or caregiver was a parent to any of the victims of sibling in the initial report
- Indicator of whether or not the subject was parent to any of the victims of sibling in any earlier report
- The fraction of times the subject had a role of perpetrator on earlier reports

The following risk factor applied to the models of Reports 3 and 4:

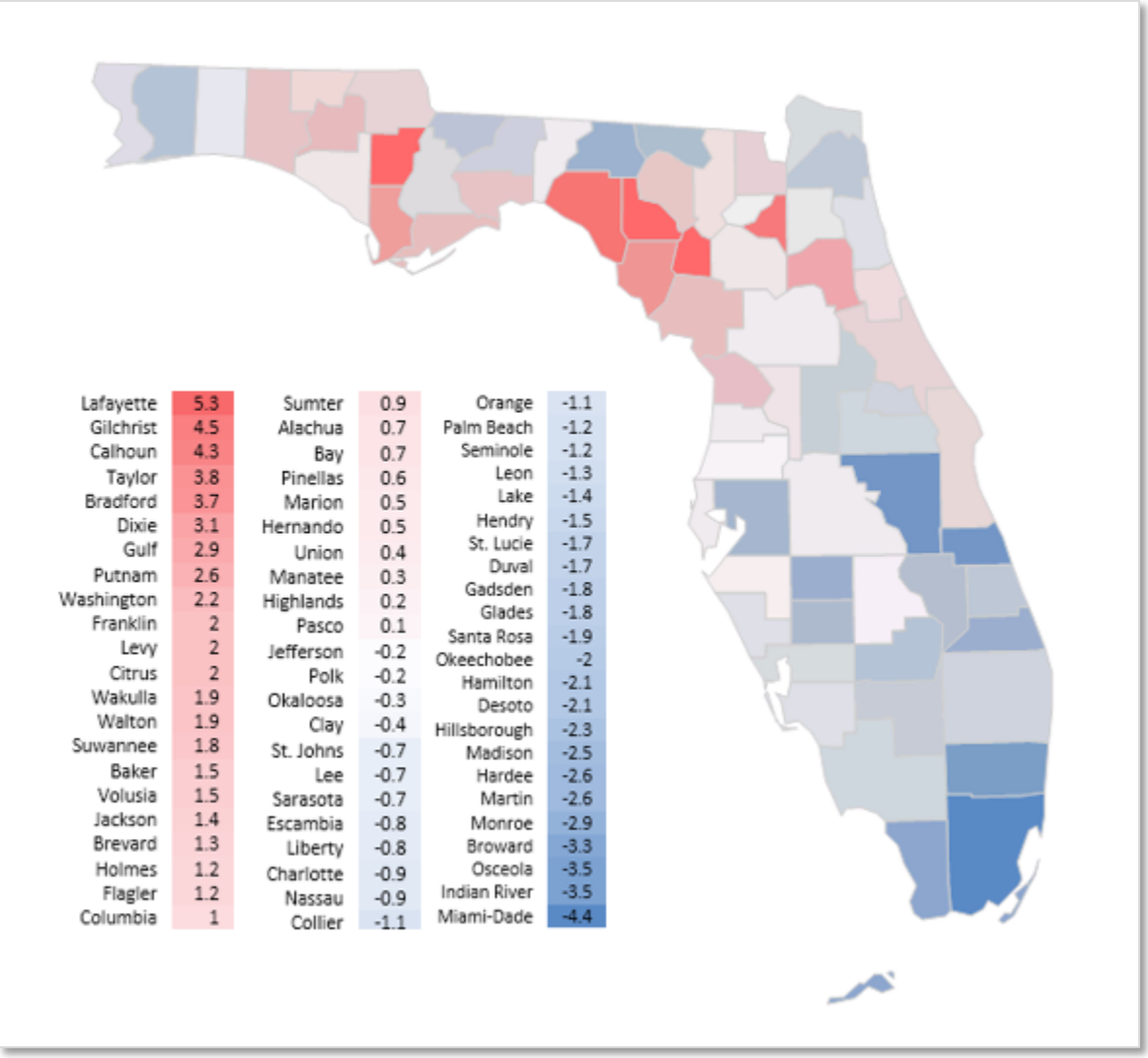
- Time since the previous report of the alleged perpetrator or caregiver

Note that the models themselves also characterized inter-report risk. While each model was fit separately on a separate set of data, the four models as a collection characterize risk for alleged perpetrators or caregivers. Thus, the number of the reports to the child welfare system can be described as risk factor for the collection of the four models.

5.3.2.11 GEOGRAPHIC RISK

Geography was included as a modeling risk factor by calculating the log-odds of re-reporting within each county of the state. The ordering of the counties generated by this calculation was included as a numeric risk factor. Figure 15 shows the relative risk ranking of the counties generated by this process. The score values in the figure show the deviation from average risk on an adjusted log scale. A positive number indicates the county was riskier than average for re-reporting, and a negative number indicates the county was less risky than average. Since a 10-point change in the final risk score doubled the risk, this meant Lafayette County was about twice as risky for re-reporting as Miami-Dade County. Whether this was due to an actual lower amount of risk in Miami-Dade County or an under-reporting of maltreatment in Miami-Dade is a matter for further investigation.

Figure 15: Re-reporting Risk Ranking of Florida Counties



5.3.2.12 Risk Factor Transformations

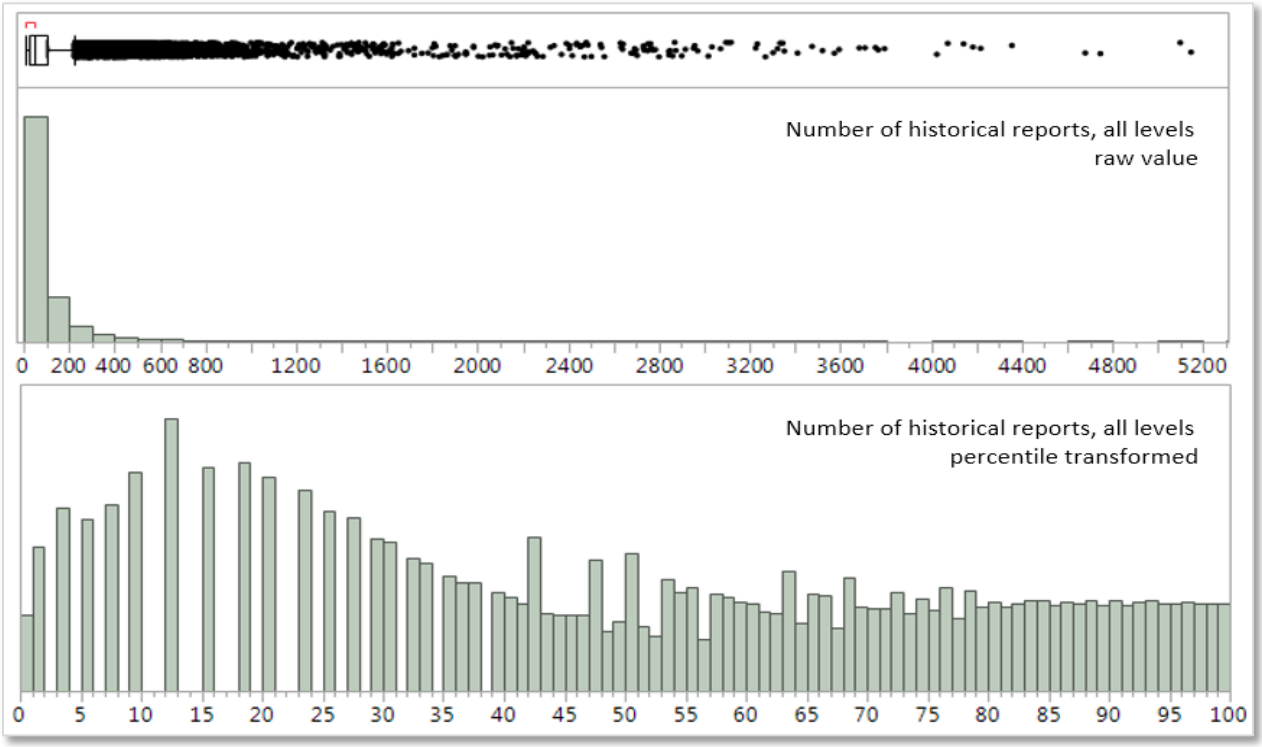
Many risk factors, especially those related to counting the number of historical reports with particular features, had extremely skewed distributions with outliers. In general, such distributions are problematic for regression-based predictive modeling methods. The typical remedy for this issue is some type of truncation or transformation. Truncation methods suffer from information loss for observations exceeding the truncation threshold. On the other hand, many transformation methods suffer from interpretability issues or limits on the values of the raw data (for example a logarithm transformation requires strictly positive values for the raw data).

Transforming the raw risk factor values into percentile scores circumvents these issues. Percentile scores are commonly understood and allow for easy comparison between disparate inputs (a percentile-transformed value 97, meaning 97th percentile, is known to be large,

independent of the actual definition of the underlying raw value). Most importantly, percentile-transformed risk scores behave well in regression-based modeling methods.

Figure 16 provides an example of the original and percentile transformed value for one of the model risk factors. In theory, the transformed version of the risk factor should be uniformly distributed, with each percentile having an equal number of observations. The irregularity observed in the example is due to ties in the raw value. Therefore, the percentile scores were adjusted in modeling to compensate. In this analysis, all risk factors related to counts were transformed to a percentile scale prior to modeling.

Figure 16: Effect of Percentile Transformation on a Model Risk Factor



5.3.3 Risk Factor Selection

The more than 500 modeling risk factors available for characterizing alleged perpetrator and caregiver chronicity were evaluated, selected and weighted using the data-driven methodology of predictive modeling. This process excluded many risk factors due to either for statistical irrelevance or redundancy, and the number of risk factors actually used in the end for predicting chronicity was dramatically less than 500. In fact, across the four final predictions models, the number of risk factors with non-zero weights ranged from 13 to 23.

5.3.3.1 Model Odds Ratios

Table 55 lists the risk factors in each of the four chronicity models along with their odds ratios. In general, odds ratios greater than 1.0 indicated an increase in chronicity risk with increasing risk

factor value, and odds ratios less than 1.0 indicated a decrease in chronicity risk with increasing risk factor value.

Table 5: Effect of Percentile Transformation on a Model Risk Factor

Risk Group	Risk Factor	Model for Reports:			
		1	2	3	4
Historical report risks	Number of directly linked verified or some indicator reports in last year		0.9958		
	Number of verified or some indicator reports in last year		1.0054		
	Number of previous caregiver reports in last year		0.9976		
	Number of Level 1 caregiver reports in last two years			0.9975	0.9981
	Number of Level 1 caregiver reports in last five years		0.9975		
	Number of Level 1 perpetrator reports in last two years		0.9974	0.9972	
	Number of Level 1 sibling reports in last five years		1.0033		
Placement risks	Number of Level 1 removals in last year				0.9957
Maltreatment risks	Other neglect maltreatments in last six months	1.0014			
	Substance abuse maltreatments in last six months	1.0026	1.0014		
Services risks	Number of services offered in last five years		1.0022		
	Perpetrator services offered in last five years	1.0083			
Current report risks	Missing or erroneous victim dates of birth	1.5017			
	Subject is parent to at least one victim in current post-initial report		1.3482	1.2262	1.2562
	Report is verified			0.8245	0.7911
	Average age of victims			0.7991	0.8041
	Average age of victims and siblings		0.6686		
	Minimum age of victims	0.4261	0.6429	0.6076	0.6502
	Number of individuals in current report	0.9929			
	Number of verified or some indicator in current report	1.0024			
Subject demographic risks	Subject Age	0.9732	0.9794	0.9828	0.9859
	Subject Black ethnicity	0.8424	0.7951	0.8291	0.8944
	Subject Hispanic ethnicity	0.6572	0.8317	0.8848	
	Subject Other ethnicity	0.7147			
	Subject is female	1.5930	1.4171	1.3419	1.2691
Intergenerational risks	Number of intergenerational victim reports for Subject	1.0073	1.0051	1.0041	
	Number of directly linked network reports in last 20 years	1.0046			
	Number of directly linked verified reports in last 20 years	0.9984			
	Number of network reports in last 20 years (all levels)	1.0069			
	Number of verified reports in last 20 years		0.9977		
	Number of previous victim reports in last 20 years		1.0094	1.0073	1.006
Mental health risks	Mental health services provided in last six months	1.0058			
Inter-report risks	Subject assigned perpetrator role in last 10 years	0.4221	0.6731		
	Subject is parent to at least one victim in some report (initial to current)		1.3051	1.2971	1.1996
	Subject is parent of at least one victim in initial report	3.8192	1.2063		
	Time since initial report		0.7847	0.8127	0.8014
	Time since previous report			0.9022	0.8889
Geographic risks	Geographic risk	3.4938	2.229	1.6513	

5.3.3.2 DETERMINING RISK FACTOR IMPORTANCE

While the odds ratios in Table 5 shows the impact of individual risk factors on chronicity risk, it is not appropriate to compare the relative importance of the risk factors using odds ratio. There are two reasons for this:

- The risk factors have different scales and value ranges. Because the odds ratio describes the change in odds for a unit change in the underlying risk factor, a direct comparison of the odds ratios is not meaningful. For example:
  - The risk factor *Report is verified* had two values: 0 and 1. The odds ratio for this risk factor was either 0.79 or 0.82 depending on the model. This meant over its entire range of values, the *Report is verified* risk factor decreased the risk of chronicity by either 21% or 18%.
  - The risk factor *Number of reports in the last 20 years* had a wide range of possible values (percentile scores between 0 and 99). The odds ratio for this risk factor was 1.0069. For a unit (percentile) change in the risk factor value, the odds of chronic perpetration increased by 0.69%. However, over its entire range of values, it increased the risk of chronicity by a factor of $(1.0069)^{99}$=1.97, or 97%.
- In these models, the risk factors were correlated. For example, in the first-report model, it is impossible to change the values of risk factors in the *Intergenerational risks* group independently; an increase in the *Number directly verified reports in the last 20 years* would also increase the *Number of verified reports in the last 20 years*. A complicating factor was that while the former decreased chronicity risk (odds ratio=0.9984), the latter increased chronicity risk (odds ratio=1.0046). The influence of the pair was connected and modified risk in opposite directions.

Perhaps surprisingly, in predictive modeling and machine learning, issues such as the importance of risk factors are sometimes ignored. This is because the primary focus of predictive modeling is on the utility of predictions themselves and not necessarily on the impact of the underlying risk factors. Moreover, certain modeling methodologies like neural networks and other modern machine learning techniques make the impact of individual risk factors less transparent. Care must be exercised to understand the impact of individual risk factors in predictive models, since the approach for understanding impacts of individual risk factors depends on the modeling technique used. In this study, an additive regression model form was chosen to model chronicity risk.

5.3.3.3 ADJUSTED SCORE CONTRIBUTIONS AND RISK SCORECARDS

The first of the two complications noted above, risk factors on different scales, was addressed as follows.

To start, the contribution of each risk factor to a given subject's risk score was computed. Conceptually, this was accomplished by simply multiplying the risk factor weight (obtained from the modeling process) by the value of the corresponding risk factor measurement.

Score contribution of risk factor = (risk factor weight) x (risk factor value)

For example, if the model weight for the risk factor *subject age* is -0.028 and the subject was 20 years old at the time of a report, the score contribution of *subject age* to is calculated as (-0.028)x(20)=-0.56.

Computing the score contribution for each risk factor across all subjects quantifies how much a given risk factor can change the overall risk score. To make more interpretable, the score contribution was re-scaled so that:

1. The minimum value was zero. This was done by subtracting the theoretical minimum score contribution value of the risk factor.
2. A 10-point change in importance represented a doubling in total risk score. This was done by multiplying the shifted score contribution value by 14.4 = 10/ln(2).

This re-scaled score contribution was called the *adjusted score contribution*.

For example, the score contribution of *subject age* for a 20-year-old subject was calculated above to be -0.56. The minimum score contribution for *subject age* is -2.44, corresponding to a 90-year-old subject. Therefore, the adjusted score contribution for a 20-year-old subject was (-0.56 – (-2.44)) x 14.4 = 27.1.

The same calculation was done for every value of every risk factor. By tabulating the adjusted score contributions and the corresponding risk factor values, the impact of each risk factor on the score can be quantified. This tabulation is known as a *risk scorecard*. A risk scorecard is a complete representation of a risk model which enables the calculation of the risk score for any given subject. The risk scorecard for the initial report model is found in Table; the risk scorecards for the other three models are found in the Appendix, Table18 through Table 21.

Presenting a risk model in terms of a risk scorecard had several advantages:

- Calculating chronicity risk for a given subject is accomplished by looking up the point value in a table corresponding to each risk factor and adding up all of the resulting point values.
- The effect of each risk factor is on the same scale, making it easy to understand the effect each risk factor has on the overall risk score.
- Risk differences between two subjects are quantifiable without calculation.
- Differences between risk models are easy to compare.
- Scorecards have a long history for quantifying risk. Some of the earliest predictive risk models in the financial industry took the form of a scorecard. Structured Decision Making is an application of risk scorecard (although SDM scorecards are generated in a substantially different fashion).

Table 6: Initial Report Risk Scorecard

Item	Details	Points
Subject Age (years)	Less than 17	29
	17-20	28
	20-22	27
	22-25	26
	25-27	25
	27-30	24
	30-32	23
	32-35	22
	35-37	21
	37-40	20
	40-42	19
	42-45	18
	45-48	17
	48-50	16
	50-53	15
	53-55	14
	55-58	13
	58-60	12
	60-63	11
	63-65	10
	65-68	9
	68-70	8
	70-73	7
	73-76	6
	76-78	5
	78-81	4
	81-83	3
	83-86	2
	86-88	1
	88-90	0
Subject is parent of at least one victim in initial report	Yes	19
	No	0
Minimum age of victims	0-1	18
	1-2	17
	2-3	16
	3-4	15
	4-5	14
	5-6	13
	6-7	12
	7-8	11
	8-9	10
	9-10	9
	10-11	8
	11-12	7
	12-13	6
	13-14	5
	14-15	4
	15-16	3
	16-17	2
	17-18	1
	18-18	0
Subject assigned perpetrator role	No	12
	Yes	0
	0-2	10

Item	Details	Points
Number of individuals in current report	3	8
	4	5
	5	3
	6	2
	7	1
	8+	0
Number of network reports in last 20 years (all levels)	109+	10
	40-108	9
	21-39	8
	12-20	7
	7-11	6
	6-6	5
	5-5	4
	4-4	3
	3-3	1
	0-2	0
Number of directly linked network reports in last 20 years	65+	7
	13-64	6
	8-12	5
	6-7	4
	5-5	3
	4-4	2
	3-3	1
	0-2	0
Subject is female	Yes	7
	No	0
Subject Black ethnicity	No	2
	Yes	0
Subject Hispanic ethnicity	No	6
	Yes	0
Subject Other ethnicity	No	5
	Yes	0
Missing or erroneous victim dates of birth	Yes	6
	No	0
Mental health services provided in last six months	Yes	4
	No	0
Neglect maltreatments in last six months	Yes	1
	No	0
Number of intergenerational victim/sibling reports for Subject	5+	6
	1-4	5
	0-0	0
Substance abuse maltreatments in last six months	Yes	2
	No	0
Perpetrator services offered in last five years	Yes	6
	No	0
Number of directly linked verified report in last 20 years	0-2	1
	3+	0
Number of verified or some indicator substantiations in current report	7+	3
	4-6	2
	1-3	1
	0	0
	Lafayette	12

Item	Details	Points
County	Calhoun, Gilchrist	11
	Bradford, Taylor	10
	Putnam, Gulf, Dixie	9
	Suwannee, Walton, Wakulla, Citrus, Levy, Franklin, Washington	8
	Sumter, Columbia, Flagler, Holmes, Brevard, Jackson, Volusia, Baker	7
	Pasco, Highlands, Manatee, Union, Hernando, Marion, Pinellas, Bay, Alachua	6
	Sarasota, Lee, St. Johns, Clay, Okaloosa, Polk, Jefferson	5
	Hendry, Lake, Leon, Seminole, Palm Beach, Orange, Collier, Nassau, Charlotte, Liberty, Escambia	4
	Hillsborough, Desoto, Hamilton, Okeechobee, Santa Rosa, Glades, Gadsden, Duval, St. Lucie	3
	Monroe, Martin, Hardee, Madison	2
	Indian River, Osceola, Broward	1
	Miami-Dade	0

5.3.3.4 CORRELATED RISK AND VARIABLE IMPORTANCE

It is tempting to reduce risk factor impact to comparing the ranges of values of the adjusted score contributions for the risk factors. However, this is not straightforward for these models. As discussed in Section 5.3.3.2, correlations among the risk factors complicates the quantification of impact, because an increase in the adjusted score contribution of one factor may be connected to a decrease in the adjust score contribution of another.

To address this problem, an analysis of the adjusted score contributions for each risk factor was conducted. Called *variable clustering* (SAS Institute, 2012), it determined which adjusted score contributions were highly correlated and varied in synchronicity. Once the correlated groups of risk factors were identified, the adjusted score contributions were simply added together and considered as a single group value.

For example, the initial-report risk model included both *Number of network reports in the last 20 years* and *Number of directly linked network reports in last 20 years* as separate risk factors. Not surprisingly, the variable clustering analysis found the adjusted score contributions of these two to be highly correlated. In fact, the variable cluster process also found these two factors were also highly correlated with *Number of individuals in current report*. To compensate for these correlations, the adjusted score contributions for the three risk factors were added and treated as a single group. As these risk factors in the group appeared related to long-term report count, the group was identified as Number of Network Reports in Last 20 Years.

The variable clustering analysis found several sets of closely correlated risk factors. A group of factors were defined for each of these sets. The members of each group are shown in Table 7. The first column identifies the model in which the group of factors appears, the second column the conceptual grouping name and third column the risk factors in the group.

The point of risk factor groups was to create sets of relatively independent factors that could be directly compared. The impact of each independent risk factor (or risk factor group) could then be accurately understood.

The range of adjusted score contribution identifies the relative importance of the modeling inputs in terms of impact to the score, as seen in Figure 17. In the initial-report model, *subject*

age is the most important differentiator of chronicity risk, followed by the parents as perpetrators, the age of the youngest victim and the total number of historical reports.

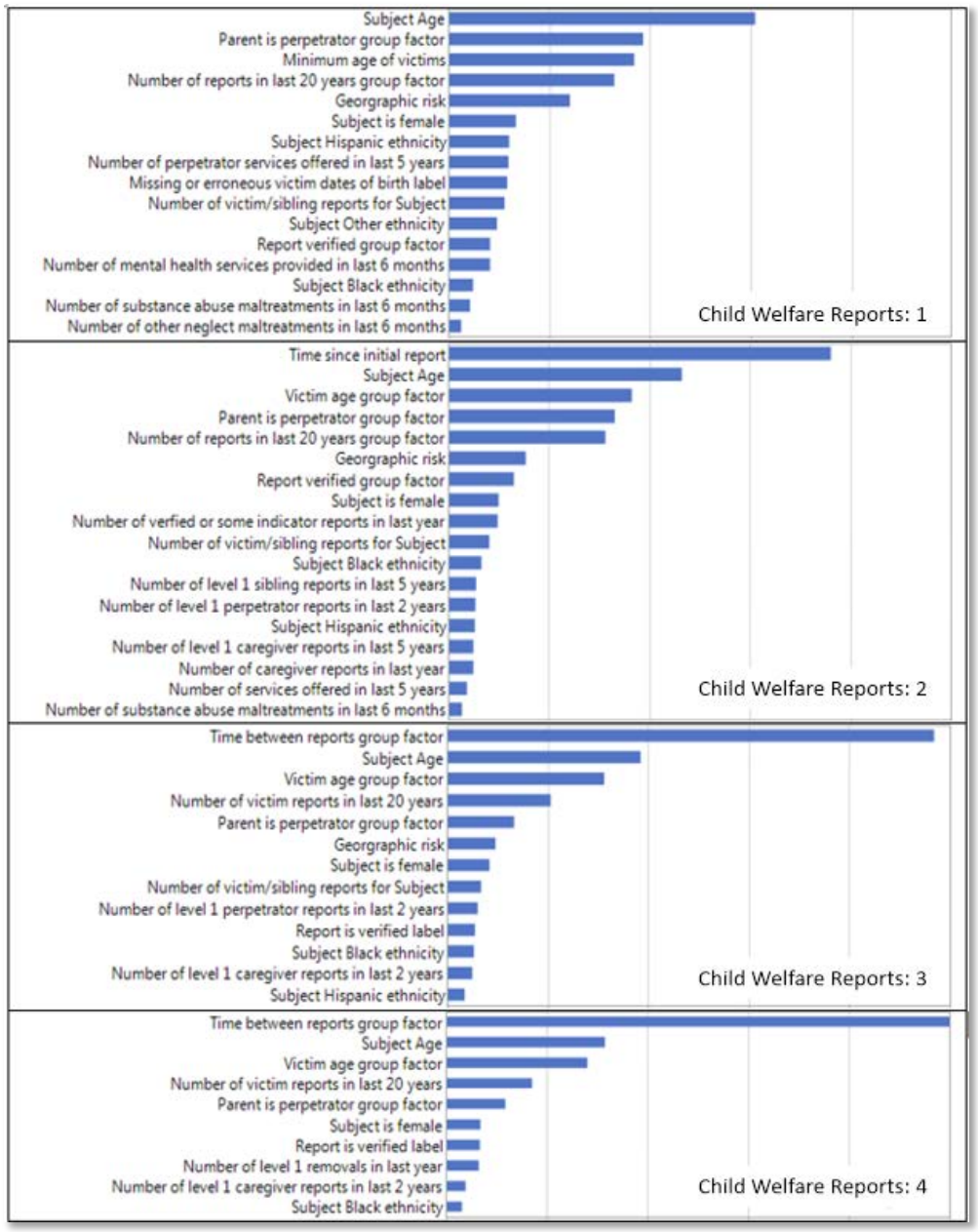
Because the adjusted score contribution for all groups of risk factors are on the same scale, a comparison between models can also be made. The second-report and subsequent models are dominated by time elapsed since the initial report. The elapsed time factor increases in impact as additional reports are made.

Table 7: Grouped Score Contributions

Report Count	Group Factor Name	Risk Factor
1	Number of reports in last 20 years	Number of individuals in current report
		Number of directly linked network reports in last 20 years
		Number of network reports in last 20 years (all levels)
	Parent is perpetrator	Subject is parent of at least one victim in initial report
		Fraction of times Subject has perpetrator role in last 10 years
	Report verified	Number of directly linked verified report in last 20 years*
		Number of verified or some indicator substantiations in current report
2	Victim age	Average age of victims and siblings
		Minimum age of victims
	Number of reports in last 20 years	Number of verified reports in last 20 years
		Number of victim reports in last 20 years
	Parent is perpetrator	Subject is parent to at least one victim in all reports
		Subject is parent of at least one victim in initial report
		Subject is parent to at least on victim in current report
		Subject assigned perpetrator role in last 10 years
	Report verified	Number of verified reports in last 20 years
		Number of verified or some indicator reports in last year
3	Victim age	Average age of victims
		Minimum age of victims
	Time between reports	Time since initial report
		Time since previous report
	Parent is perpetrator	Subject is parent to at least one victim in all reports
		Subject is parent to at least on victim in current report
4	Victim age	Average age of victims
		Minimum age of victims
	Parent is perpetrator	Subject is parent to at least one victim in all reports
		Subject is parent to at least on victim in current report
	Time between reports	Time since initial report
		Time since previous report

*** Due to data limitations, there are no verified reports prior to 2004. For the initial report, the number of verified reports in the past 20 years is effectively the number of verified reports in the first report.**

Figure 17: Risk Factor Impact on Score



5.3.4 Model Performance and Assessment

Two approaches were used when assessing model performance. The first approach, purely statistical, quantifies how each of the four models separated the chronic and non-chronic cases independently of time. The second approach, more practically oriented, quantifies how the models taken together would aid in the early detection of chronic maltreatment. In the latter assessment, time was a critical consideration.

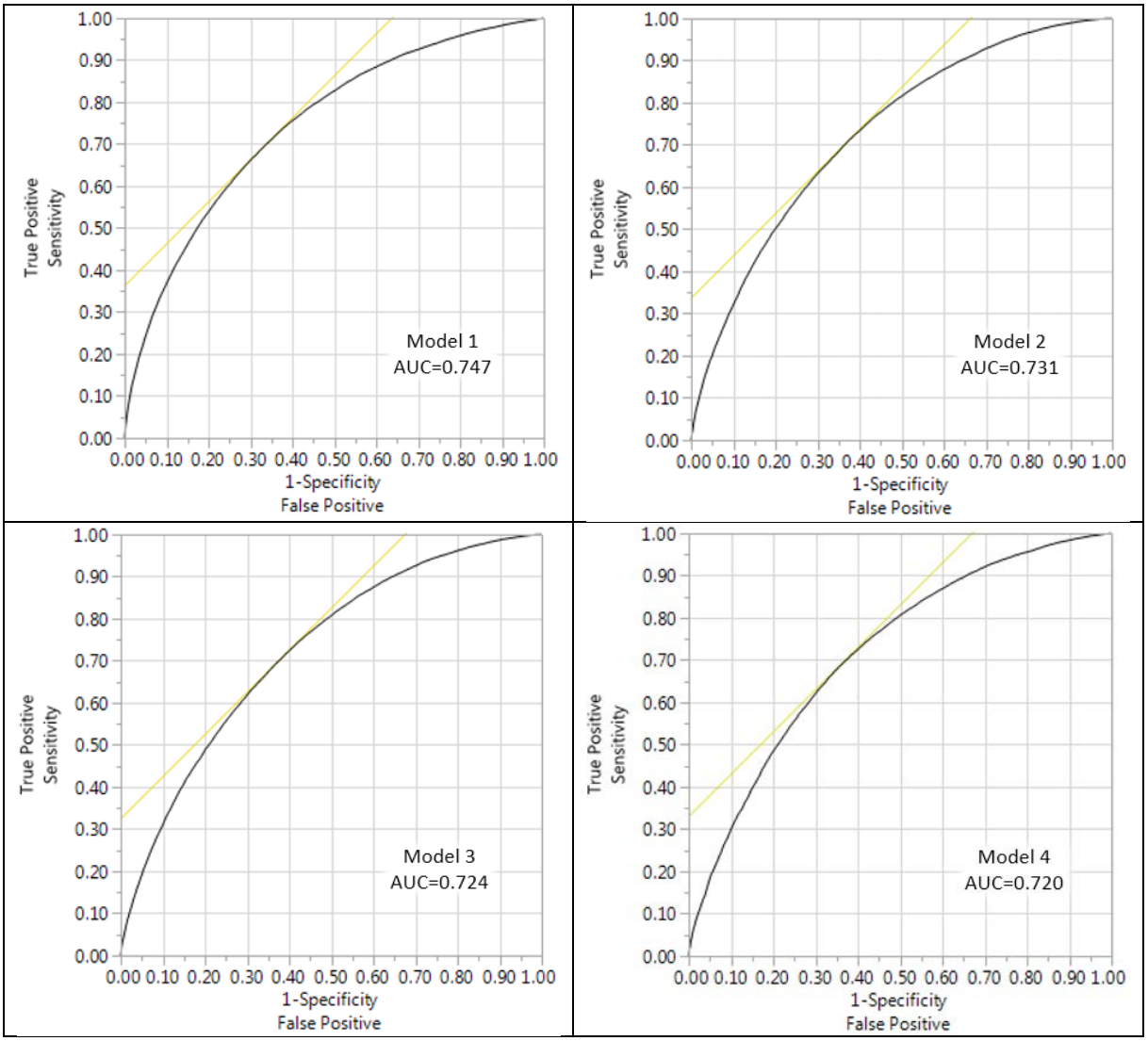
5.3.4.1 STATISTICAL ASSESSMENT OF MODEL PERFORMANCE

A variety of statistical model assessment can be employed to gauge risk model performance. One of the most common is the ROC curve (from Receiver Operating Characteristic), which plots the trade-off between true positive rate (also known as sensitivity or percent captured) and the false positive rate (also known as *1-specificity* or *false alarm rate*) for various operating thresholds. ROC curves for each of the four models are shown in Figure 18. To eliminate bias, the curves were constructed using a statistical technique called bootstrapping.

The more rapidly the ROC curve increases, the better the model is at separating chronic from non-chronic subjects. In a model with no ability to separate the subjects, the true positive rate increases at the same pace as the false positive rate, and the ROC curve will look like a 45-degree diagonal line. In a model with excellent separating ability, the true positive rate increases much more rapidly than the false positive rate, and the ROC curve will look like a steep hill with a flat top. The shape of the curve, and therefore the ability of the model to separate, can be summarized by the amount of area under the curve (AUC). A rapidly increasing ROC curve will have a higher AUC than a slowly increasing curve. Good values for AUC are highly dependent on model application.

For all of the chronicity risk models, the AUC statistic exceeded 0.72. This serves as the evidence that each model can effectively separate the chronic from the non-chronic subjects from the statistical perspective. Unfortunately, this assessment by individual model misses a key point that a subject with three reports to the child welfare system was considerably more likely to reach the chronic fifth report than a subject with only two reports and more likely still than a subject with just one report. Moreover, having reasonably high likelihood that a case would become chronic after the first report was much more valuable than having the same likelihood that another case would become chronic after four reports. Considerations like these are not captured in basic statistical assessments like the ROC curve. This suggested the need for an additional assessment methodology.

Figure 18: Model ROC Curves



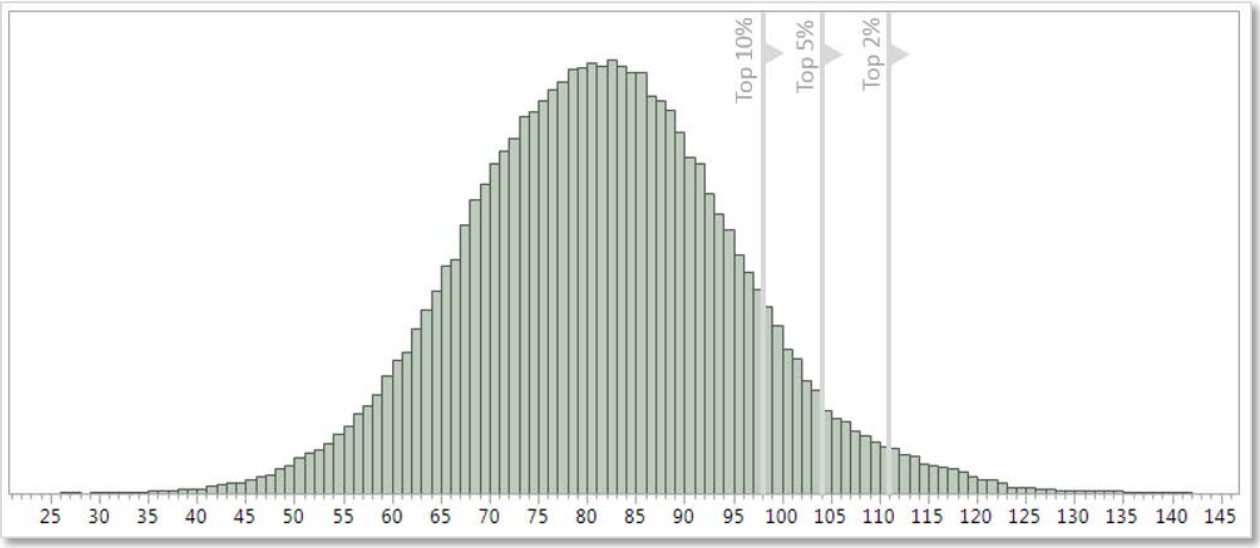
5.3.4.2 CHRONICITY DETECTION AT THE INITIAL MALTREATMENT REPORT

An assessment of model performance that incorporated time was found to better quantify the practical potential of the chronic re-reporting models. In fact, the earlier a chronic perpetrator could be identified, the more opportunity existed to take appropriate actions to minimize recurrent risk to families.

The first question examined was how many chronic perpetrators could be identified after their first report. Translated into statistical terms, this is the appropriate operating threshold that balances a high true positive rate with a low false discovery rate. (False discovery rate, a concept different from false positive rate, is the percentage of individuals who were classified by a model as chronic but were not.)

The overall rate of chronicity after the first report was about 10%. Intuitively, it does not make sense to select a larger group. If the model were able to perfectly separate the chronic from the non-chronic individuals, selecting more than 10% would introduce false positives. To reduce false positive risk, selecting individuals with the top 5% and top 2% of risk scores were also considered. The risk score cutoff corresponding to the top 10%, 5%, and 2% were obtained from the first-report model risk scores. They corresponded to scorecard totals of 98, 104, and 111 points, respectively. These values are shown in Figure 19.

Figure 19: Initial-Report Model Risk Score Distribution



To assess model performance, the following quantities were calculated for each threshold:

- True positive rate. This is the percent of all chronic individuals identified as such from the first report, using the specified threshold.
- Average lead time. This is the time between the first and fifth reports for individuals with risk scores above the specified threshold. This quantifies how much time was available, on the average, from first discovery of high chronicity risk to having that risk realized.
- False discovery rate. This is the percent of individuals with risk score above the specified threshold who were not chronic.
- Adjusted false discovery rate. This was the percent of individuals with risk score above the specified threshold that had only one report ever. While certain high-risk individuals may not become chronic, many had additional reports after their initial report. The adjusted false discovery rate is the fraction of high risk individuals that never had another interaction with the child welfare system.

From Table 8, between 9.5% and 32.6% of all chronic alleged perpetrators could be identified from their first interaction with the child welfare system. The average lead time for these early detections was more than five years. While the relatively high false discovery rate indicated that the high-risk selections included many non-chronic individuals, most turned out to have at least one additional eventual interaction with the child welfare system.

Table 8: Initial-Report Model Assessment

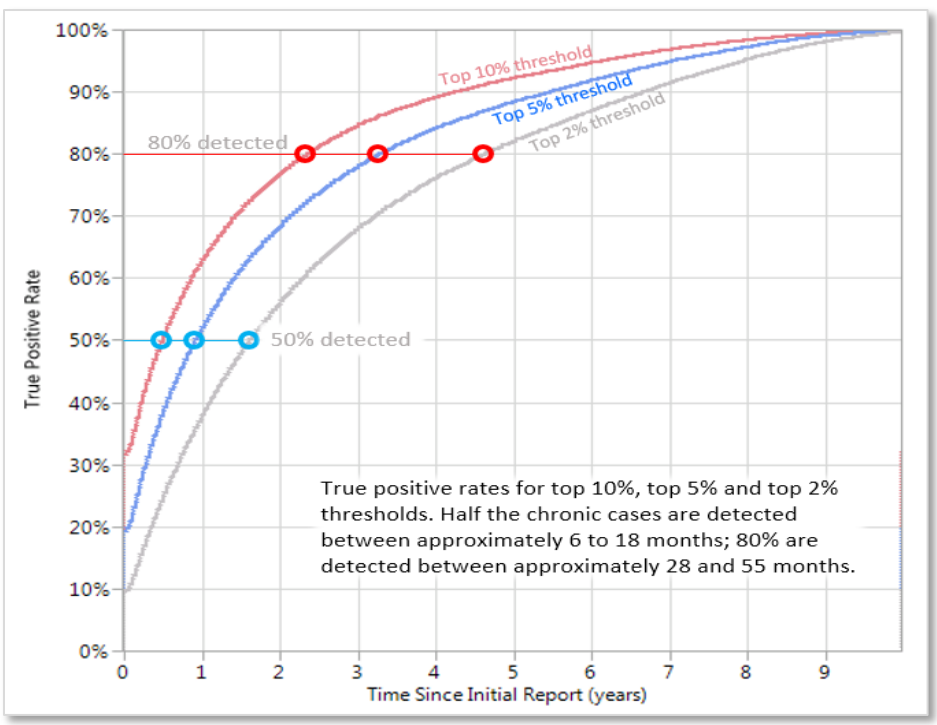
Threshold (individual count)	True Positive Rate	Average Lead Time (years)	False Discovery Rate	Adjusted False Discovery Rate
Top 10% (29,130)	31.6%	5.7	69.1%	26.5%
Top 5% (14,558)	19.3%	5.5	62.4%	20.3%
Top 2% (5,828)	9.5%	5.4	53.5%	14.7%

5.3.4.3 Chronicity Detection After the Initial Maltreatment Report

The findings from the model development concluded that each additional maltreatment report substantially increased the chronicity risk. It was also seen that each additional maltreatment report decreased the lead time to chronicity. The trade-off between these two competing ideas, along with the issue of false discovery rate was investigated. The question examined was how many chronic perpetrators could be identified as time progressed from the initial report.

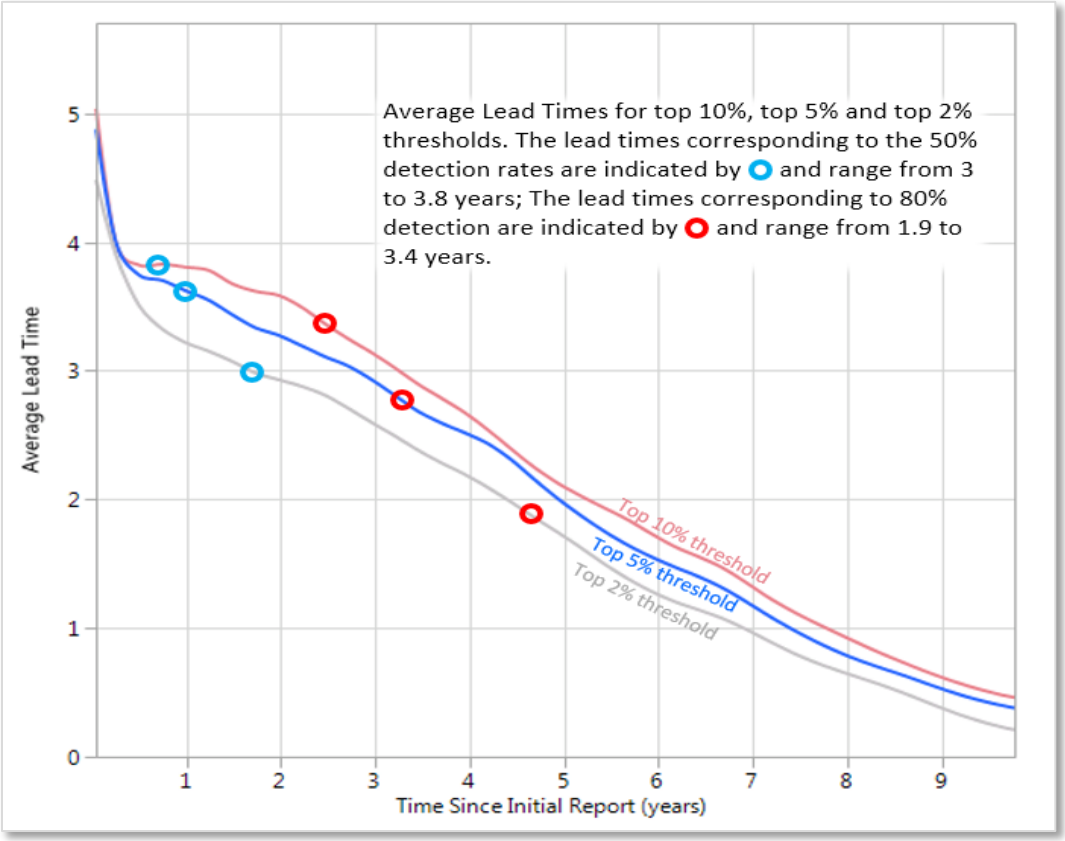
The variation in the true positive rate, the average lead time, and the false detection rate was studied. The results are shown in Figure 20, Figure 21, and Figure 22, respectively. For risk estimation after then initial report, an individual was considered high risk when his or her risk score exceeded the thresholds used in the initial model assessment.

Figure 20: True Positive Rate vs. Time Since Initial Report



By incorporating time into the analysis, the full effect of the chronicity models became apparent. In the riskiest 10% of the population by the score, half of the chronic individuals can be detected in just over six months and 80% in just over two years. Increasing the threshold to the riskiest 2% of the population by risk score increased these times to just over 1.5 years and 4.5 years, respectively.

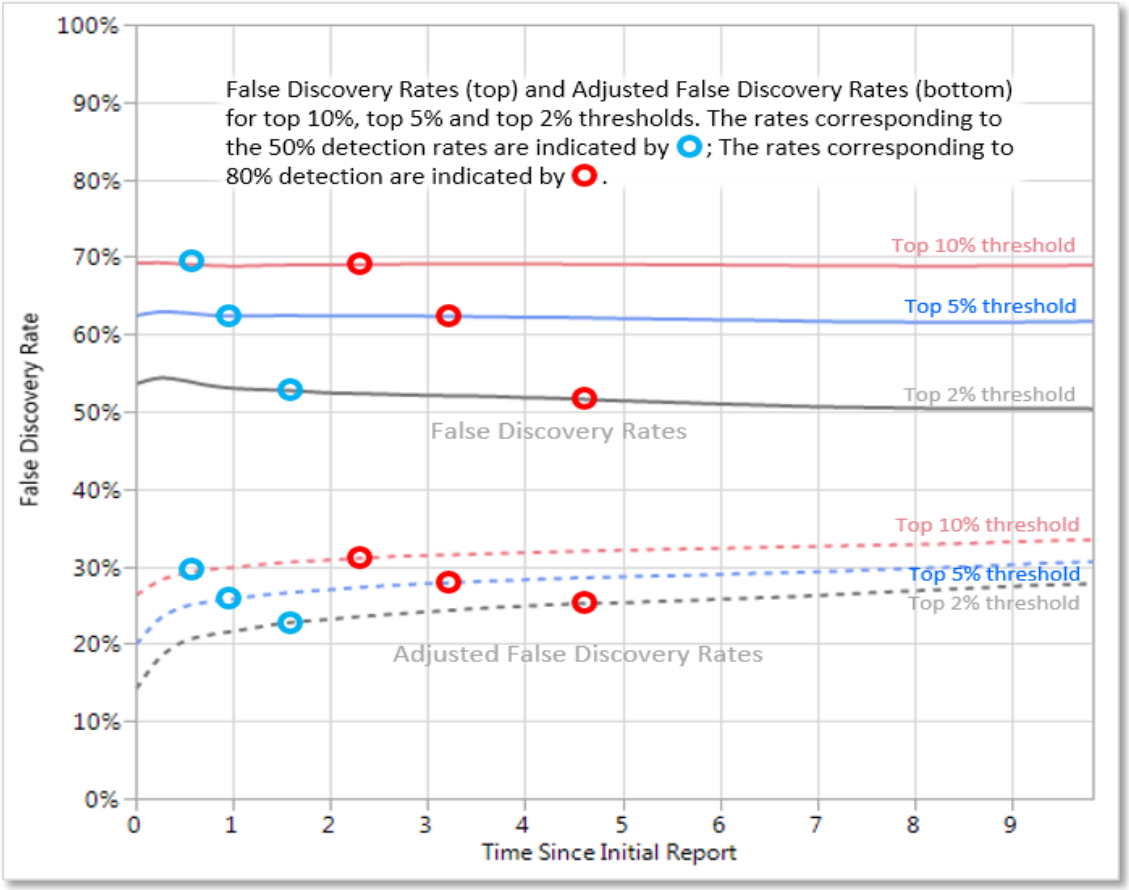
Figure 21: Average Lead Time vs. Time Since Initial Report



The average lead times decreased with time since initial report, and risk scores changed with each new report. The average time between the initial and second maltreatment reports for chronic cases was just over 1.6 years. Therefore, the shorter waiting period between the first and second reports reduces the average lead time to chronicity. As time since initial report increased, this problem became more pronounced. Nevertheless, for even the most conservative threshold (the riskiest 2%, with an 80% true positive rate), there was a minimum of two years on average between the time an individual was detected as chronic and the time the fifth maltreatment report arrived.

The false discovery rates were largely constant, if not slightly decreasing, across time. The adjusted false discovery rates increased slightly with time. The reason for the increase was related to the number of additional reports after receipt of a new report, since many individuals had no additional reports. While they were high-risk, they were not chronic, and specifically they had no additional reports to put them in the adjustment group.

Figure 22: Raw and Adjusted False Discovery Rates vs. Time



5.3.5 MODEL INTERPRETATION

An analysis of both high-risk and low-risk individuals was conducted to better understand the performance and utility of the chronicity risk models.

5.3.5.1 ANALYSIS OF HIGH-RISK INDIVIDUALS

In this analysis, the high risk threshold corresponded to the riskiest 5% of initial-report risk scores. As discussed in Section 5.3.4, the initial-report model identified nearly 20% of the eventually chronic individuals. The question was what made these chronic cases identifiable at their first contact with the child welfare system.

While the risk scorecard presented in Section 5.3.3 showed the contribution each factor could have on total risk score, the task of determining how high-risk individuals differed from other has not been addressed. To answer this question, the analysis cohort was divided into two groups: a high-risk group (with a scorecard point total of 104 or higher) and everyone else. The average number of points for each risk factor was calculated for both groups and difference in the score averages was examined. To better gauge how much the separation mattered relative to the range of the risk factor, the differences were divided by the risk factor point range and

expressed as the percentage of the risk factor point range. The results are presented in Table9, ordered by the percentage of point range. The larger the percentage, the more the factor separated the high-risk group from everyone else.

Table 9: Average Point Differences for Individuals above and below the Risk Threshold

Risk Factor	Average Points for Subjects Below Threshold	Average Points for Subjects Above Threshold	Average Point Difference	Point Range	Percent of Point Range
Number of intergenerational victim/sibling reports for Subject	0.2	3.8	3.6	6	60%
Subject is parent of at least one victim in initial report	7.2	15.2	8	19	42%
Subject is female	3.4	5.8	2.4	7	34%
Number of network reports in last 20 years (all levels)	4.7	7.9	3.3	10	33%
Number of directly linked network reports in last 20 years	3.1	5.3	2.2	7	31%
Minimum age of victims	12	17	5	18	28%
Substance abuse maltreatments in last six months	0.4	0.8	0.4	2	20%
Subject Age	21.1	26.8	5.7	29	20%
Subject Hispanic ethnicity	4.8	5.7	0.9	6	15%
Neglect maltreatments in last six months	0.3	0.3	0.1	1	10%
Geographic risk	4	5	1	12	8%
Number of individuals in current report	5	5.7	0.7	10	7%
Perpetrator services offered in last five years	0	0.3	0.3	6	5%
Number of verified or some indicator substantiations in current report	0.9	1	0.1	3	3%
Mental health services provided in last six months	0.1	0.1	0.1	4	3%
Subject Other ethnicity	4.9	5	0	5	0%
Missing or erroneous victim dates of birth	0.2	0.1	-0.1	6	-2%
Number of directly linked verified or some indicator reports in last 20 years	0.8	0.7	-0.1	3	-3%
Subject Black ethnicity	1.6	1.4	-0.1	2	-5%
Subject assigned perpetrator role	4.7	2.5	-2.2	12	-18%

The appearance of the factor *Number of intergenerational victim/sibling reports* appearing as the most important separator in the initial-report model for high-risk cases was somewhat surprising. In the overall scorecard, it only has a modest point range compared to other factors. While a risk factor like *subject age* played a critical role in overall chronicity risk, the intergenerational factor was important only for high risk cases. This is because most of the individuals with intergenerational effects were young and therefore high-risk by the factors *subject age* and *minimum age of victims* as well.

5.3.5.2 ANALYSIS OF LOW-RISK INDIVIDUALS

The risk model appears to effectively identify individuals likely to have chronic re-reporting. Is it possible to use the model to identify individuals of sufficiently low risk to reasonably screen-out these individuals from further investigation? To test this idea, individuals upon their initial report with the lowest risk score point totals were collected into three groups: the bottom 10%, bottom 5% and bottom 2%.Similar to the high-risk analysis, the following statistics were calculated for each group:

- True positive rate. This is the percent of individuals who had no additional report and identified as such by the model, using the specified threshold.
- False discovery rate. This is the percent of individuals identified as low-risk according to the threshold yet subsequently had another maltreatment report.
- False discovery rate with chronicity. This is the percent of individuals identified as low-risk according to the threshold turned out to be chronic with four additional maltreatment reports. Given the close relationship between chronicity and verification, this would be the most serious screening error.

The results of the analysis are presented in Table 1010. The overall single-report rate is 58.4%, or 170,272 of 291,499.

Table 10: Assessment of Low-Risk Individuals

Threshold (individual count)	True Positive Rate	False Discovery Rate	False Discovery Rate with Chronicity
Bottom 10% (29,128)	13.61% (23,173 of 170,272)	20.44% (5,955 of 29,128)	1.85% (540 of 28,128)
Bottom 5% (14,575)	7.00% (11,911 of 170,272)	18.28% (2,664 of 14,575)	1.63% (238 of 14,575)
Bottom 2% (5825)	2.86% (4,867 of 170,272)	16.45% (958 of 5,825)	1.68% (98 of 5,825)

The least risky tiers by the score contained very few chronic perpetrators. This presents an opportunity for the Department to add another tool into the screening process to reduce the number of individuals subject to investigation.

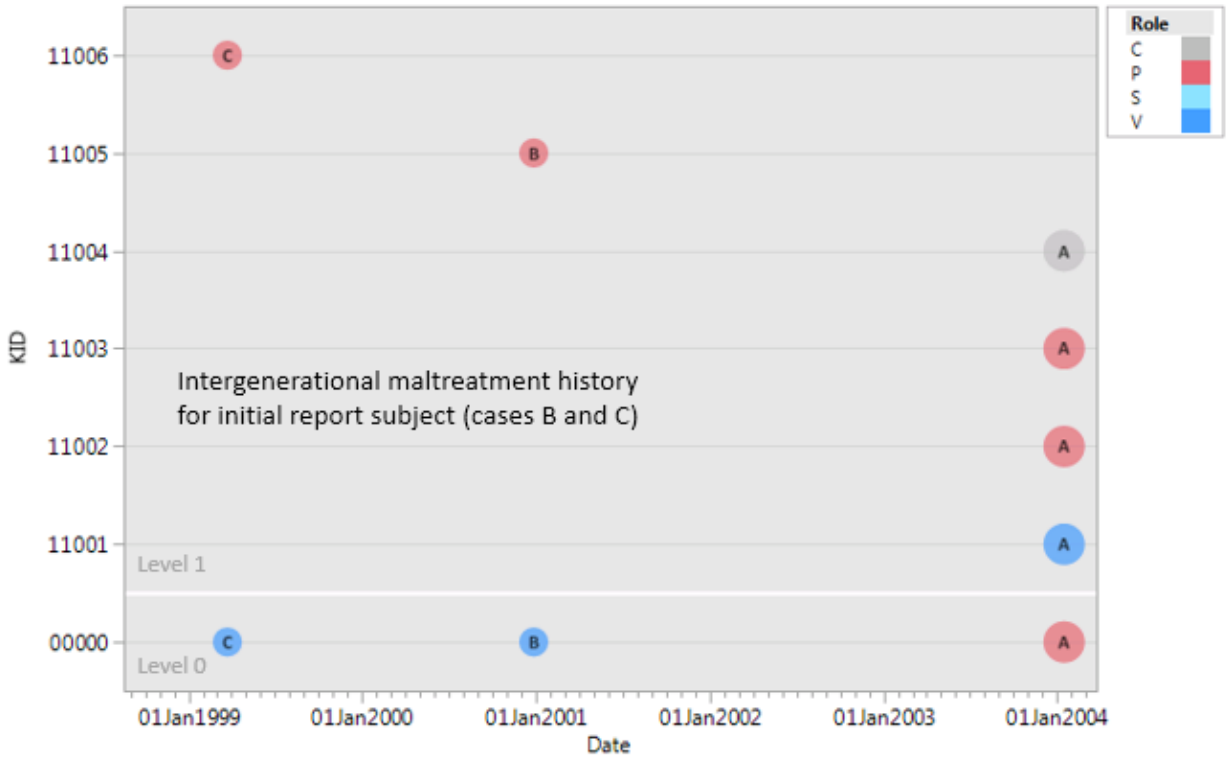
5.4 TYPOLOGIES OF HIGH CHRONICITY RISK

The report and case histories of alleged perpetrator and caregivers provided sufficient information to construct the chronicity models described in the previous sections. When visualized on a timeline along with the networks of individuals related to the subject, distinct patterns or typologies emerged. Using these typologies, together with basic demographic information, one can visually distinguish subjects with high-chronicity risk from those with low-chronicity risk upon their first contact with the child welfare system.

5.4.1 *High-Risk Typologies for the Initial Report*

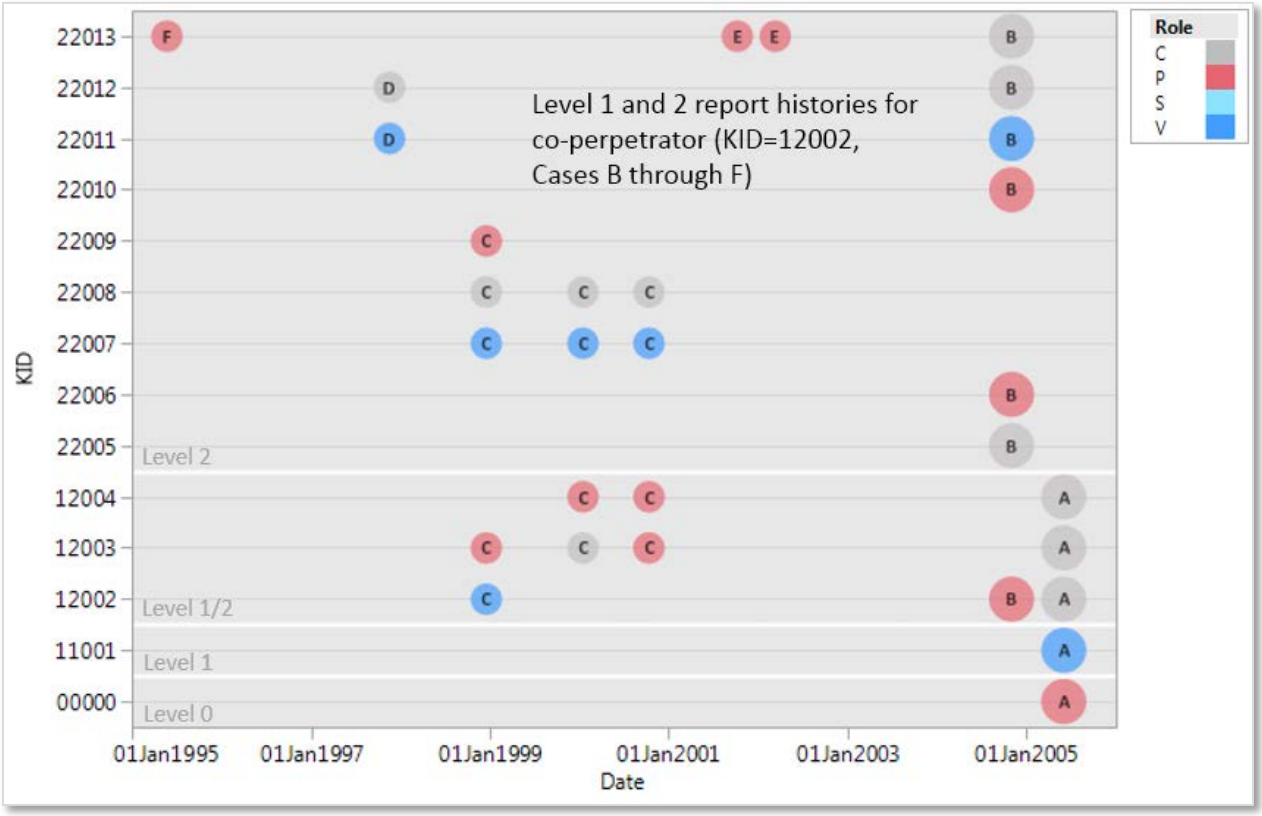
Individuals with the highest risk scores (riskiest) on their initial report were, on the average, young mothers to at least one young victim named in the report. While these characteristics were generally necessary to be considered high-risk at the initial report, they were not sufficient for the subject to be in the highest risk tiers. In addition to basic demographic characteristics, there needed to exist a report history either for the subject (in the form of intergeneration maltreatment, Figure 23), for another individual listed on the initial report (Figure 24), or both (Figure 25).

Figure 23: Subject Report History (Intergenerational Maltreatment) Typology



*KID identifies a unique person.

Figure 24: Co-Perpetrator Report History Typology

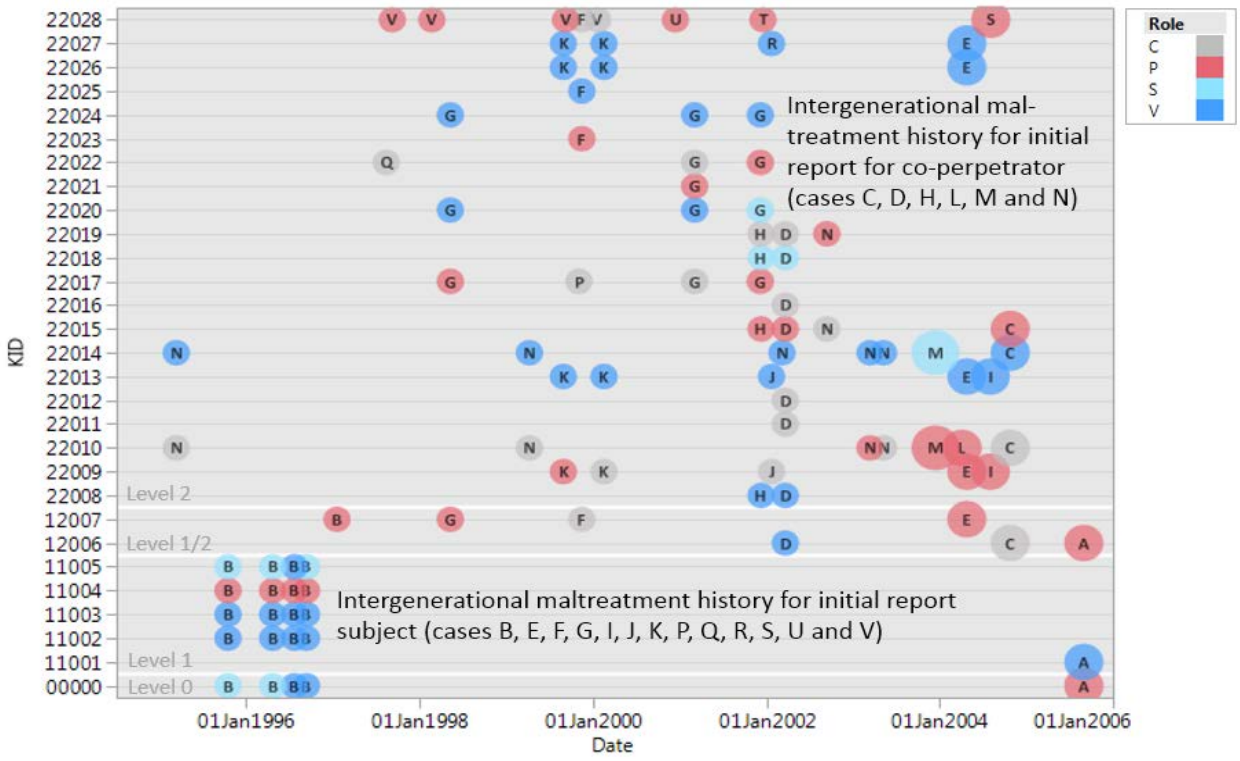


*KID identifies a unique person.

The report history pattern in Figure 25 is typical of individuals with the highest chronicity risk. The subject's Level 0 report history showed four separate reports of victimization between 1995 and 1997. The co-perpetrator was seen to have an earlier report as a caregiver (approximately a year prior to the subject's initial report) in addition to a report of victimization in 2002. The Level 2 reports associated with the subject and the co-perpetrator numbered in the dozens.

Initial-report risk scores for the high-risk typologies shown in Figure 23 to Figure 25 ranged from 97.5th percentile for Figure 23 to 98.7th percentile for Figure 24 and Figure 25. These risk percentiles only increased as additional reports for each subject came into the child welfare system. The severity of the risk could only be truly understood by viewing the case history from a network perspective.

Figure 25: Example of Maltreatment Network



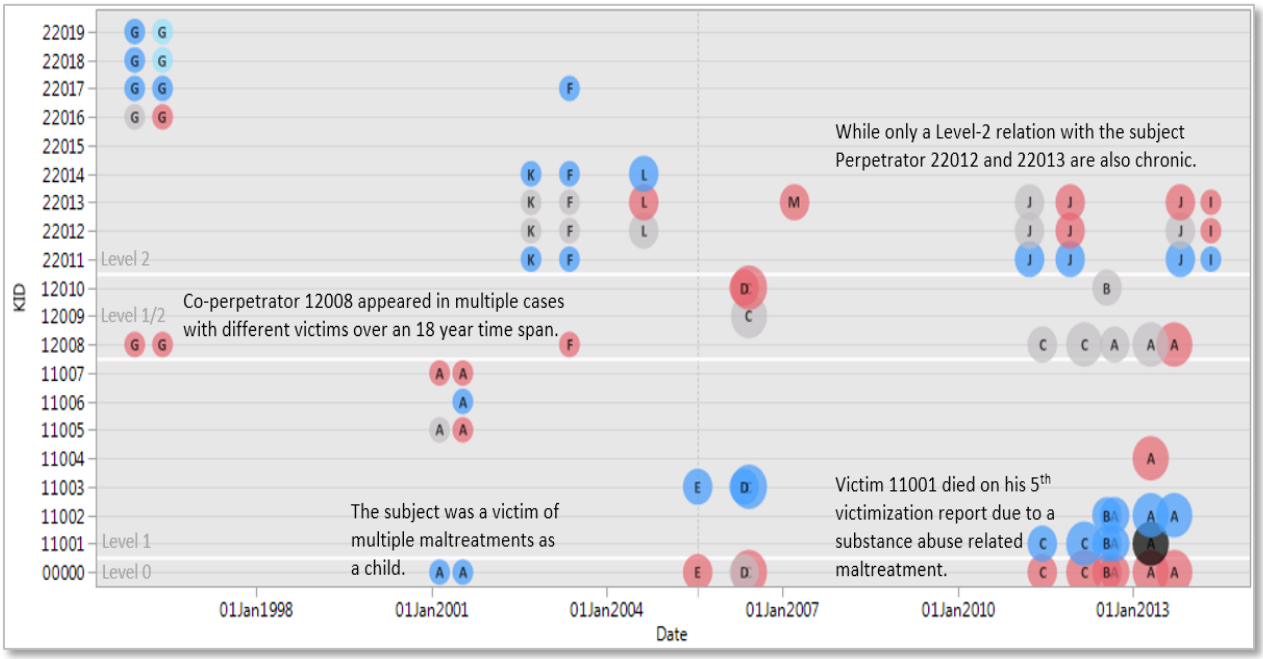
*KID identifies a unique person.

5.4.2 High-Risk Case Study

Tracking a particular high initial risk individual through time provided insight into the nature of chronic maltreatment. This case study is illustrated in Figure 26. The individual in question had two reports as a child victim (Case A in 2001) which resulted in a 99.9th percentile initial-report risk score in June 2005 (Case E). Two additional maltreatment reports followed within a year. The verified third report resulted in a removal of the victim from the home in mid-2006. Approximately five years later in 2011, a fourth report came into the child welfare system for the subject for another child (Case C). A caregiver listed in the fourth report had a history of prior perpetration spanning more than a decade (Cases G and F). Due to entity resolution issues, these prior perpetration reports were apparently not known to the case. The chronicity risk for the caregiver at the fourth report exceeded that of the initial report. Over the course of the next three years, four additional maltreatment reports came into the child welfare system involving the subject, the affiliated caregiver and eventually two victims (Cases B, C and A). The last of these, in early 2013, saw the death of one of the victims from substance-abuse related neglect (indicated by a black dot in Figure 26).

Approximately in time to the second batch of reports in 2011, there were reports on another family (Case I and J). While not directly related to the subject, one of the recurring victims in these reports was maltreated by the aforementioned caregiver (Case F in 2003). The exact relationship between Cases A through C with Cases I and J between 2011 and 2014 is not known.

Figure 26: Fatality Case Study



*KID identifies a unique person.

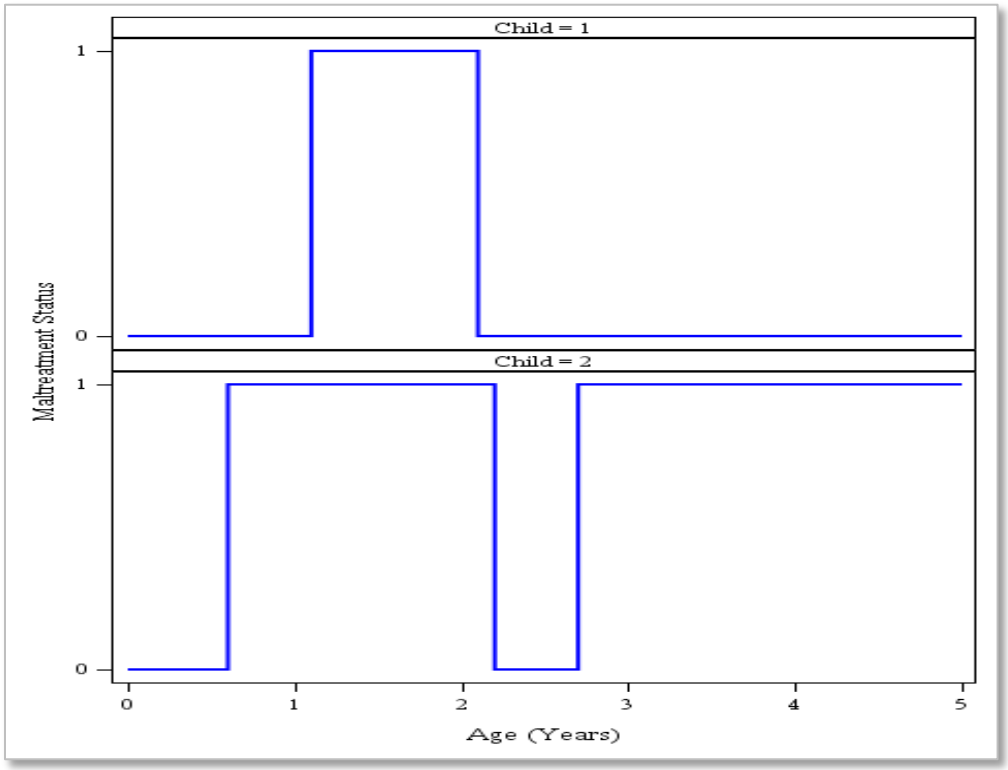
This case study illustrates the ability of the chronicity models to detect extremely serious maltreatment (including eventual fatality) from the initial perpetration report. It also demonstrated the fact that chronicity can be an extremely long-term problem requiring a deep longitudinal data reserve to accurately understand risk.

The relationship between chronicity and fatality is complex and is not formally addressed in this report, since Child Death Review data is only available for a portion of the analysis window for this report (2004 to 2014). Future analysis should be directed toward analyzing the relationship between chronicity and fatality.

5.5 Trajectories of Maltreatment Types and Substantiation

A child's maltreatment reporting trajectory is his or her specific pattern of being in and out of a maltreatment state. A maltreatment state is the period starting when an alleged maltreatment report is created followed by a twelve-month washout period. Examples of the maltreatment trajectories can be seen in Figure 28. The first child had a single report shortly after one year of age. The trajectory shows the child was out of a maltreatment state until his or her first report, was in a maltreatment state for the following 12 months during the washout period, then resumes in a non-maltreatment state. Child 2 had maltreatment reports at 10 and 14 months, then multiple reports starting at 31 months. This trajectory for this child shows a long period of being in a maltreatment state until age 26 months, followed by a 5-month period of non-maltreatment state, then resumed in a state of chronic maltreatment.

Figure 27: Examples of Child Maltreatment Trajectories



Trajectory analysis attempts to cluster longitudinal observations into homogenous groups that follow common trajectory patterns, identify covariates that are common among the members of each cluster and identify covariates that shape the trajectory (Jones and Nagin, 2007). Trajectory analysis has been used in a variety of sociological and psychological research settings including identifying patterns of maltreatment (Jones and Runyan et al., 2010).

The first five years of life of the children in the 2005 birth cohort were used for the trajectory analysis. Covariates to identify variation between clusters include the child's gender, ethnicity, and birth weight along with the mother's age and marriage status. Additionally, whether the child was born in a rural or urban county as defined by the Florida Department of Health was also used as a covariate. Report substantiation was also evaluated to see if it had an effect on the shape of the trajectories.

The results of the analysis identified the following trajectories as seen in Figure 28:

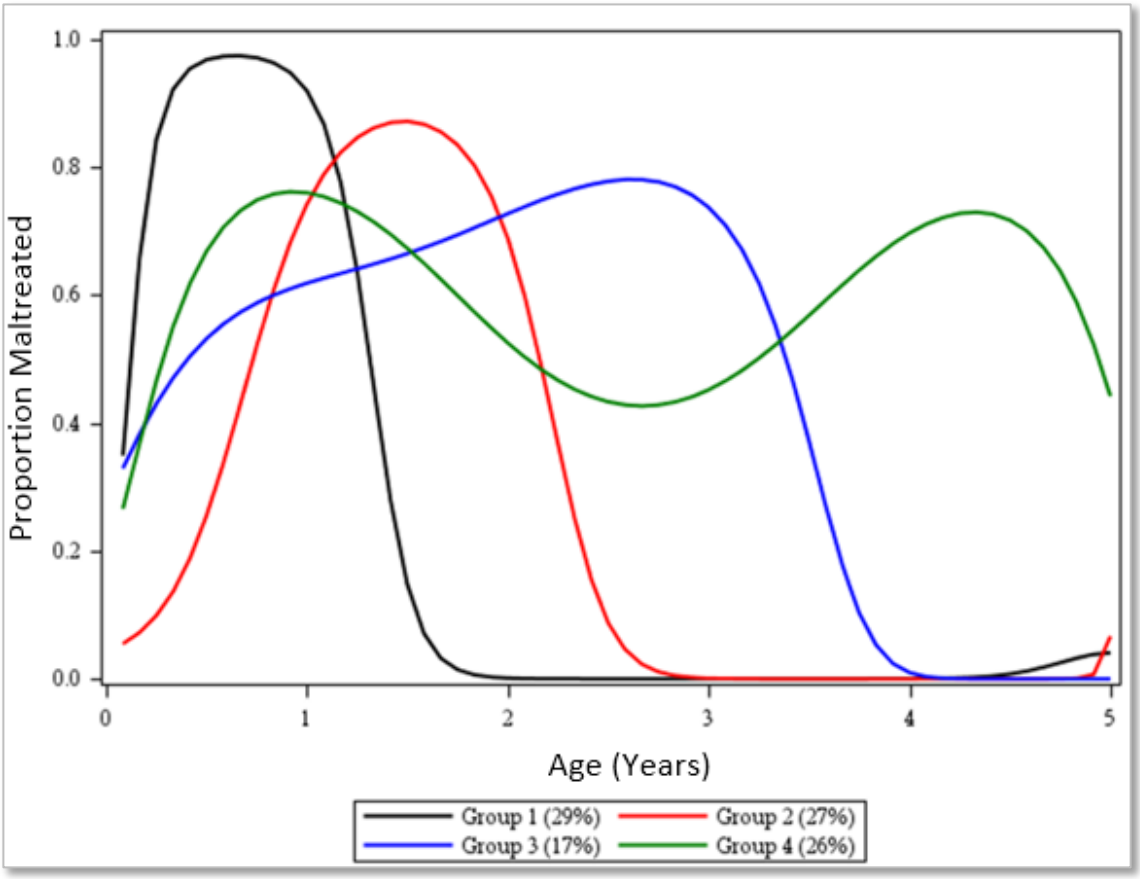
- A single alleged maltreatment report occurring between six months and one year of age. This group comprised of 29% of the 2005 birth cohort
- A single alleged maltreatment report, typically between one and two years of age. This group comprised of approximately 27% of the 2005 birth cohort.
- Chronic maltreatment in the first three to four years of age then no subsequent reports. This group comprised of 17% of the birth cohort.

- Chronic maltreatment throughout the five years. This group comprised 26% of the population.

Ethnicity showed some evidence of differentiating between groups. Hispanic children were more likely to be in Group 2 than in Group 1 compared to white children; black children and children of other ethnic backgrounds were more likely to be in Group 1 than in Group 3 compared to white children. Older mothers were less likely to be in the chronic groups (Groups 3 and 4) than in Group 1; children with lower birth weights were less likely to be in Group 2 than in Group 1.

The substantiation status of the reports had no effect on the trajectory shape.

Figure 28: Maltreatment Trajectories

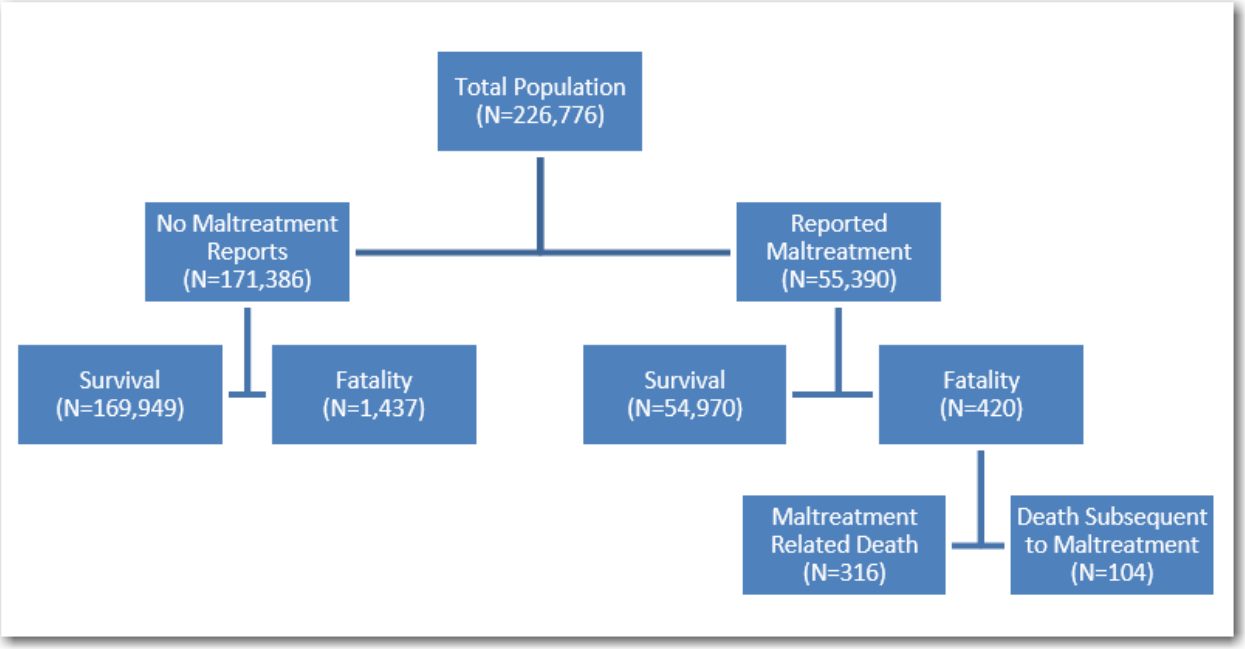


5.6 Child Maltreatment Fatalities

Using the fuzzy matching algorithms as described in Section 3.2, a dataset was created combing the 2005 birth cohort, the Florida Vital Statistics Death Records, and the maltreatment reports from FSFN. This gives a holistic picture of the first ten years of a child born in Florida in 2005, including any maltreatment reports and death. The result was a data set with 226,776 children.

Figure 29 presents an accounting of the children born in 2005. 55,390 (24.4%) had at least one alleged maltreatment report. Of those children with a report, 420 (0.76%, or 420 out of 55,390) had a fatality on or before the age of ten. Out of these 420 fatalities, 316 of them were maltreatment related and 104 of them were not related to maltreatment. The fatality rate of children that never had a maltreatment report is a similar 0.84%.

Figure 29: Accounting of Maltreatment Reports and Death Records for 2005 Births



While the overall fatality rate between children with and without an alleged maltreatment report is similar, there is a contrast between the reported causes of death between both groups. A large majority (78.5%) of deaths in the children without a maltreatment report were due to natural causes. Only 39% of deaths in the children with a maltreatment report were due to natural causes, with another 39% of deaths due to accidents and 9% due to homicide (no reported homicides in the non-maltreated group).

Table 11: Manner of Death by Maltreatment History

Manner of Death	No Maltreatment Reported (N=1,437)	At Least 1 Maltreatment Report (N=420)	Total (N=1,857)
Accident	89 (6.2%)	165 (39.3%)	254 (13.7%)
Could Not Be Determined	42 (2.9%)	43 (10.2%)	85 (4.6%)
Homicide	0 (0.0%)	38 (9.0%)	38 (2.1%)

Manner of Death	No Maltreatment Reported (N=1,437)	At Least 1 Maltreatment Report (N=420)	Total (N=1,857)
Natural	1,128 (78.5%)	163 (38.8%)	1,291 (69.5%)
Not Stated	176 (12.3%)	11 (2.6%)	187 (10.0%)
Pending Investigation	2 (0.1%)	0 (0.0%)	2 (0.1%)

547 (38%) of the 1,437 fatalities in the non-maltreated group occurred within the first three days of birth and were due to natural causes. Even when excluding these fatalities, as seen in Table 12, the disparity in the causes of death between the two groups remains, with a greater proportion of deaths by homicide and accidents in the children with a maltreatment report.

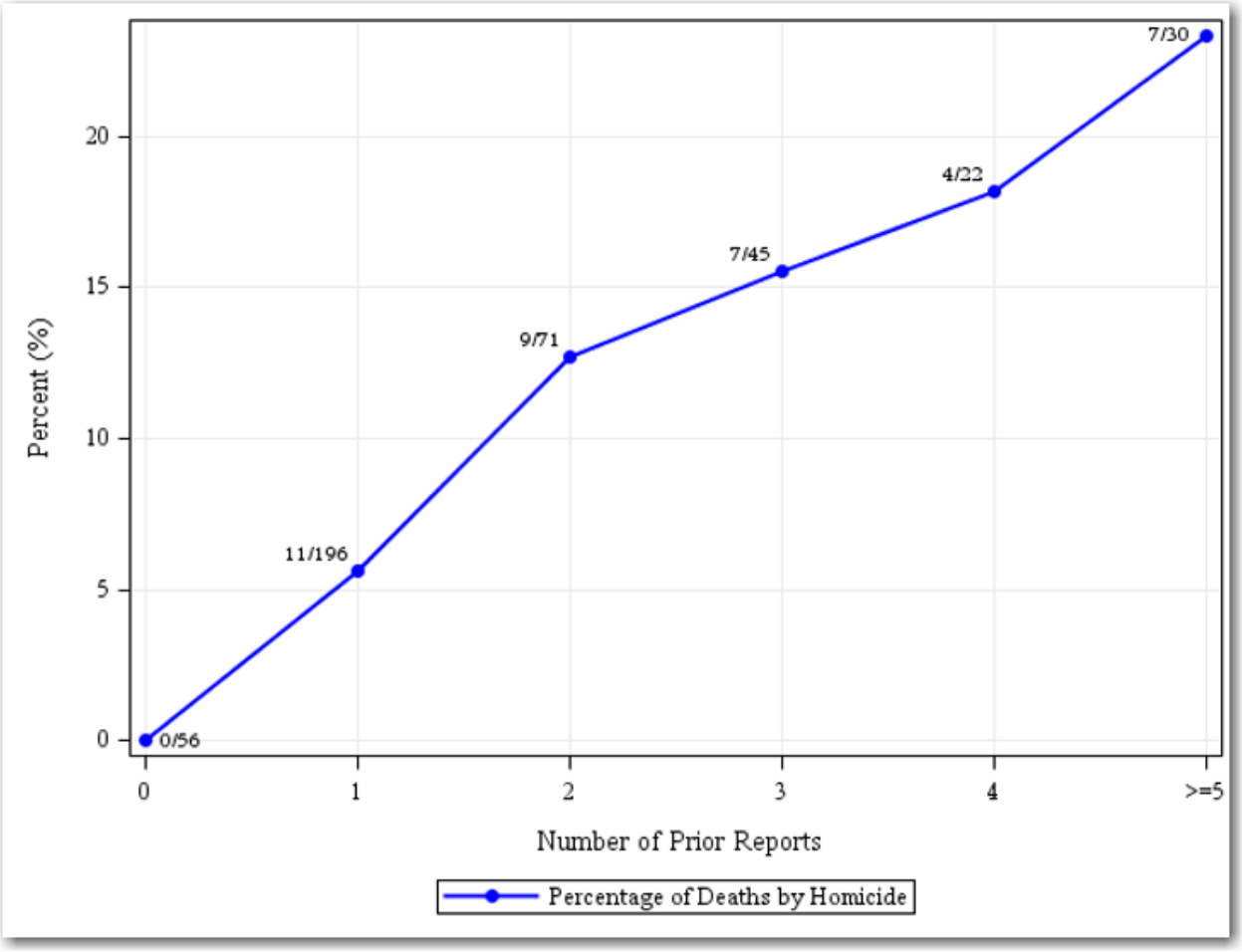
Table 12: Manner of Death by Maltreatment History Excluding Early Natural Fatalities[a]

Manner of Death	No Maltreatment Reported (N=890)	At Least 1 Maltreatment Report (N=411)	Total (N=1,301)
Accident	89 (10.0%)	165 (40.2%)	254 (19.5%)
Could Not Be Determined	42 (4.7%)	43 (10.5%)	85 (6.5%)
Homicide	0 (0.0%)	38 (9.3%)	38 (2.9%)
Natural	581 (65.3%)	154 (37.5%)	735 (56.5%)
Not Stated	176 (19.8%)	11 (2.7%)	187 (14.3%)
Pending Investigation	2 (0.2%)	0 (0.0%)	2 (0.2%)

[a] "Early natural fatalities" refers to deaths by natural causes occurring within three days of birth.

The degree of chronicity of maltreatment in the child's history may also be a factor of the risk of death and, specifically, homicide. Figure 30 displays the homicide rates (blue) as a percentage of total fatalities by the previous number of alleged maltreatment reports. The figure shows that, in general, the percentage of fatalities caused by homicide increases with the number of maltreatment reports in the child's history. This holds true irrespective of age.

Figure 30: Homicide Rates by Number of Prior Reports



A child's maltreatment report which resulted in a death was also analyzed to determine if the perpetrators' history had an effect on the manner of death. Specifically, the question was whether accidental deaths and homicides could be predicted if the perpetrator was on a previous report (Table 13). However, due to the small number of deaths with previously reported perpetrators, no conclusion can be drawn statistically. Criminal information related to the persons in the child's ecosystem (including but not limited to the perpetrators and caregivers), not available for this study, may be useful in evaluating this idea.

Table 13: Manner of Death by Perpetrator Status

Manner of Death	No Known Perpetrator (N=164)	Known Perpetrator (N=56)	Total (N=220)
Accident	71 (43.3%)	20 (35.7%)	91 (41.4%)
Could Not Be Determined	20 (12.2%)	7 (12.5%)	27 (12.3%)
Homicide	11 (6.7%)	0 (0.0%)	11 (5.0%)
Natural	57 (34.7%)	25 (44.6%)	82 (37.3%)
Not Stated	5 (3.1%)	4 (7.1%)	10 (4.1%)
Pending Investigation	0 (0.0%)	0 (0.0%)	0 (0.0%)

SECTION 6 THE PREDICTIVE MODELS VS. THE INITIAL FAMILY RISK ASSESSMENT TOOL

6.1 INTRODUCTION

A major challenge faced by the decision-making process of child protective agencies is the assessment of likelihood of a subsequent maltreatment, which is the main focus of this study. Based on this assessment, child protective agencies can target and intervene with families who are at the highest risk of recurrence of maltreatment to protect the safety of their children.

Even though the benefits of caseworkers are recognized, including bringing their experience, expertise and compassion while making this assessment, their judgments are often criticized in the literature as being inaccurate and inconsistent, even unfair (Carnochan et al., 2013; Dorsey et al., 2008; Hughes and Rycus, 2007). These shortcomings are attributable to many factors such as the changing dynamics of families, lack of cooperation of families who are afraid of practitioner's power to remove their children, lack of engagement with parents, practitioners' over-reliance on their intuitions and preferences, and practitioners' tendency to overlook relevant as well as missing and contradictory information (Bartelink et al., 2015; Forrester et al., 2008; Garb, 2005). The inherent difficulty of making accurate assessments and differences in skill levels and experiences among child protective workers leads to unreliable and biased decisions that do not fit the needs and the problems families experience, failing to attain expected outcomes (Shlonsky and Wagner, 2005).

To reduce errors in decision-making, the majority of the U.S. states have developed or adopted actuarial risk assessment tools to assist workers in identifying families at higher risk of maltreating their children in the future (Coohey et al., 2013; Shlonsky and Friend, 2015). This section presents a brief and preliminary analysis of the comparison between the predictive risk models developed in this study to predict the likelihood of chronic maltreatment and the tool adopted by the Department for the initial family risk assessment of child abuse/neglect (IFRA-SDM), a version of California Family Risk Assessment (CFRA). CFRA is a structured decision model (SDM), an instrument of actuarial risk assessment.

6.2 RISK ASSESSMENT TOOLS AND SDM

Actuarial risk assessment is a statistical procedure for estimating the probability that a critical event, such as child maltreatment, will occur in the future based on observed case characteristics often referred to as risk factors. Actuarial tools have been applied in many fields of the public sector with greater predictive validity and reliability than the earlier generation of consensus-based assessment tools (Coohey et al., 2013).

Actuarial models rely on individual predictor variables or risk factors with established statistical relationships to a criterion like future maltreatment. A variety of statistical methods can be used to select and weigh risk factors such as regression methods or decision trees. After the weights are estimated, the final step in developing the model or tool is to establish boundaries for each risk level. An overall risk score is calculated by calculating the sum of the weights of individual predictors. Then, the score classifies cases or individuals into groups that are relatively low, moderate, high, or very high in risk based on the selected score thresholds (Johnson, 2011).

CFRA is an actuarial model currently in use in 45 of California's 58 counties and the most widely applied SDM in child welfare decision systems (Johnson, 2011). It was developed and validated by the Children's Research Center, a center of the National Council of Crime and Delinquency (Coohey et al., 2013).

The CFRA uses 20 risk factors divided into two 10-item scales, one assessing the likelihood of future abuse and the other assessing the likelihood of future neglect. Risk factors includes the characteristics of alleged perpetrators and children living in a household. The risk score for a case is calculated by calculating the sum of the points and applying a cut-off to the total points to produce ratings of low-, moderate-, high-, or very-high-risk. Unless overridden, the highest risk rating produced by either scale is taken as the score of record upon which service provision decisions are to be based (Coohey et al., 2013). CFRA protocols allow child welfare workers to override risk assessment findings when the child welfare worker's clinical impressions suggest that the case is higher-risk than the standard CFRA score indicates. Any risk score below very-high risk can be changed to very-high risk in the presence of case attributes agreed to by program administrators to indicate greater risk to children (Coohey et al., 2013).

SDM such as CFRA is a tool that combines actuarial risk assessment and clinical judgment (Shlonsky and Wagner, 2005). Since the structure of the tool is made of checklists filled out by caseworkers based on their interviews and observations, as well as other data they might be able to obtain, it involves both statistical risk adjustment and clinical decision-making. Some of these items are easily quantifiable, such as number of children; however, other items such as the caregiver's excessive discipline are more subjective.

This hybrid nature of SDM raised concerns due to the semi-manual nature of the process, which is open to the manipulation by caseworkers to reach the desired outcomes. The most common criticism of the SDM is its operator-driven nature. There is a concern is that operator-driven tools rely on the caseworker correctly applying the model, whose compliance is dependent upon sufficient training, motivation to apply the model, and responsiveness to the estimated risk (Vaithianathan et al., 2012). To counter these arguments, it has been suggested that actuarial risk assessment is not designed to replace clinical judgment but rather to be a tool used in conjunction with the professional judgment of a child welfare worker. Practitioners' expertise is needed to assess rare risks and engage families for better assessments (Shlonsky and Wagner, 2005).

It is beyond the scope of this report to present a full critique of the SDM, which is available in the literature (See Bartelink et al., 2015; Coohey et al., 2013; Hughers and Rycus, 2007; Johnson, 2011). Besides its sensitivity to the manipulation, SDMs are seldom validated for the population being risk-rated and for inter-rate reliability of agreement among raters. Finally, the aggregate risk levels of low, moderate, high and very high may fail to separate low and high risk levels with precision, leading to large numbers of false positives (families incorrectly identified as high-risk) and/or false negatives (high-risk families not identified as such). While some studies have shown imperfect but better than chance predictive validity (Coohey et al., 2013; Johnson, 2011), some others found that the impact of SDM is limited (Bartelink, et al., 2014; 2015).

6.3 FLORIDA'S IFRA-SDM

The SDM adopted by the Department is a version of CFRA described in the previous section. The IFRA-SDM tool is shown in Table14. Similar to the CFRA; IFRA-SDM uses 20 risk factors divided into two 10-item scales, assessing the likelihood of future maltreatment. However, there are some differences in the risk factors listed. The ranges of possible scores are between 0 and 17 for both future neglect and future abuse. While a few of the risk factors are common to both scales, such as ongoing services and learning disability of children, most of the risk factors are different for neglect and abuse allegations.

Almost all risk factors are assigned a point of **1**, with a few exceptions. For the total neglect score, past or ongoing services, more than three children in the incident, youngest child under two, primary caregiver characteristics (historic or current mental health problem, historic or current alcohol or drug problems and not providing physical care consistent with child needs), child characteristics (medically fragile or failure to thrive, developmental, physical, or learning disability, and positive toxicology screen at birth) and physical unsafe current housing are all scored one point. Homelessness scores two points. For the prior investigations, one or more prior abuse complaints are assigned one point, one or two prior neglect allegations are assigned two points, three or more prior neglect complaints are assigned three points, then the highest of the three point values is selected as the point value associated with the prior investigations risk factor.

For the total abuse score, ongoing services, primary caregiver characteristics (providing insufficient emotional/psychological support, employing excessive/inappropriate discipline and domineering and history of abuse or neglect as a child), secondary caregiver characteristics (historic or current alcohol or drug problems), child characteristics (delinquency, developmental or learning disability, mental health or behavioral problem) are given one point. Domestic violence in the past year is given two points. One prior abuse investigation is given one point and two or more prior investigations are given two points. Finally, if a primary caregiver blames child for maltreatment, it is given one point, and if a primary caregiver justifies maltreatment, it is given two points.

The risk score for a case is reached by calculating the sum of the points for each scale and applying cut-offs to produce ratings of low, moderate, high, or very-high-risk. For neglect, the score ranges for these four risk groups are, 0-1, 2-4, 5-8, and 9 or more. For the abuse scale, they are 0-1, 2-4, 5-7, and 8 or more.

As noted earlier, while some of the factors are quantifiable easily or can be derived from the FSFN data, many are subjective and may be input incorrectly due to various reasons including the reluctance of the family to provide accurate information. This opens the door for manipulation by the caseworkers, who may be doctoring the scores to move families from lower to higher or higher to lower risk brackets.

Table 14: Florida's IFRA-SDM

NEGLECT — Score

N1. Current complaint is for neglect
- a. No 0
- b. Yes ..... 1 ____

N2. Prior investigations (*assign highest score that applies*)
- a. None 0
- b. One or more, abuse only 1
- c. One or two for neglect 2
- d. Three or more for neglect ..... 3 ____

N3. Household has previously received ongoing child protective services
- a. No 0
- b. Yes ..... 1 ____

N4. Number of children involved in the child abuse/neglect incident
- a. One, two, or three 0
- b. Four or more ..... 1 ____

N5. Age of youngest child in the home
- a. 2 or older 0
- b. Under 2 ..... 1 ____

N6. Primary caregiver provides physical care consistent with child needs
- a. Yes 0
- b. No ..... 1 ____

N7. Primary caregiver has historic or current mental health problem
- a. No 0
- b. Yes ..... 1 ____

N8. Primary caregiver has historic or current alcohol or drug problem
- a. Not applicable 0
- b. One or more apply (*mark applicable items and add for score*):
  - ☐ Alcohol (current or historic) 1
    - ☐ Current (within the last 12 months)
    - ☐ Historic (prior to last 12 months)
  - ☐ Drug (current or historic) ..... 1 ____
    - ☐ Current (within the last 12 months)
    - ☐ Historic (prior to last 12 months)

N9. Characteristics of children in household
- a. Not applicable 0
- b. One or more present (*mark applicable items and add for score*):
  - ☐ Medically fragile or failure to thrive 1
  - ☐ Developmental, physical, or learning disability 1
  - ☐ Positive toxicology screen at birth ..... 1 ____

N10. Housing
- a. Not applicable 0
- b. One or more apply (*mark applicable items and add for score*):
  - ☐ Current housing is physically unsafe 1
  - ☐ Homeless ..... 2 ____

TOTAL NEGLECT RISK SCORE ____

ABUSE — Score

A1. Current complaint is for abuse
- a. No 0
- b. Yes ..... 1 ____

A2. Number of prior abuse investigations
- a. None 0
- b. One 1
- c. Two or more ..... 2 ____
  (actual number: _____)

A3. Household has previously received ongoing child protective services
- a. No 0
- b. Yes ..... 1 ____

A4. Prior injury to a child resulting from child abuse/neglect
- a. No 0
- b. Yes ..... 1 ____

A5. Primary caregiver's assessment of incident
- a. Not applicable 0
- b. One or more apply (*mark applicable items and add for score*):
  - ☐ Blames child for maltreatment 1
  - ☐ Justifies maltreatment ..... 2 ____

A6. Domestic violence in the household in the past year
- a. No 0
- b. Yes ..... 2 ____

A7. Primary caregiver characteristics
- a. Not applicable 0
- b. One or more apply (*mark applicable items and add for score*):
  - ☐ Provides insufficient emotional/psychological support 1
  - ☐ Employs excessive/inappropriate discipline 1
  - ☐ Domineering ..... 1 ____

A8. Primary caregiver has a history of abuse or neglect as a child
- a. No 0
- b. Yes ..... 1 ____

A9. Secondary caregiver has historic or current alcohol or drug problem
- a. No 0
- b. Yes, one or more apply ..... 1 ____
  - ☐ Alcohol
    - ☐ Current (within the last 12 months)
    - ☐ Historic (prior to last 12 months)
  - ☐ Drug
    - ☐ Current (within the last 12 months)
    - ☐ Historic (prior to last 12 months)

A10. Characteristics of children in household
- a. Not applicable 0
- b. One or more apply (*mark applicable items and add for score*):
  - ☐ Delinquency 1
  - ☐ Developmental or learning disability 1
  - ☐ Mental health or behavioral problem ..... 1 ____

TOTAL ABUSE RISK SCORE ____

6.4 Comparison of the Predictive Risk Models against the Florida's IFRA-SDM Tool

A direct comparison of IFRA-SDM with the predictive risk models is less than straightforward. IFRA-SDM has separate models, one predicting future neglect and another predicting future abuse each with its own set of risk factors. Predictive risk models assess the risk for chronic future maltreatment, in general, be it abuse or neglect, and maltreatment types enter the model as potential predictors.

As discussed earlier, the findings from this study as well as of other research have shown that the type of allegation is generally not predictive. On the other hand, IFRA-SDM considers the difference between abuse and neglect important enough to warrant separate scoring algorithms for each.

However, a high-level comparison of the risk factors included in each set of models shows that these models generally do not disagree with each other where there are similar factors. The difference is more due to the fact that some factors in the IFRA-SDM was not available in the data for the predictive risk model development, and it is unknown whether the risk factors included in the predictive models but not in IFRA-SDM were omitted from the algorithm because they were unimportant or because they were not available to be evaluated.

Table 15 provides a comparison of the risk factors. The first column refers to the risk group, which shows groups of risk factors under different areas such as historical or current report. IFRA-SDM column shows whether a given risk factor is used by the IFRA-SDM, where *B* refers to overall maltreatment, *N* refers to neglect only and *A* refers to abuse only. For the predictive risk models, Columns 1-4 refer to the separate predictive risk models for each recurrence stage—from initial report to the second report, from the second report to the third, and so on. In these columns as well as in the IFRA-SDM column, "+" indicates that the risk factor is associated with the recurrence risk positively and "-"*indicates* negative association. Finally, in the predictive risk model columns, "*" indicates that the risk factor was not available for the development of these models.

Some perceived differences in this table are relatively minor. While used by one predictive risk model, placement characteristics were not considered effective risk factors, and they are not used by the IFRA-SDM.

Table 15: Comparison of Risk Factors Used by IFRA-SDM and Predictive Risk Models

Risk Group	Risk Factor	IFRA-SDM	Predictive Risk Model 1	2	3	4
Historical report risks	Number of directly linked verified or some indicator reports in last year			-		
	Number of verified or some indicator reports in last year			+		
	Number of previous caregiver reports in last year			-		
	Number of Level 1 caregiver reports in last two years				-	-
	Number of Level 1 caregiver reports in last five years			-		
	Number of Level 1 perpetrator reports in last two years			-	-	
	Number of Level 1 sibling reports in last five years			+		
	Number of prior reports ever	+(B)				
	Prior injury to a child	+(A)	*	*	*	*
Placement risks	Number of Level 1 removals in last year					-
Maltreatment risks	Number of other neglect maltreatments in last six months		+			
	Substance abuse maltreatments in last six) months	+(B)	+	+		
Services risks	Number of services offered in last five years	+(B)		+		
	Perpetrator services offered in last five years		+			
Current report risks	Subject is parent to at least one victim in current post-initial report			+	+	+
	Report is verified				-	-
	Average age of victims				-	-
	Average age of victims and siblings			-		
	Minimum age of victims		-	-	-	-
	Number of individuals in current report		-			
	Number of verified or some indicator in current report		+			
	Number of children > 3 in current report	+(N)				
	Minimum age of victims < 2	+(N)				
	Domestic violence	+(A)				
	Children-medical fragility, disabilities, toxicology screen at birth	+(N)	*	*	*	*
	Children-delinquency, disabilities, behavioral problems	+(A)	*	*	*	*
	Physically unsafe housing and homelessness	+(N)	*	*	*	*
Subject demographics risks	Subject Age		-	-	-	-
	Subject Black ethnicity		-	-	-	-
	Subject Hispanic ethnicity		-	-	-	
	Subject Other ethnicity		-			
	Subject is female		+	+	+	+
Intergenerational factors risks	Number of intergenerational victim/sibling reports for Subject	+(A)	+	+	+	
	Number of directly linked network reports in last 20 years		+			
	Number of directly linked verified reports in last 20 years		-			
	Number of network reports in last 20 years (all Levels)		+			
	Number of verified reports in last 20 years			-		
	Number of previous victim reports in last 20 years			+	+	+
	Caregiver has a history of maltreatment as a child	+(A)				
Mental health risks	Mental health services provided in last six months	+(N)	+			
Inter-report risks	Subject assigned in perpetrator role in last 10 years		-	-		
	Subject is parent to at least one victim in some report (initial to current)			+	+	+
	Subject is parent of at least one victim in initial report		+	+		
	Time since initial report			-	-	-
	Time since previous report				-	-
Geographic risks	County risk rating		+	+		
Other caregiver factors (not in risk model)	Caregiver provides physical care consistent w/ child needs	-(N)	*	*	*	*
	Caregivers' assessment of incident-blame children or justify	+(A)	*	*	*	*
	Insufficient emotional support, excessive discipline, domineering	+(A)	*	*	*	*

In the services risk group, both approaches used current or prior services. However, for the predictive risk models, it was effective for only one model as services for victims and for one model as services for perpetrators.

For the current report risks group, none of the child-related risk factors such as delinquency, medical fragility, or toxicology screen at birth were available for the predictive risk models. One exception was physical disabilities and other problems of victims, which were available but was not a statistically significant factor. Similarly, domestic violence was not statistically significant in the predictive risk models. Predictive risk models used two different age variables for victim's age: average and minimum age of victims. IFRA-SDM only uses a flag variable for only neglect allegations to use if the age of the youngest child is under the age of two. The number of children is also used only for neglect allegations by IFRA-SDM, which has a positive effect. In one of the predictive risk models, number of all persons was significant with a negative effect. There were two other variables that were significant for the predictive risk models but omitted by IFRA-SDM: if the current report is verified (negative effect on risk) and if the subject is parent to at least one victim in all reports after the initial report.

IFRA-SDM does not include any demographic risks related to the subject (perpetrator/caregiver). However, the age of the subject is a very strong predictor with a negative effect on risk in all predictive risk models. If the subject's ethnicity was black or Hispanic, it was a protective factor in all predictive risk models. Gender was also a strong predictor; being female lowered the risk.

IFRA-SDM used several subjective caregiver characteristics, such as providing physical care consistent with child needs, assessment of the maltreatment incident (blaming the child or not) or applying excessive discipline. These factors were not available for the predictive risk models.

IFRA-SDM uses only one intergenerational risk factor, the caregiver's history of maltreatment as a child. In contrast, the predictive risk models used six intergenerational risk factors, which are all continuous (numbers) rather than binary flags. In addition to the number of intergenerational victim/sibling reports for the subject, these risk factors included the number of reports, verified reports and victim reports in last 20 years which were very strong predictors.

Mental health risk factor is included by both approaches but in different ways. IFRA-SDM includes the mental health problem of a caregiver for only neglect allegations. The first predictive risk model included the provision of mental health services during the last six months as a risk factor. Similarly, alcohol and substance abuse risk factor is included in both approaches but in different ways. IFRA-SDM includes the alcohol and substance abuse problem of a caregiver. The first two predictive risk models includes the existence of alcohol and substance abuse maltreatment allegations during the last six months as a risk factor.

IFRA-SDM does not take into account the time intervals between reporting stages. Hence it does not have any inter-report risks. On the other hand, after the first model, time since the initial and previous reports were very strong predictors for the predictive risk models. In addition, if the subject was a parent to at least one victim in the initial or another report, it was a very strong risk factor. Finally, while IFRA-SDM does not include geographic factors, whereas the county of residence was a strong predictor for the first two predictive risk models.

There also are differences between two approaches in the relative strengths of the risk factors used. The relative strength of risk factors of IFRA-SDM is almost the same among all factors (one point) with the exception of a few with two points. In other words, the scoring scheme of IFRA-SDM does not allow for substantive differences among the contributions of different risk factors to the total scores.

On the other hand, each predictive risk model shows the relative strengths of risk factors as described in Section 5.3.5.2. For example, Table9 showed the relative strengths of risk factors for the first model. The table showed that intergenerational maltreatment was the most powerful factor, followed by if subject is a parent, gender of the subject, number of network reports in last 20 years, minimum age of the victims, substance abuse maltreatments in last six months, and the subject age.

Furthermore, there are key structural differences between the two approaches:

- The unit of analysis for the IFRA-SDM is family. The predictive risk models in this report used perpetrator as the unit of analysis but various family level (both caregiver and child) factors were considered as well. However, it should be noted that the predictive risk models predict risk of a perpetrator; the risk of family and children can be derived from the risk estimated for a perpetrator to whom the family and children are connected.
- IFRA-SDM scores risk in the same way, whether the recurrence is the first, second, or the ninth instance, with the exception of assigning one or two additional points for prior investigations. This study developed different predictive risk models for each recurrence, with four different models. This approach is supported by existing research concluding that the set of predictors significantly associated with re-reporting differed across stages. Furthermore, once a perpetrator is re-reported, the time between the current and previous reports becomes the most powerful predictor. The time factor is taken into account by the IFRA-SDM in a very limited way, while it is one of the most critical elements of the predictive risk models. Since each predictive risk model for different recurrence stage had different set of predictors, this approach is radically different than the IFRA-SDM, which assumes that the risk factors are consistent regardless of the number of previous reports.
- As an extension of this argument, the relative scores for different recurrence stages do not increase significantly in the IFRA-SDM. For example, the score increases by one point for an abuse re-report and is not affected by additional reports. However, as shown in Figure 12 earlier, the overall probability of chronicity increased substantively with the number of reports received, which is not reflected in the scoring system of IFRA-SDM.
- The contribution of almost all risk factors in the IFRA-SDM is the same, adding one point to the total score. For example, for the high risk group (scores 5 to 8 for neglect), any of the risk factors would contribute constantly in the range of 12.5% to 20% depending on the score. However, in the predictive risk models, the contribution of each factor is different for each variable in a given model. Moreover, as noted above, the set of predictors change across stages of recurrence. It is completely unrealistic to expect constant weights for almost all variables in a statistical model.
- The predictive risk models are based on all available data spanning multiple decades. For example, intergenerational maltreatment, one of the most critical factors in

assigning high risks, would not be detected for many parents without this process. IFRA-SDM, relies on both available data and self-declaration of families, which may introduce inaccuracies and miss the existence of the history of maltreatment for a caregiver when she/he was a child.

While there are commonalities between the IFRA-SDM and predictive risk model approaches, and while what can be observed in common generally do not disagree with each other at a very high level, several critical differences exist. These differences suggest that using both sets of models in conjunction is a valid strategy, as each provide a different perspective into child maltreatment.

SECTION 7 SUMMARY AND RECOMMENDATIONS

7.1 SUMMARY

This report studied re-reporting and re-maltreatment dynamics of perpetrators and caregivers in the Florida child welfare system between 2004 and 2014. Chronicity of maltreatment has been a major concern to the Department because of its link to adverse child outcomes, disproportional use of child welfare and financial resources, and its persistent harm to children. Repeated reports may also suggest an opportunity for improvement of child welfare community's intended mission to adequately protect children from re-victimization. The primary objective of this study was to assist the decision-making process of the Department in alleviating chronic maltreatment, which requires understanding the long-term risk potential of alleged perpetrators and caregivers.

Building predictive risk models was the central focus of this analytical methodology. These models were developed to assist the Department at least in two different decision-making points:

- at the time when a report is received for screening and assessment decisions, and
- at the time of disposition of an investigation for service planning and placement decisions.

The models perform well in identifying perpetrators with high risk of chronicity of maltreatment. The models contain several risk factors that contribute to the likelihood of chronic maltreatment for perpetrators at different reporting stages. At the first report, the most powerful risk factors are whether the perpetrator or caregiver (subject) was a parent, subject age, and gender, the minimum age of the victim, the number of intergenerational maltreatment reports for the *subject*, the total number of reports in all levels in the last 20 years and the county of residence. For subsequent reports, the time interval between the current and previous as well as initial reports became the dominant risk factor, in addition to the covariates from the initial report.

Other findings on re-reporting and re-maltreatment patterns were:

- Analyzing the time to chronicity (the time between the initial and fifth reports), the study concluded that the proportion of perpetrators becoming chronic was constant after the first year and approximately 10% were re-reported annually until the eighth year. The median time to chronicity was 64 months suggesting that perpetrators have been repeatedly abusing their children over a very long period of time. It is a steady and long process, indicating that these perpetrators have been high-risk maltreaters continuously.
- The study showed a consistent relationship between chronicity and substantiation. The findings demonstrated that, by the fifth report, almost two-thirds of perpetrators had at least one substantiated (verified) report and over nine out of 10 had a report with either verified or some evidence (*some indicator*) of maltreatment. The findings of the study suggest that the likelihood of substantiation increases substantively over time. This is the case despite the fact that the type of transition of report disposition from one report

to another does not contribute in explaining chronicity of maltreatment and the type of next disposition, as a perpetrator is re-reported multiple times.

- As already demonstrated in the interim report, this study showed that there is no consistency or pattern in terms of transitions from one maltreatment type to another for any family irrespective of the initial allegations contained in a maltreatment report. Substantial cross-level recidivism between maltreatment allegation types exists for maltreatment reports over time, which requires a holistic approach in the assessment of maltreatment allegations.

Merging the Florida birth records with FSFN data resulted in the following findings:

- A considerable fraction of Florida's children have had contact with the child welfare system over their first few years of life. Approximately one in every five children born in Florida was reported at least once to the child welfare system, by the end of the 60th month, approximately one in every 14 children born in Florida were reported at least once with verified maltreatment. In addition, the results suggested that there was no significant shift in the prevalence of re-reporting and re-maltreatment between 2005 and 2009.
- The study showed high prevalence rates for re-reporting for perpetrators over a long tracking window. 42% of perpetrators were reported multiple times over the eight-to-ten-year follow-up period. Approximately 10% of the study cohort of 291,499 perpetrators had five or more reports forming the chronic maltreatment group, the focus of this study. Moreover, results indicated that re-reports and recurrence occur faster for families with prior child welfare system involvement.
- A new trajectory analysis to establish common patterns of maltreatment in the first five years of childhood showed four patterns. Two of these patterns were single cases of a maltreatment report, one before the age of 12 months, the other between the ages of 12 and 24 months. The third group showed chronic maltreatment reporting until the age of 40 months. The fourth had chronic maltreatment for the entire five years.

By linking the FSFN data to Florida birth records and the ACCESS data, this study analyzed the extent of overlap between child welfare and public assistance programs. The analysis showed that:

- Out of 221,638 children born at Florida in 2009, approximately two-thirds (67.3%) participated in a public assistance program such as SNAP, Medicaid, and TANF between 2010 and 2014. Then, comparing 2005 and 2009 prevalence rates of child maltreatment, despite of the large increase in SNAP participation and poverty rates in Florida after the Great Recession, the study did not find a substantive impact of poverty on child maltreatment. Almost half of the 2009 birth cohort received public assistance but were not reported for child maltreatment, while approximately one-third of the cohort included children who did not participate in public assistance and did not have contact with the child welfare system.
- Analysis of the remaining 19%, children with at least one maltreatment report over five years, showed that only a small fraction (1.7% of all children) were reported for alleged maltreatment but stayed outside of the public assistance program. This suggests that nine out of 10 children with maltreatment reports were coming from low-income

families. However, the three-quarters of low-income families who received public assistance had no contact with the child welfare system.

A limited analysis on the Healthy Families data resulted in the following findings:

- For all children born in Florida in 2009, around 3% participated in the Healthy Families program.
- Comparison of children participated in the Healthy Families without a maltreatment report and with a maltreatment report showed statistically significant differences between the two groups in terms of child's race and prenatal care, mother's socioeconomic condition, marital status, whether mother is first time mother and whether it is the first time for mother to participate in the Healthy Families program.
- Substance abuse concerns, domestic violence concerns, disabled children, and adults in house were identified as important risk factors for children in Healthy Families program to have a maltreatment report.
- Child Assessment Overall Score (ASQ:SE), HFPI scores and HFFAT scores were also recognized to be positively correlated with the occurrence of Healthy Family children maltreatment reports.

Furthermore, a direct comparison of IFRA-SDM with the predictive risk models is less than straightforward; IFRA-SDM has separate models, one predicting future neglect and another predicting future abuse each with its own set of risk factors, while the predictive risk models assess the risk for future maltreatment, in general, be it abuse or neglect. Additionally, several structural differences in the design of the approaches exist. However, a high-level comparison of the risk factors included in each set of models shows that these models generally do not disagree with each other where there are similar factors. This suggests that IFRA-SDM and the predictive risk models may be used in a complementary fashion to provide a more robust view of the child's risk for re-maltreatment.

7.2 Strengths and Limitations

To the knowledge of the North Highland team, this report is the first prospective study in the literature that studied a cohort of perpetrators over 10 years with multiple episodes of recurrence of maltreatment and the first study that built predictive risk models to identify perpetrators with high and low risk of chronicity of maltreatment. The study has several strengths and also is subject to some limitations that need to be mentioned.

The strengths of the study are as follows:

- The study adopted a robust longitudinal analysis tracking cohort members over 10 years to analyze long-term patterns and dynamics of the recurrence of maltreatment recognizing that re-maltreatment is a long-term phenomenon. The analysis window of this study is much longer than almost all studies in the literature.
- The study not only tracked families over 10 years after an initial report, but also went back over 10 years to capture the impact of intergenerational maltreatment, which was shown to be an effective risk factor.

- The study selected perpetrators and caregivers as the unit of analysis, because recidivism of perpetrators is particular interest to practitioners generally geared to produce changes in the behavior of the perpetrator/adult caregiver. Therefore, focusing on perpetrators is a more effective way of assessing chronic maltreatment.
- Given the potentially unique nature of multiple recurrences and the lack of knowledge in this area, the study focused on the chronically maltreated for policy and practice concerns and applied separate models for different reporting stages to capture the patterns and dynamics of re-maltreatment more accurately.
- The lack of the Child Death Review data for the complete 2004-2014 time window did not permit studying the relationship between chronicity and fatality. Preliminarily, the relationship that exists was found to be complicated. This was primarily due to the inability to reliably separate maltreatment related fatalities from other fatalities.
- With a dynamic approach and multiple models capturing the effect of time, the study was able to assess the complex transitions between different stages of reports, verification statuses, and perpetrator-victim relationships.
- The study adopted multi-level hierarchies of report histories to include the large networks of maltreatment relations between perpetrators and victims in their ecosystems, proven to be a very effective approach to capture the real effect of previous maltreatment incidents.
- The study conducted a robust Entity Resolution process to assign unique identifiers to individuals (perpetrators, caregivers, victims and other children) who were assigned multiple FSFN Person IDs over time. This process improved the internal validity of the study producing major advantages, such as providing an accurate count of previous report (a critical risk factor), enabling the proper incorporation of intergenerational maltreatment, which would otherwise be underestimated, enabling correct network connections, and avoiding a significant level of measurement error. Applying the same robust methodology used for the Entity Resolution process, several administrative data sets were matched with precision to study several research areas that would not be covered accurately otherwise, including the assessment of prevalence of child maltreatment for all children born in Florida.

This analysis and the models developed in this study are also subject to some limitations. Most of these limitations are inherent to analysis involving administrative data sets:

- Our study was limited by the usual shortcomings of research based on linked administrative records, including errors in the underlying data sources, such as missing data or data entry errors particularly in person identifiers that introduce matching inaccuracies.
- Since administrative databases do not collect data for research purposes, some of the critical risk factors are not available or only relatively crude proxy or surrogate variables can be used to capture the effect of these risk factors. For example, information regarding perpetrator/caregiver income and socioeconomic status, marital status, education, and whether they have emotional and behavior problems that may affect the child maltreatment recurrence were not available for this study. The information on reporters were not available to protect their confidentiality. This may result in lower predictive accuracy of the models.

- Another shortcoming related to the use of administrative data refers to the timing of the maltreatment. The analysis relied on the report time rather than the actual maltreatment occurrence time. This may bias the model estimation if the difference between the report time and the actual occurrence time is large and systematic.
- A similar limitation is the difficulty of capturing dynamic changes in risk factors such as family structure changes (for example, entry and exit of spouses or paramours, and so on), which may lead to less accurate results. Similarly, the difficulty of including dynamic interaction between the child welfare system and families precluded measuring the child welfare worker's ability to engage with the caregiver in these data, which is a critical risk factor.
- Another shortcoming is the inability to know how many perpetrators for whom no subsequent report of maltreatment was recorded simply because they might have moved out of Florida. Moreover, if some of the cohort perpetrators had been reported for alleged maltreatment in other states previously, these incidents are unknown to FSFN data and therefore unaccounted for.
- Finally, there are two limitations related to the external validity.
  - The use of data from Florida restricts the generalizability of findings. Referral practices and child welfare policies differ across states, and the influence of local policy variations in child welfare mandates for accepting or substantiating maltreatment referrals should be considered when interpreting the results.
  - These results describe perpetrators who were reported to the child welfare system. Hence, the findings may not be generalized to others who were never reported since the results reflect assessment of recurrence based only on reports.

Together, these shortcomings can diminish the predictive utility of the analytic tool in successfully identifying high risk and low risk individuals. It should be recognized, however, that perfect separation is an idealistic ambition and is therefore impossible to achieve, since there are always limits to the predictability of human behavior. Whether these models have reached that limit is unknown.

7.3 Model Application

The utility of the model as an assessment tool for identifying high risk and low risk for chronic perpetration has been discussed extensively in the main text. There are other applications for the risk model worth mentioning:

- The chronicity model risk scores provide a simple quantification of the risk imposed by an alleged perpetrator or caregiver on children in their care. This number can be used as an input to risk models for children including risk of fatality due to alleged maltreatment.
- The risk score may also reflect the success probability for actions taken by the child welfare system. Certain services and placements may be more appropriate for families with chronic perpetration risk scores within specific ranges.

- Similarly, quantification of risk at screening may assist in directing high risk cases to specialty caseworkers with more experience with complex cases or with a workload level compatible with the greater attention a high risk case may require.

7.4 RECOMMENDATIONS

Analytics is helpful in answering a series of questions while studying a problem such as the recurrence of maltreatment. Russell (2015) lists these as *why*, *when*, *who*, *who not* and *how* questions, which are addressed in this study in analyzing chronic maltreatment. *Why* and *when* questions were addressed by building analytical models to associate risk factors with child re-maltreatment and estimating the time to chronic maltreatment. The main objective was to find out why some perpetrators and caregivers might be more likely than others to maltreat their children repeatedly. The question *who*, the identification of high-risk perpetrators the Department may target interventions and the *who not* question, the identification of low-risk families unlikely to experience further maltreatment, were the main focus of this study.

The following recommendations are presented within the context of these questions answered by analytics. They focus on the central mandate of child protection agencies to decide which families and children to serve: the question *who*.

- The first set of recommendations is for the practical and policy implications of the findings in risk assessment and the utility of the predictive risk models.
- The second set addresses to the *how* question, which asks how to proceed, based on these findings and how to develop effective practices and programs. Some of these areas require further research.

7.4.1 INTERVENTION STRATEGIES AND PROGRAMS

The ability to target specific populations for different types of effective interventions is likely to be the most important program improvement strategy in addressing recurrence. Using the risk rankings provided by the risk assessment models, sub-populations of perpetrators and caregivers who are most likely to recur may be identified and targeted. However, accurate identification of *who* might be the most appropriate person to target interventions is not sufficient. It is also necessary to identify and implement the appropriate effective intervention to serve the targeted families. This leads to the *how* question, which refers to effective practices and programs.

Analytics provide some insights to help in the development of prescriptive evidence-based programs but usually the implementation of effective programs are evaluated with different techniques. The findings from this study lead to the conclusion that effective prevention of child maltreatment must be perpetrator-centric rather than child-centric. This conclusion, while intuitive, has transformational implications in child welfare.

The current practice at both national and state level is highly child-centric; therefore, the notion of perpetrator-centric policies and practices present a radically different approach to child welfare. This implies that the standards of policy and practice as well as the legislation require serious reconsideration. Second, because the perpetrators re-perpetrate over a long period of time, and because the path to perpetration often begins when the given perpetrator was a

himself/herself a victim of child maltreatment, it requires consideration of a much longer timeframe than is currently defined for re-maltreatment; that is, breaking the cycle of maltreatment requires taking a five- to ten-year view or even longer in order to treat the cause of the problem rather than the symptom manifested as the current child maltreatment reports. While the impact of this approach is nearly impossible to measure in the relatively short time frame of 12 to 24 months widely considered, it is a necessary shift in order to transform child welfare.

The primary recommendations from this study in order to achieve this transformation can be summarized as follows:

- Fundamentally shift the child welfare approach from being child-centric to perpetrator-centric. This involves advocating policy and practice changes at the national level, as well as legislative changes at the state and local level, and changing some practices to focus on the adults around the children from re-perpetrating rather than forming policies and practices strictly based on protecting current children from relatively imminent maltreatment.
- Consider practice changes around services that may prevent current child victims from becoming future perpetrators. This is necessary in order to break the cycle of maltreatment and especially chronic maltreatment.
- Re-examine legislative mandate in child welfare that are child-centric; consider augmenting with perpetrator-centric actions. This includes a potential re-definition of the three-report mandate currently in force in Florida.

Furthermore, fundamental to this approach is the ability to correctly identify and link the persons involved in the child's environment. The findings and recommendations presented here is heavily based on the ability to correctly build a network of people involved in the child's ecosystem, which in turn depends on the concept of entity resolution in order to ensure that the complete history of a case and its environment can be identified. Further discussion on the topic of entity resolution is available in a separate FY15-16 report, "Results-Oriented Accountability Program and Data Analytics: Data Assessment Report," with specific recommendations regarding FSFN presented in another related FY15-16 report, "Recommended Short-Term Plan of Actions for FSFN."

7.4.1.1 PROMISING PRACTICES TO REDUCE RE-MALTREATMENT

There are a series of promising practices aimed at preventing recurrence of maltreatment. They include interventions at the child, caregiver, family, and child welfare system levels and include a range of service modalities. However, it is a general recognition that the literature provides very little experimental research on evaluating specific prevention strategies, and there is a lack of evidence on the effectiveness of these practices. In other words, *there is no clear evidence-based method for preventing the recurrence of maltreatment*. The treatment of the topic is still sparser from the perpetrator-centric perspective. It has been argued that further research is needed to devise strategies for better reaching, engaging, and retaining target populations, as well as to develop the capacity to deliver services to communities at high risk (Carnochan et al., 2013; Fluke et al., 2003; Pecora et al., 2014; Petersen, Joseph and Feit, 2013; Reynolds, Mathieson and Topitzes, 2009). Particularly, virtually no effective program exists for chronic child abuse and neglect (Pecora et al., 2014). On the other hand, the literature has listed

several promising practices that have yet to be evaluated to the evidence-based practice level but is gaining recognition among practitioners as being helpful. A few are presented below as potential practices to alleviate the chronic maltreatment problem and a full list of these services are available in the literature (see Bartelink, et al., 2015; Carnochan et al., 2013; Petersen, Joseph and Feit, 2013; Pecora et al., 2014; Reynolds, Mathieson and Topitzes, 2009).

- Apply response tactics appropriate for the given level of perpetrator risk for re-perpetration at the time of maltreatment report. The simplest form of this approach is to apply a more traditional response for high-risk cases or severe instances of maltreatment, while considering different sets of service options that targets low- and moderate-risk cases. Although some examples exist in other states, determining what tactics may ultimately work for Florida requires additional research.
- Supplement the current "three-hit" rule with perpetrator-centric criteria. Currently, the Florida state statute 39.201(7) mandates that:

  > On an ongoing basis, the department's quality assurance program shall review calls, fax reports, and web-based reports to the hotline involving three or more unaccepted reports on a single child, where jurisdiction applies, in order to detect such things as harassment and situations that warrant an investigation because of the frequency or variety of the source of the reports. A component of the quality assurance program shall analyze unaccepted reports to the hotline by identified relatives as a part of the review of screened out calls. The Program Director for Family Safety may refer a case for investigation when it is determined, as a result of this review, that an investigation may be warranted.

  This is a child-centric approach. Based on the insights gained from this study, it is recommended that this be augmented with the incorporation of perpetrator-centric component; e.g., the Department may consider adding criteria that requires review when the number of unaccepted reports on a single *perpetrator* exceeds a certain threshold.

- Home visiting such as the Safecare program, is a promising service strategy, which uses nurses, paraprofessionals, social workers, and other social service professionals in providing family services and programs inside the home. It is a brief program for families with young children who have been reported for maltreatment. It takes into account individual, family, and societal factors that affect maltreatment to improve parenting skills and reduce future maltreatment (Edwards and Lutzker, 2008). Its effectiveness to reduce re-maltreatment has been shown (Carnochan, et al., 2013, Chaffin et al., 2012). Home visits may also target prospective or new mothers (Petersen, Joseph and Feit, 2013). Using risk factors identified by predictive models developed in this study, it is possible to target certain sub-populations at high or medium risk for home visiting, such as teen parents with intergenerational child maltreatment history.
- Universal to the literature on intervention in maltreatment is the importance of early intervention. Early disruption and replacing unhealthy trends within the family prevent them from becoming entrenched and more difficult to change later. The literature review has shown the lasting effects of early child maltreatment: The Chicago Child-Parent Centers and the Nurse-Family Partnership programs demonstrated the effectiveness of

longer term preventive effects. These were comprehensively implemented by professional staff in relatively high dosage and intensity. The programs were shown to be effective for high-risk parents (Reynolds, Mathieson, and Topitzes, 2009). Using the risk model, high-risk parents can be targeted for early intervention programs to reduce the likelihood of future maltreatment. The predictive model accurately identifies many high-risk perpetrators upon their first contact with the child welfare system and more than half within 6 to 18 months of their initial contact.

7.4.1.2 ADDITIONAL IDEAS

The Department may take further steps to improve its risk assessment methodology with the following actions:

- The presence of a workforce that is capable of implementing critical risk assessment decisions is vital to the whole decision-making process. Organization and environment should be suitable for making good decisions (Shlonsky, 2015). This requires making needed change in management, staffing, and training in the child welfare system. Hence, the Department incorporating the analytic findings to date into pre-service and in-service training for child protective investigators and case managers is recommended. It is critical that this training provides caseworkers and their supervisors with
  - an understanding of the characteristics of chronic perpetrators and their families
  - the patterns of maltreatment associated with their behavior
  - the areas in which these families often need services and support
  - enhanced training on comprehensive assessment as opposed to a more limited focus on the specific allegations contained in a single report of maltreatment
  - training may be extended to other service providers to attain better assessment results and outcomes
- Based on the findings presented in this study and several best practices of prevention programs as suggested earlier, it is recommended that the Department adopt evidence-based services for high risk *perpetrators* in an effort to stop the cycle of maltreatment. This effort would involve the delivery of secondary and tertiary programs using assessments informed by predictive risk models.
  - Secondary prevention programs, such as early childhood education interventions, are not specifically designed to help those who have displayed problems. Rather they are targeted toward families who possess risk factors characteristics that render them at risk for child maltreatment. For example, Chicago Child-Parent Centers program was successful at decreasing the rate of child maltreatment throughout childhood and adolescence (Curenton, McWey, and Bolen, 2009). Secondary prevention could be deployed at both screening and disposition touch-points.
  - Tertiary prevention programs, such as in-home family therapy are designed for children and families who have already displayed problems with maltreatment. The goal is to improve and strengthen family relationships. The output of risk

assessment models would be helpful determining which families to target and which specific interventions to perform.

- While there are commonalities between the IFRA-SDM and predictive risk model approaches, and while what can be observed in common generally do not disagree with each other at a very high level, several critical differences exist. These differences suggest that using both sets of models in conjunction is a valid strategy, as each provide a different perspective into child maltreatment. A main recommendation of Bartelink et al. (2015) in their review of child maltreatment decision-making methods was that practitioners use a combination of methods when deciding on child maltreatment cases. The effort involves:
  - Broadening Rapid Safety Feedback QA Review Protocol by including risk factors identified by this study
  - Testing the complementary relationship of predictive risk models with the IFRA-SDM by cross-validating, comparing and contrasting these two models in a region or county. Both models have their strengths and limitations. Although the predictive risk models are expected to perform better by incorporating dynamic and network factors as well as applying a holistic approach, IFRA-SDM includes various risk factors not available for the predictive models.

7.4.1.3 AREAS FOR FURTHER STUDY

The following topics are recommended for further research:

- It was demonstrated that, in alignment with the existing research, even among perpetrators and victims with chronic maltreatment histories, a majority had no evidence of services. While it is acknowledged that service details, especially those for in-home services, are generally incomplete and/or not available in FSFN, exploring why so many families with perpetrators who repeatedly maltreated children do not have any record of receiving services. Some of these families may not have an access for services, some may reject to participate in voluntary services, or some may be engaged in other community-based organization for supportive services. However, it is also possible that these families are missed by the child welfare system due to poor risk assessment decisions, which requires separate attention.
- Further research to assess the effectiveness of services and placement for the prevention of chronic maltreatment is recommended. A particular interest would be studying the permanency outcome applying a similar analytical methodology presented in this study to assess the patterns, dynamics, and risk factors for permanency. In the analysis, two distinct groups were observed among families with at least one re-report:
  - One group contained families that, after receiving in-home services, experienced a higher-than-average number of reports. Similar findings were observed for placements. Studying why these victims were re-reported with a higher rate following an intervention is recommended to better understand the reasons behind this observation. Several reasons were cited in this report and in the existing research to explain the positive association between the provision of services or placements and the recurrence of maltreatment, including the surveillance factor and higher needs of these families. This finding suggests that, for certain families, when interventions are delivered, they may be miscalibrated:

there may be misalignments in terms of service slots, dosage, or quality. These misalignments may not adequately alter circumstances to prevent later reports of maltreatment. Further study is necessary to understand why services and placements are ineffective in preventing re-maltreatment of the children in a family.

- The second group includes families that, after receiving in-home services, experienced lower-than-average rates of recidivism. Further studying this group is recommended as well in order to understand why and how interventions are working well with some families of perpetrators with chronic maltreatment risk. The availability and use of effective services are critical in targeting families before they become chronic. However, it is not understood how and, critically, which service mechanisms address effectively target populations result in better outcomes.

7.4.2 Risk Assessment Models

This report focused on the development of predictive risk models to assist the decision-making process of the Department. Based on the findings presented in this study, the following recommendations are proposed for the implementation of a better risk assessment methodology to estimate the risk of chronic maltreatment:

- Risk assessment of perpetrators and caregivers is key to identify high-risk families. Predicting recurrence of maltreatment for a perpetrator and then linking this risk to the risks of victims and families of this perpetrator was found to be a more effective approach of risk assessment. Hence, it is proposed to consider assessing the risk of chronic maltreatment for perpetrators as the first step.
- The findings in this study and previous research have shown that unsubstantiated investigations as well as substantiated investigations both are risk factors for chronic reports of maltreatment. Relying merely on verified reports overlook many perpetrators with high risk of further maltreatment, and the disposition status of the current report (verified or not) is not a sufficient basis for disposition status of the subsequent report. Hence, it is recommended that risk assessment should be made for all reports irrespective of the verification of maltreatment.
- The Department should reconsider the definition of chronic maltreatment, how it is measured, how many events, and over what period of time. This study considered five or more reports to be chronic, based on the previous research and the distribution of re-reporting in Florida.
- Since re-maltreatment is a long-term phenomenon and chronic perpetrators return to the system over a very long time, the assessment of chronic maltreatment should be conducted over a time window at least five years long. This report used a study window of eight to ten years.
- Child maltreatment reports represent a very limited view of a family. A single report is like the tip of an iceberg, and the iceberg revolves many times displaying a different tip (Loman, 2006). Responding only to the particular allegations of child maltreatment or the safety conditions observed in a single report does not take into account the fundamental and more complex causes of child maltreatment. Based on this

observation, and supported by previous research, building the risk assessment analysis adopting a holistic model is recommended, rather than different models for different types of maltreatment allegations. A particular reported allegation about a family is generally not predictive of what kind of allegation will be made in subsequent reports.

- Since the findings indicated the set of predictors significantly associated with re-reporting differed across stages, implementing different models designed for each re-report to predict the likelihood of chronic maltreatment is recommended. A single model of assessment does not provide accurate results ignoring the time between different reports and using separate predictive risk models identifies high-risk perpetrators at earlier stages with higher accuracy.

7.4.3 Model Application and Targeting

Following the methodology proposed above, the perpetrator predictive model is recommended to be implemented as an assessment and prioritization tool to estimate high and low risk for chronic perpetration in multiple ways:

- Approximately one out of five children born in Florida is reported to the child welfare system by age five. Given the high proportion of new victims reported, every worker has a heavy caseload. It is recommended to implement predictive risk models such as those developed in this study to assist in the screening process and help reduce the number of cases investigated. This implementation can identify perpetrators with low risk or a low likelihood of recurrence of maltreatment with good accuracy. These cases may then be screened-out since they are not expected to return to the child welfare system in the future.
- Workers need to accurately predict which perpetrators are likely to re-maltreat their children so that their families can be targeted for specific kinds of services to prevent future maltreatment. Implement the predictive risk models is recommended to target the most intensive and costly child protection services to families at highest risk of future maltreatment. Low- to moderate-risk families may be referred to other community agencies for supportive services. The accurate risk assessment is expected to contribute to the effectiveness of these interventions.
- The chronicity model risk scores provide a simple quantification and summarization of the risk imposed by an alleged perpetrator or caregiver on children in their care. It is based on historic data comparing individuals with similar risk factors. The numerical output of predictive scoring models may be used as an input to other risk models for children including risk of fatality due to alleged maltreatment.
- Finally, risk levels at screening can be used to direct high-risk cases to specialty caseworkers with more experience with complex cases and/or with a workload level compatible with the greater attention. Furthermore, risk levels may be used to determine specific minimum contact guidelines between a family and caseworkers.

7.5 FINAL COMMENTS

This report studied the chronic child maltreatment problem using a ten-year longitudinal cohort of perpetrators. Predictive risk models were used to identify high-risk perpetrators with a good performance and several effective risk factors were determined. The study does not provide simple answers. However, it does demonstrate that, by making better and smarter use of existing data and applying advanced analytical techniques, it is possible to:

- assess risk accurately,
- target high-risk populations,
- develop strategic preventive efforts, and
- protect children.

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SECTION 9 APPENDIX

Table 16: Allegations - Overview

Code	Text	Type
1	Abandonment	PN
2	Asphyxiation	PN
3	Bizarre Punishment	PA
4	Bone Fracture	PA
5	Burns	PN
7	Environmental Hazards	O
8	Failure to Protect	PN
9	Failure to Thrive	PN
10	Family Violence Threatens Child	FV
11	Inadequate Supervision	PN
12	Internal Injuries	PA
13	Malnutrition/Dehydration	PN
14	Medical Neglect	O
15	Mental Injury	O
16	Physical Injury	PA
17	Sexual Abuse	S
18	Substance Misuse	SA
19	Threatened Harm	PN
20	Asphyxiation	PN
21	Bizarre Punishment	PA
22	Bone Fracture	PA
23	Burns	PN
26	Environmental Hazards	O
27	Exploitation	PN
28	Inadequate Supervision	PN
33	Physical Injury	PA
34	Self-Neglect	O
35	Sexual Abuse	S
36	Substance Misuse	SA
40	Alcohol Exposed Child	O
41	Beatings	PA
43-44	Bruises/Welts	PA
46	Child-On-Child	S
47-48	Cuts/Punctures/Bites	PA
51-52	Deadly Weapon Injury	PN

Code	Text	Type
53-54	Dislocation	PN
55	Excessive Corporal Punishment	PA
56	Failure to Provide Medical Care (Religious Reasons)	O
64-65	Inadequate Clothing	PN
66-67	Inadequate Food	PN
68-69	Inadequate Shelter	PN
71	Inadequate Supervision - Parent Absent	PN
72	Inadequate Supervision/DJJ-Restorative	PN
77-78	Inappropriate/Excessive Isolation (Facility Only)	PN
79-80	Inappropriate/Excessive Restraints (Facility Only)	PN
83	Other Sexual Maltreatment	S
89-90	Poisoning	PN
91	Sexual Abuse - Other Child	S
92-93	Sexual Battery (Incest)	S
94-95	Sexual Battery (Not Incest)	S
96-97	Sexual Exploitation	S
98-99	Sexual Molestation	S
100	Skull/Brain/Spinal Injury	PA
102	Substance Exposed Child	SA
107	Inappropriate/Excessive Drug Given	O
110	Other Neglect (Not Medical)	O
111	Decubitus	PN
112	Human Trafficking	O
113	Human Trafficking - Labor	O
114	Human Trafficking - CSEC	S
117	Child-On-Child Sexual Abuse	S
119	Sexual Abuse - Sexual Battery	S
120	Sexual Abuse - Sexual Exploitation by Parent/Legal Guardian	S
121	Sexual Abuse - Sexual Molestation	S
122	Substance Misuse - Alcohol	SA
123	Substance Misuse - Illicit Drugs	SA
124	Substance Misuse - Prescription Drugs	SA

Table 17: Maltreatment Types

Code	Description		Code	Description		Code	Description
FV	Family Violence		PA	Physical Abuse		S	Sexual Abuse
O	Other Neglect		PN	Physical Neglect		SA	Substance Abuse

Table 18 present scorecards for the second report through fourth report chronicity risk models. The second row of each table is a baseline risk points for that model. Adding these points to the total score calibrates the model to the risk scale of the initial report model. In this way, risk thresholds established for the initial report model can be extended to subsequent models.

Table 18: Second-Report Risk Scorecard

Item	Details	Points
Second report baseline risk score	Add to total points to calibrate with initial report risk scorecard	12
Average age of victims and siblings (years)	Less than 1 year	9
	1-3	8
	3-5	7
	5-7	6
	7-9	5
	9-11	4
	11-13	3
	13-15	2
	15-17	1
	17-18	0
County	Lafayette	8
	Taylor, Calhoun, Gilchrist	7
	Putnam, Gulf, Dixie, Bradford	6
	Brevard, Jackson, Volusia, Baker, Suwannee, Walton, Wakulla, Citrus, Levy, Franklin, Washington	5
	Pasco, Highlands, Manatee, Union, Hernando, Marion, Pinellas, Bay, Alachua, Sumter, Columbia, Flagler, Holmes	4
	Seminole, Palm Beach, Orange, Collier, Nassau, Charlotte, Liberty, Escambia, Sarasota, Lee, St. Johns, Clay, Okaloosa, Polk, Jefferson	3
	Madison, Hillsborough, Desoto, Hamilton, Okeechobee, Santa Rosa, Glades, Gadsden, Duval, St. Lucie, Hendry, Lake, Leon	2
	Indian River, Osceola, Broward, Monroe, Martin, Hardee	1
	Miami-Dade	0
	0%	6

Item	Details	Points
Fraction of times Subject assigned perpetrator role in last two reports	50%	3
	100%	0
Minimum age of victims (years)	Less than 1 year	10
	1-2	9
	2-4	8
	4-6	7
	6-8	6
	8-10	5
	10-11	4
	11-13	3
	13-15	2
	15-17	1
	17-18	0
Number of directly linked network reports in last 20 years	0	5
	1-2	4
	3-3	3
	4-5	2
	6-8	1
	9+	0
Number of intergenerational victim/sibling reports for Subject	2+	4
	1	3
	0	0
Number of previous networked caregiver reports in last year	0	3
	1-2	1
	3+	0
Number of previous networked Level 1 caregiver reports in last 5 years	0	3
	1	1
	2+	0
Number of previous networked Level 1 perpetrator reports in last 2 years	0	3
	1	1
	2+	0
	2+	3
	1	2

Item	Details	Points
Number of previous networked Level 1 sibling reports in last 5 years	0	0
Number of previous networked victim reports in last 20 years	61+	13
	32-60	12
	21-31	11
	14-20	10
	9-13	9
	6-8	8
	5	7
	3-4	6
	2	4
	1	1
	0	0
Number of services offered in last 5 years	2+	2
	1	1
	0	0
Substance abuse maltreatments in last six months?	Yes	1
	No	0
Number of networked verified or some indication reports in last year (all levels)	25+	7
	9-24	6
	7-8	5
	5-6	4
	4	3
	2-3	2
	1	1
	0	0
Number of networked verified reports in last 20 years (all levels)	0	3
	1-3	2
	4-8	1
	9+	0
Subject Age (years)	Less than 18	22
	18-21	21
	21-25	20
	25-28	19
	28-31	18
	31-35	17
	35-38	16

Item	Details	Points
	38-41	15
	41-45	14
	45-48	13
	48-51	12
	51-55	11
	55-58	10
	58-61	9
	61-65	8
	65-68	7
	68-71	6
	71-75	5
	75-78	4
	78-81	3
	81-85	2
	85-88	1
	88-90	0
Subject Black ethnicity	No	3
	Yes	0
Subject Hispanic ethnicity	No	3
	Yes	0
Subject is female	Yes	5
	No	0
Subject is parent of at least one victim in initial report	Yes	3
	No	0
Subject is parent to at least one victim in current post-initial report	Yes	4
	No	0
Subject is parent to at least one victim in some report (initial to current)	Yes	4
	No	0
Days since initial report	Less than 64	38
	64-167	37
	168-272	36
	273-376	35
	377-480	34
	481-585	33
	586-689	32
	690-794	31
	795-898	30
	899-1002	29
	1003-1107	28
	1108-1211	27
	1212-1316	26
	1317-1420	25
	1421-1524	24

Item	Details	Points
	1525-1629	23
	1630-1733	22
	1734-1837	21
	1838-1942	20
	1943-2046	19
	2047-2151	18
	2152-2255	17
	2256-2359	16
	2360-2464	15
	2465-2568	14
	2569-2673	13
	2674-2777	12
	2778-2881	11
	2882-2986	10
	2987-3090	9
	3091-3195	8
	3196-3299	7
	3300-3403	6
	3404-3508	5
	3509-3612	4
	3613-3717	3
	3718-3811	2
	3822-3926	1
	3927+	0

Table 19: Third-Report Risk Scorecard

Item	Details	Points
Third report baseline risk	Add to total points to calibrate with initial report risk scorecard	26
Average age of victims (years)	0-1	5
	1-5	4
	5-9	3
	9-12	2
	12-16	1
	16-18	0
County	Lafayette	5
	Putnam, Gulf, Dixie, Bradford, Taylor, Calhoun, Gilchrist	4
	Bay, Alachua, Sumter, Columbia, Flagler, Holmes, Brevard, Jackson, Volusia, Baker, Suwannee, Walton, Wakulla, Citrus, Levy, Franklin, Washington	3
	Leon, Seminole, Palm Beach, Orange, Collier, Nassau, Charlotte, Liberty, Escambia, Sarasota, Lee, St. Johns, Clay, Okaloosa, Polk, Jefferson,	2

Item	Details	Points
	Pasco, Highlands, Manatee, Union, Hernando, Marion, Pinellas	
	Broward, Monroe, Martin, Hardee, Madison, Hillsborough, Desoto, Hamilton, Okeechobee, Santa Rosa, Glades, Gadsden, Duval, St. Lucie, Hendry, Lake	1
	Miami-Dade, Indian River, Osceola	0
Minimum age of victims (years)	Less than 1	11
	1-2	10
	2-4	9
	4-5	8
	6-7	7
	7-9	6
	9-10	5
	11-12	4
	12-14	3
	14-15	2
	16-17	1
	17-18	0
Number of intergenerational victim/sibling reports for Subject	1+	3
	0	0
Number of previous networked Level 1 caregiver reports in last 2 years	0	3
	1	1
	2+	0
Number of previous networked Level 1 perpetrator reports in last 2 years	0	3
	1	2
	2	1
	3+	0
Number of previous networked victim reports in last 20 years	75+	10
	43-74	9
	26-42	8
	17-25	7
	11-16	6
	8-10	5
	6-7	4
	4-5	3
	3	2
	2	1
	0-1	0
Report is verified	No	3
	Yes	0
Subject Age (years)	Less than 16	19
	16-20	18
	20-24	17

Item	Details	Points
	24-28	16
	28-32	15
	32-36	14
	36-40	13
	40-44	12
	44-48	11
	48-52	10
	52-56	9
	56-60	8
	60-64	7
	64-68	6
	68-72	5
	72-76	4
	76-80	3
	80-84	2
	84-87	1
	88+	0
Subject Black ethnicity	No	3
	Yes	0
Subject Hispanic ethnicity	No	2
	Yes	0
Subject is female	Yes	4
	No	0
Subject is parent to at least one victim in this report	Yes	3
	No	0
Subject is parent to at least one victim in some report (initial to current)	Yes	4
	No	0
Days since initial report	Less than 29	33
	29-142	32
	143-264	31
	265-386	30
	387-508	29
	509-630	28
	631-752	27
	753-874	26
	875-996	25
	997-1118	24
	1119-1240	23
	1241-1362	22
	1363-1484	21
	1485-1606	20
	1607-1728	19
	1729-1850	18
	1851-1972	17
	1973-2094	16

Item	Details	Points
	2095-2216	15
	2217-2338	14
	2339-2460	13
	2461-2582	12
	2583-2704	11
	2705-2826	10
	2827-2948	9
	2949-3070	8
	3071-3192	7
	3193-3314	6
	3315-3436	5
	3437-3558	4
	3559-3680	3
	3681-3802	2
	3803-3926	1
	3927+	0
Time since second report (days)	Less than 117	16
	117-362	15
	363-608	14
	609-854	13
	855-1100	12
	1101-1346	11
	1347-1591	10
	1592-1837	9
	1838-2083	8
	2084-2328	7
	2330-2575	6
	2576-2821	5
	2822-3067	4
	3068-3314	3
	3315-3560	2
	3561-3854	1
	3855+	0

Table 20: Fourth-Report Risk Scorecard

Item	Details	Points
Fourth report baseline risk	Add to total points to calibrate with initial report risk scorecard	52
Average age of victims (years)	0-1	5
	1-5	4
	5-8	3
	8-12	2
	12-16	1
	16-18	0

Item	Details	Points
Minimum age of victims (years)	Less than 2	9
	2-4	8
	4-5	7
	6-7	6
	7-9	5
	9-11	4
	11-13	3
	13-15	2
	15-17	1
	17-18	0
Number of Level 1 removals in last year	0	3
	1+	0
Number of previous networked Level 1 caregiver reports in last 2 years	0	2
	1	1
	2+	0
Number of previous networked victim reports in last 20 years	395+	9
	74-394	8
	43-73	7
	26-42	6
	17-25	5
	12-16	4
	8-11	3
	6-7	2
	4-5	1
	0-3	0
Report is verified	No	3
	Yes	0
Subject Age (years)	Less than 18	15
	18-23	14
	23-28	13
	28-33	12
	33-38	11
	38-43	10
	43-48	9
	48-53	8
	53-58	7
	58-63	6
	63-67	5
	67-72	4
	72-77	3
	77-82	2
	82-87	1
	87+	0
Subject Black ethnicity	No	2
	Yes	0
Subject is female	Yes	3

Item	Details	Points
	No	0
Subject is parent to at least one victim in current report	Yes	3
	No	0
Subject is parent to at least one victim in some report	Yes	3
	No	0
Days since initial report	Less than 148	34
	148-262	33
	263-376	32
	377-490	31
	491-605	30
	606-719	29
	720-833	28
	834-948	27
	949-1062	26
	1063-1176	25
	1177-1290	24
	1291-1405	23
	1406-1519	22
	1520-1633	21
	1634-1748	20
	1749-1862	19
	1863-1976	18
	1977-2091	17
	2092-2205	16
	2206-2319	15
	2320-2433	14
	2434-2548	13
	2549-2662	12
	2663-2776	11
	2777-2891	10
	2892-3005	9
	3006-3119	8
	3120-3234	7
	3235-3348	6
	3349-3462	5
	3463-3576	4
	3577-3691	3
	3692-3805	2
	3806-3920	1
	3921+	0
Days since third report	Less than 211	17
	211-425	16
	426-639	15
	640-854	14

Item	Details	Points
	855-1069	13
	1070-1284	12
	1285-1499	11
	1500-1714	10
	1715-1928	9
	1929-2143	8
	2144-2358	7
	2359-2571	6
	2572-2789	5
	2790-3003	4
	3004-3221	3
	3222-3457	2
	3458-3754	1
	3755+	0

Table 21: Model Coefficients and Statistical Significance

Note: All risk factors have one degree of freedom.

Risk Factor	Statistic	Model First	Second	Third	Fourth
Intercept	Estimate	-3.0087	-0.59926	0.78143	2.476447
	Chi-Square (p-value)	1287.048 (p<0.0001)	91.29494 (p<0.0001)	132.3792 (p<0.0001)	780.7681 (p<0.0001)
Fraction of times Subject assigned perpetrator role in last 10 years	Estimate	-0.86248	-0.39590		
	Chi-Square (p-value)	1304.512 (p<0.0001)	143.3833 (p<0.0001)		
Missing or erroneous victim dates of birth	Estimate	0.406604			
	Chi-Square (p-value)	105.0034 (p<0.0001)			
Subject is parent to at least one victim in some report (initial to current)	Estimate		0.266296	0.260106	0.18202
	Chi-Square (p-value)		73.83416 (p<0.0001)	114.7702 (p<0.0001)	32.23406 (p<0.0001)
Subject is parent of at least one victim in initial report	Estimate	1.340045	0.187521		
	Chi-Square (p-value)	3218.712 (p<0.0001)	51.24741 (p<0.0001)		
Subject is parent to at least one victim in current post-initial report	Estimate		0.298759	0.203936	0.228112
	Chi-Square (p-value)		140.7036 (p<0.0001)	98.07134 (p<0.0001)	80.37615 (p<0.0001)
Report is verified	Estimate			-0.19298	-0.23436
	Chi-Square (p-value)			57.20160 (p<0.0001)	47.38522 (p<0.0001)

Risk Factor	Statistic	Model First	Second	Third	Fourth
Geographic risk	Estimate	1.2509	0.801539	0.501553	
	Chi-Square (p-value)	464.9723 (p<0.0001)	152.8179 (p<0.0001)	44.96860 (p<0.0001)	
Average age of victims (years)	Estimate			-0.01869	-0.01817
	Chi-Square (p-value)			30.84447 (p<0.0001)	16.68367 (p<0.0001)
Average age of victims and siblings (years)	Estimate		-0.0335		
	Chi-Square (p-value)		83.67389 (p<0.0001)		
Minimum age of victims (years)	Estimate	-0.07108	-0.03681	-0.04152	-0.03587
	Chi-Square (p-value)	1783.070 (p<0.0001)	102.7249 (p<0.0001)	159.9869 (p<0.0001)	74.05388 (p<0.0001)
Number of directly linked reports in last 20 years (percentile)	Estimate	0.004589			
	Chi-Square (p-value)	29.40417 (p<0.0001)			
Number of individuals in current report (percentile)	Estimate	-0.0071			
	Chi-Square (p-value)	398.864 (p<0.0001)			
Number of directly linked verified report in last 20 years (percentile)	Estimate	-0.00161			
	Chi-Square (p-value)	26.91107 (p<0.0001)			
Number of directly linked verified or some indicator reports in last year (percentile)	Estimate		-0.00422		
	Chi-Square (p-value)		34.67321 (p<0.0001)		
Number of verified or some indicator substantiations in current report (percentile)	Estimate	0.002438			
	Chi-Square (p-value)	77.13950 (p<0.0001)			
Number of reports in last 20 years (percentile)	Estimate	0.006894			
	Chi-Square (p-value)	99.44822 (p<0.0001)			
Number of verified reports in last 20 years (percentile)	Estimate		-0.00229		
	Chi-Square (p-value)		44.13218 (p<0.0001)		
Number of verified or some indicator	Estimate		0.005404		
	Chi-Square (p-value)		48.63129 (p<0.0001)		

Risk Factor	Statistic	Model First	Second	Third	Fourth
reports in last year (percentile)					
Number of mental health services provided in last 6 months (percentile)	Estimate	0.005761			
	Chi-Square (p-value)	66.0491 (p<0.0001)			
Number of other neglect maltreatments in last 6 months (percentile)	Estimate	0.001445			
	Chi-Square (p-value)	23.0583 (p<0.0001)			
Number of Level 1 removals in last year (percentile)	Estimate				-0.00435
	Chi-Square (p-value)				17.34679 (p<0.0001)
Number of previous caregiver reports in las year (percentile)	Estimate		-0.0024		
	Chi-Square (p-value)		44.40965 (p<0.0001)		
Number of previous Level 1 caregiver reports in last 2 years (percentile)	Estimate			-0.00250	-0.00186
	Chi-Square (p-value)			49.37804 (p<0.0001)	15.60854 (p<0.0001)
Number of previous Level 1 caregiver reports in last 5 years (percentile)	Estimate		-0.002457		
	Chi-Square (p-value)		59.76450 (p<0.0001)		
Number of previous Level 1 perpetrator reports in last 2 years (percentile)	Estimate		-0.00264	-0.00277	
	Chi-Square (p-value)		63.21762 (p<0.0001)	58.78149 (p<0.0001)	
Number of intergenerational victim/sibling reports for Subject (percentile)	Estimate	0.007302	0.005079	0.004128	
	Chi-Square (p-value)	191.3287 (p<0.0001)	115.2720 (p<0.0001)	57.03165 (p<0.0001)	
Number of previous Level 1 sibling reports in last 5 years (percentile)	Estimate		0.003316		
	Chi-Square (p-value)		71.87328 (p<0.0001)		
Number of previous victim reports in last 20 years (percentile)	Estimate		0.009382	0.00723	0.006002
	Chi-Square (p-value)		686.2653 (p<0.0001)	466.4314 (p<0.0001)	220.1965 (p<0.0001)
Number of substance abuse maltreatments in last 6 months (percentile)	Estimate	0.002556	0.001399		
	Chi-Square (p-value)	66.20101 (p<0.0001)	22.1738 (p<0.0001)		
	Estimate		0.002231		

Risk Factor	Statistic	Model First	Second	Third	Fourth
Number of services offered in last 5 years (percentile)	Chi-Square (p-value)		31.22690 (p<0.0001)		
Number of perpetrator services offered in last 5 years (percentile)	Estimate	0.008307			
	Chi-Square (p-value)	43.65471 (p<0.0001)			
Subject Age	Estimate	-0.02719	-0.02080	-0.01732	-0.01415
	Chi-Square (p-value)	1246.574 (p<0.0001)	561.8510 (p<0.0001)	295.2959 (p<0.0001)	130.7025 (p<0.0001)
Subject Black ethnicity	Estimate	-0.17153	-0.22933	-0.18738	-0.11165
	Chi-Square (p-value)	106.5529 (p<0.0001)	154.8380 (p<0.0001)	79.77684 (p<0.0001)	18.83484 (p<0.0001)
Subject Hispanic ethnicity	Estimate	-0.41982	-0.1843	-0.12243	
	Chi-Square (p-value)	442.534 (p<0.0001)	67.67586 (p<0.0001)	22.55894 (p<0.0001)	
Subject Other ethnicity	Estimate	-0.33582			
	Chi-Square (p-value)	23.4927 (p<0.0001)			
Subject is female	Estimate	0.465608	0.34859	0.294089	0.238293
	Chi-Square (p-value)	1140.567 (p<0.0001)	521.5868 (p<0.0001)	282.3901 (p<0.0001)	108.9077 (p<0.0001)
Time since initial report (days)	Estimate		-0.00066	-0.00056	-0.00060
	Chi-Square (p-value)		2672.1 (p<0.0001)	2044.402 (p<0.0001)	2001.787 (p<0.0001)
Time since previous report (days)	Estimate			-0.000281	-0.00032
	Chi-Square (p-value)			236.5648 (p<0.0001)	239.0586 (p<0.0001)