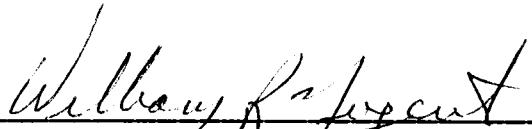
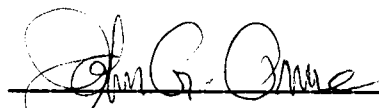
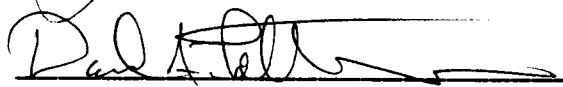


To the Graduate Council:

I am submitting herewith a dissertation written by Jeffrey B. Paddock entitled "Factors Predictive of Injury Severity in Cases of Physical Child Abuse Among Air Force Families: A Cross-validation Study." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Social Work.


William R. Nugent, Major Professor

We have read this dissertation
and recommend its acceptance:


Accepted for the Council:


Associate Vice Chancellor and Dean
of the Graduate School

**FACTORS PREDICTIVE OF INJURY SEVERITY
IN CASES OF PHYSICAL CHILD ABUSE
AMONG AIR FORCE FAMILIES:
A CROSS-VALIDATION STUDY**

**A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville**

**Jeffrey B. Paddock
December 1995**

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DEDICATION

Dedicated to the memory of my dear friends, Suzanne Cherrington Moulton and Harold Keith Brown, who lost their battles with cancer during the summer of 1995. In life, they provided me with love, friendship, humor, support, and acceptance. In death, they have given me the desire to emulate their courage, strength of character, devotion to family, and unending service to others. May God bless them and keep them.

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ABSTRACT

While most studies of risk assessment in the child maltreatment literature focus on characteristics of children and families who have been reported to authorities, or on the risk of recurrence of maltreatment, the present study focused on injury severity as the outcome. The purpose of the study was to develop and test, via a cross-validation sample, a model for predicting severity of injury in cases of physical child abuse.

Conducted on a subset of observations from child abuse reports in the U.S. Air Force Family Advocacy Program's central registry, data included selected variables from 6246 substantiated cases of physical child abuse from Fiscal Year 1990 through Fiscal Year 1994. The study included a total of fifteen predictor variables: four child characteristics (gender, age, race, handicapping condition), two family characteristics (number of children in the home, income), two report characteristics (source, season), and seven perpetrator characteristics (gender, age, race, relationship to the child, marital status, history of substance abuse, history of violence). Injury severity was categorized into four levels: mild, moderate, severe, or death.

It was hypothesized that each of the fifteen predictors would be related to injury severity when controlling for all other variables in the model, and that two interactions (child age-by-child gender, perpetrator gender-by-child gender) would be confirmed. Using

ordinal logistic regression procedures to analyze data, only eight of the fifteen predictors, and neither of the interactions, were found to be statistically significant predictors of injury severity. The eight significant predictors included income, child age, child race, perpetrator gender, perpetrator history of violence, perpetrator alcohol and/or drug involvement, perpetrator race, and source of referral. When this model was applied to the cross-validation sample, however, it fared poorly, predicting no cases in the severe injury or death categories. While statistically significant, the overall model was able to predict injury severity only six percent better than chance.

A test of the distributional assumption of ordinal logistic regression for the estimation sample revealed that the model was indeed misspecified, and that nonlinearities, interactions, and additional predictors should be included in future models.

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CHAPTER I

INTRODUCTION

Since the publication of "The Battered Child Syndrome" by C. Henry Kempe and associates (1962), child maltreatment has been the subject of massive programming and legislative efforts in the United States. In spite of these efforts, child maltreatment continues to be a pervasive, devastating, and costly social problem. According to the National Center on Child Abuse and Neglect over one million children are maltreated each year while nearly double that number are reported to state agencies for suspected child abuse and neglect (Gelles & Cornell, 1990). A finding by the American Association for Protecting Children that child abuse reports increased by 31 percent between 1985 and 1990 (American Humane Association, 1990) is consistent with a recent survey of all U.S. states which revealed a 6 percent increase per year between 1985 and 1992 (McCurdy & Daro, 1994). During the 1980's nearly 2000 child deaths were recorded annually as a result of abuse and neglect (McClain, Sacks, Froehlke, & Ewigman, 1993), and in 1990 alone an additional 160,000 children were seriously injured (Daro & McCurdy, 1991). While these numbers are staggering and elicit a strong emotional response, their reliability and validity have been the subject of considerable debate, and they tell us little about the long term consequences and social costs of the problem.

In a review of the literature on the psychosocial adjustment of battered children, Lamphear (1985) suggests that compared to non-abused children: ". . . physically abused children manifest a greater number of behavior problems, have poor peer relationships, social skills deficits, are less socially involved, have less empathy, and manifest poor school adjustment and academic performance" (p. 260). While research into the links between child maltreatment and later social problems remains incomplete, retrospective studies of juveniles arrested for violent crime, status offenses, and runaway consistently reveal a history of recurring and often severe childhood maltreatment (Meyers, 1990). Though relatively few studies have examined the connection between childhood abuse and adult criminality, preliminary evidence suggests a similar pattern, especially with violent adult criminals (Meyers).

The human and social costs of child abuse and neglect become even more tangible when broken down in terms of dollars and cents. Daro (1988) calculated some of the direct public expenditures associated with child maltreatment for the nearly 24,000 children who suffered serious physical injuries in 1983 at nearly \$500 million (for medical, special education, and foster care services). The General Accounting Office (1991) has arrived at a similar figure. Further estimates of the cost of maintaining the small percentage of children from that same year (1983) in foster care for an additional 1.8 years approached \$650 million. Clearly, the lasting costs imposed by child abuse--in lost human potential, criminal

detentions, institutionalization, special education, emergency and therapeutic services --multiply each year as more children are psychologically, emotionally, and developmentally disabled by maltreatment.

At the same time, child abuse investigations are a harsh intrusion by the state into the lives of a community's families. Investigation plays out the dilemma inherent in balancing the rights of children against the rights of their parents. It deprives family members of their right to privacy without offering them the due process protections of criminal investigation (Alter, 1987). For these reasons the decision to proceed with a child abuse investigation is exceptionally important.

Given the seriousness of the problem and the substantial increases in reports of abuse without concomitant increases in funding, staffing, and training for personnel, how are child protection services (CPS) agencies responding? In spite of the fact that most state laws are in compliance with the federal statute that all reports of child abuse and neglect will be investigated (Child Abuse Prevention and Treatment Act, 1974, P.L. 93-247), 87 percent of state CPS agencies have policies which allow for screening at intake to decide whether to accept a report for investigation (Wells, 1988). In some cases these policies have been derived in a legitimate attempt to identify appropriate reports in adherence with laws that require state intervention, while in others the policies (often unwritten) are a direct result of worker overload and time

available to conduct investigations. In a recent survey of CPS supervisors in seven states, 15 percent reported that workers "occasionally" screen out reports they ordinarily would accept, while others noted that de facto screening occurs when cases initially accepted for investigation are later not investigated because of overload (Wells, Stein, Fluke, & Downing, 1989).

In order to cope with the disparity between workload and resources many agencies have adopted risk assessment tools as a means of prioritizing reports for investigation (Wells, Downing, & Fluke, 1991) as well as a means to guide casework decision making throughout the various stages of a case. The speed with which risk assessment and its own jargon (e.g., models, checklists, forces) has spread across the states is not so much an indicator of the quality of the approaches currently in use as it is an indication that CPS agencies are under extreme stress (Cicchinelli, 1989). In fact, very few risk assessment systems have been the subject of systematic evaluation regarding their accuracy, efficiency, or effectiveness, leading Johnson (1991) to comment:

The truth is that the number of risk assessment systems that have been studied at all can be counted on one hand, while the number . . . is large and growing. Whole states with millions of people and, potentially hundreds of thousands of clients, rely on risk assessment systems whose effects on the quality of child protection decisions are virtually unknown and unstudied. The

construction of risk assessment instruments without empirical research is the norm and is proceeding apace (p. 1).

Zuravin, Orme, & Hegar (1994) have suggested that decisions regarding triage and how quickly to investigate abuse might be substantially improved if "they were driven by empirically derived criteria for predicting the probability of injury severity and immediate recurrence of abuse" (p. 131). Unfortunately, screening instruments, like most other risk assessment tools, usually include variables selected only on the basis of clinical judgment (Zuravin et al). Research has demonstrated, however, that professional judgment alone is often unreliable in predicting human behavior (Dawes, Faust, & Meehl, 1989; Gabor, 1986; Johnson, 1991; Meehl, 1954; Stein & Rzepnicki, 1984). Citing evidence from over 100 comparative studies of clinical versus actuarial decision making in a variety of fields (e.g., medicine, psychiatry, psychology, corrections), Dawes et al. conclude that "in virtually every one of these studies, the actuarial method has equaled or surpassed the clinical method, sometimes slightly and sometimes substantially" (p. 1669).

In spite of the evidence from comparative studies such as those noted above, arguments for and against the use of actuarial (statistical) methods of prediction have continued since the 1950s when psychologist Paul Meehl published his seminal work Clinical Versus Statistical Prediction (1954). Often the arguments take an

all or nothing form, centering on clinicians' beliefs that use of predictive equations in some way "dehumanizes" their clients, that empirical methods employ inflexible procedures which disregard the human capacity to make unique "qualitative" observations, and that clinical experience is being disregarded (Dawes et al., 1989). Faust (1991) rightly points out, however, that the empirical approach to prediction requires human thought, conceptualization tempered by clinical experience and observation, and just plain educated guesswork. He further suggests:

Experience has no peer or substitute in the formation of ideas and hypotheses. Experience helps us to uncover the limits of our procedures and possible directions for their improvement. However, experience is no substitute for the scientific testing of our ideas and hypotheses (Faust, 1991, p. 208).

Actuarial risk assessment is not a substitute for the critical judgment of line workers, nor does it make decisions for the agency.

Prediction, at least at the informal level, already underlies the actions of personnel within the child protection system, as it does all social behavior (Gabor, 1986). This being the case, it can be argued that the arbitrary and subjective nature of current predictions by individual caseworkers (whose experience and training may vary considerably) should be replaced by a more structured approach. Moreover, risk assessment based on simple,

empirically validated instruments can enhance the parsimonious use of child protection resources which are clearly in short supply.

Such an approach has been taken in the field of corrections, based upon more than 20 longitudinal risk assessment studies in adult and juvenile corrections to support case management/case decision making in correctional agencies (Baird, Wagner, & Neuenfeldt, 1991). The general conclusion from these studies is that increased levels of supervision will significantly reduce criminal behavior among high-risk offenders, but will have little impact on low-risk offenders. Thus, given limited staff and supervision resources, "matching the supervision level to the risk classification offers probation and parole agencies the best opportunity to maximize this impact on public safety" (Baird et al., p. 4).

Statement of the Problem

While most studies of risk assessment in the child maltreatment literature focus on characteristics of children and families who have been reported to authorities, or on the risk of recurrence of maltreatment, the present study focused on injury severity as the outcome. The ability to reliably and accurately assess the probability of severe physical injury would be an important adjunct to professional judgment, not only for those who must prioritize reports for investigation (Hegar et al., 1994), but also for those who must make critical decisions (e.g., treatment

regimen, out of home placement, case closure) throughout the life of the case. Finally, the development and utilization of valid and reliable screening tools could potentially ensure that mandatory protective services investigations are limited to cases in which actual abuse is alleged, thus preventing unnecessary intrusion into the lives of families.

In light of the limited research and knowledge in this important area, the present study attempted to answer the following research question: What factors, or combination of factors, are predictive of injury severity in cases of physical child abuse? This question was addressed by looking closely at the findings from previous research to identify factors that were either confirmed (e.g., child's age) or were inconsistent (e.g., child's gender) in terms of their predictive power, and by addressing definitional and methodological issues which may have influenced previous results. The selection of physical abuse, and the resultant exclusion of neglect, emotional, and sexual abuse, was necessitated by the significant differences in the way severity would be defined for each type. Further, different factors would be expected to predict severity in each type of maltreatment (Hegar et al., 1994).

As the search for improved methods and tools for explaining child maltreatment continues, Pelton's (1985) reminder that different kinds of samples and studies can provide good guidance for future research is well noted. Toward that end, the present study consisted of a retrospective, exploratory analysis of a large sample

of substantiated cases of physical child abuse reported to the U.S. Air Force Central Registry between 1990 and 1994. Generalizing beyond the Air Force to the general population is problematic because of obvious differences in the composition of military and civilian populations (e.g., age, employment status, mobility). It is also difficult to compare child maltreatment rates from the Air Force with civilian rates because the Air Force is a closed community with less privacy and responds to a wider range of reported maltreatment. Nonetheless, given the unique characteristics of the military it is important to investigate the child maltreatment problem within this specific system.

Objectives

Specifically, the objectives of the present study were:

1. To systematically develop a model for predicting severity of injury in cases of physical child abuse from information included in abuse reports to the U.S. Air Force Family Advocacy Program.
2. To test the model using ordinal logistic regression to determine which variables and in what combination are significant predictors of injury severity.
3. To apply the prediction model to a cross-validation sample to counter artificial inflation in the accuracy rates (due to chance) and to determine how well the model performs.

CHAPTER II

REVIEW OF THE LITERATURE

It is impossible to proceed with research in the area of child maltreatment without first considering how definitions of the phenomena in question affect the design, analysis, outcome, and comparability of results among studies. Definitional differences and problems are reflected in studies of the extent of the problem, in the theoretical models which purport to explain the behavior, and in efforts to predict recurrence and injury severity. This chapter begins with a review of the literature on research definitions in child maltreatment, followed by a discussion of the impact of definitions on incidence studies (which are often the source of data sets used in model development). The third section reviews current theoretical models of physical child abuse which have yielded the correlates of abuse most often studied in relation to the prediction of recurrence and injury severity. Sections four and five present findings on the current state of risk assessment systems for physical child abuse and the prediction of injury severity, respectively. The final section presents the research hypotheses.

Research Definitions: Current Problems

The limitations of current knowledge about the various forms of child maltreatment can be attributed, at least in part, to the lack of progress in constructing clear, reliable, valid and useful

definitions of child abuse and neglect. Without such definitions it becomes difficult, if not impossible, to compare and integrate findings across studies and to determine if specific types of abuse, or combinations thereof, vary with respect to sequelae, etiology, intergenerational transmission, and treatment response (Zuravin, 1991). While numerous authors have described the difficulties encountered in constructing child maltreatment definitions (Aber & Zigler, 1981; Giovannoni, 1989; Giovannoni & Becerra, 1979; Besharov, 1990; Zuravin, 1991), the National Research Council's (NRC) Panel on Research on Child Abuse and Neglect (1993, pp. 57-58) provides the most succinct review to date:

- Lack of social consensus over what constitutes dangerous or unacceptable forms of parenting.
- Uncertainty about whether to define maltreatment based on adult characteristics, adult behavior, child outcome, environmental context, or some combination.
- Conflict over whether standards of endangerment or harm should be used in constructing definitions.
- Confusion over the multiple purposes to which definitions are to be put: scientific, legal, clinical.
- The fact that the meaning of an act toward a child may vary greatly with the child's age, gender, relation to the actor, ethnicity, and contextual factors.
- Variations in age definitions of a "child" (which may range from 0 to 16 or 0 to 18 depending on state definitions) and the existence of a special subpopulation (commonly termed teens, youth,

adolescents, teenagers) whose physical, developmental, and social characteristics are significantly different from those of children.

- Uncertainty as to whether definitions should reflect discrete categories of maltreating behaviors or draw on dimensions of maltreatment within a broader spectrum of "normal" behaviors.
- Difficulties in developing definitions that are both meaningful and capable of being operationalized. An ideal theoretical construct that cannot be applied to real populations is of limited usefulness.

In spite of these difficulties, the Panel argues that development of standardized, consistent definitions will result in improved measurement and instrumentation, and ultimately in greater comparability and generalizability of study results. The absence of such measures has been cited as contributing, for example, to the dramatic differences in the findings of various incidence studies (described in more detail in a later section). Thus estimates of the number of children abused and neglected each year range from 60,000 to 4.5 million (Besharov, 1990).

Historical Definitions

Over the past one hundred and fifty years child abuse (cruelty, neglect, unfit parents, the battered child) has emerged, persisted, and been defined and redefined as an American social problem. Beginning with various social and religious reformers in the nineteenth century, various professions and social institutions have

emerged as participants in the definition of the problem and in its management. "Thus, at various times child abuse has been defined in statutes, by judges interpreting those statutes, by social workers intervening in the problem, by medical practitioners managing a medical entity, or by lawyers assuring legal rights" (Giovannoni, 1990, p. 10). Aber and Zigler (1981) have distinguished four primary approaches to the definition of child maltreatment: medical-diagnostic, legal, sociological, and research.

Medical-Diagnostic Perspective

In the medical-diagnostic approach, the purpose of a definition is to make a diagnosis, including an etiology and a suggested course of treatment. The seminal article by Kempe and colleagues (1962) coined the term 'battered child syndrome' to describe a "clinical condition in young children who have received serious physical abuse, generally from a parent or foster parent"(p. 17). This article launched a decade of supremacy of the medical-diagnostic approach to the definition of child maltreatment and focused attention on identifying and treating the abusive parent (NRC, 1993). Such an approach has important limitations. First, the diagnosis through manifest physical symptoms in the child emphasizes the more extreme forms of physical abuse over other types of maltreatment (such as sexual abuse or neglect) and results in a narrow definition of the problem. Second, the attempt to tie physical injury to the child to an abusive act by the parent or caretaker is replete with

assumptions and difficulties. For example, some have maintained that maternal behavior and life histories can be utilized as reliable diagnostic indicators and predictors of child abuse and neglect (Giovannoni, 1990). Others have abandoned the effort to identify certain maternal characteristics or mother-child interactions as useful diagnostic indicators because they have not found any that reliably distinguish between the abusive and neglectful and the non-abusive and neglectful (Starr, 1982). Whether certain maternal characteristics and mother-child interactions, if any, can serve as reliable indicators of abuse and neglect remains controversial (Bittner & Newberger, 1982). Third, while physicians act as medical diagnosticians, the treatment to be invoked by their diagnoses may involve legal and social components as well as a medical course of action. These "social and legal consequences may, and in fact do, deter some clinicians from making a diagnosis that would invoke them" (Giovannoni, p.13). Thus, judgments in these cases are not made on the basis of medical knowledge alone, but also involve the social values of the reporting physician (Gelles, 1979). As a result, medical definitions of maltreatment can be expected to vary from clinician to clinician and from hospital to hospital. Given the same set of facts, one clinician might diagnose maltreatment and another might not.

Legal Perspectives

Just as physicians have always been involved in individual cases of child maltreatment, so too have lawyers always been involved in court cases (Katz, 1971). Their involvement in individual cases, and as a profession, escalated during the 1970's as juvenile court procedures became more adversarial and concerns for "due process" galvanized the entire judicial system to a reconsideration of legal practices in regard to children (Axinn & Levin, 1992). This concern for due process also forced the recognition of the abusive parents' right to counsel and led to a professional movement to "clarify and justify the legal and judicial standards by which situations of child abuse and neglect can be justly and fairly defined" (Giovannoni, 1990, p. 10).

The Child Abuse Prevention and Treatment Act of 1974 attempted to emphasize the nature of the abusive acts themselves and their consequences for the child. In addition, it provided broader legal definitions of child abuse to include emotional injury, neglect, parental deprivation of medical services, and factors harmful to children's moral development (NRC, 1993). Also during the 1970's, the Juvenile Justice Standards Project (Wald, 1977), co-sponsored by the American Bar Association, sought to rectify the vagueness of definitions and the absence of standards in interpreting and applying legal statutes. In essence, the Project sought to eliminate the use of such terms as "abuse" and "neglect" and to replace them with the new term "endangered child", or a child who is suffering from one of

six kinds of harm (Giovannoni, 1990). The proposed standard referred to observable and serious consequences for each of the six kinds of harm, and focused on the issue of legal intervention. For example, "parental negligence" would only be substantiated in cases where the neglect has resulted in or was likely to result in physical injury. Similarly, "physical harm" would be limited to "disfigurement, impairment of bodily functions, or other serious physical injury" (Wald, 1977).

In these legal definitions, intervention by the state on behalf of the child is pitted against the possibility of harm to the child via separation from the family, and the problems of state intrusion into family autonomy (NRC, 1993). Not surprisingly, the proposed definitions and standards were never adopted by the American Bar Association (and none have subsequently been adopted) largely due to judicial opposition to their restrictiveness and a fear that judicial discretion would be limited. Giovannoni (1990) concludes:

The definitions of child maltreatment in the legal system thus remain ambiguous and controversial. Notably, however, the controversy is not over *what* constitutes serious consequences for children or abusive and neglectful parental behavior, but rather over what consequences and behaviors the terms *should* encompass for purposes of legitimating the exercise of legal and judicial authority" (p. 12).

Unfortunately, the desire for judicial discretion is at odds with the precision and clarity required for scientific definitions of child maltreatment (NRC, 1993).

The Sociological Perspective

In the sociological approach the focus is on the act of maltreatment, and the goal is to label and control social deviance (Cicchetti and Barnett, 1991). Gil (1975) and Pelton (1978) were among the first to espouse this approach, asserting that child maltreatment was influenced by a variety of sociocultural factors including socioeconomic status, overcrowding, inadequate services and large family sizes. In this view the problem is very broad and includes many milder forms of maltreatment that may not result in significant physical injury. From this perspective, then, the fact that medical treatment may not be required, or that sufficient grounds for legal intervention may not exist does not negate that an act of maltreatment may have occurred (Gelles & Strauss, 1988). When these less severe forms of maltreatment are considered, however, obtaining a consensus on definitional and measurement issues become particularly troublesome. Once again, the precision required for scientific definitions is absent.

The Research Perspective

As noted earlier, the aim of research definitions of child maltreatment is to develop measures that allow reliable and valid

empirical studies of incidence and prevalence rates, etiology and sequelae, and treatment response. In the absence of such explicit definitions, early researchers chose to operationalize concepts of maltreatment by acceptance of the labels used by official agencies, child protective services, and the courts (Giovannoni & Beccerra, 1979). While this approach can provide useful descriptive information with minimal data collection efforts, "the absence of precise, objective criteria complicates comparability among measures of maltreatment in subpopulations defined by locality" (NRC, 1993, p.62). Giovannoni (1990) points out that official designation is often the result of a "negotiated process" in which some cases are not reported, others are reported but not acted upon, and still others receive official designation. How the attitudes, opinions, and screening procedures of participants in this process affect the designation of a given set of cases remains unclear.

Toward a Classification System

Recent efforts at defining specific acts of maltreatment more precisely, thereby avoiding reliance on professional opinion, have been a step in the right direction. However, considerable variation remains in the definitions utilized and thus comparability between studies continues to be compromised. Zuravin (1991) and others (Besharov, 1990; Cicchetti & Barnett, 1991) have argued that the development of an agreed upon classification system is of paramount importance not only to avoid the problem of not being

able to integrate findings across studies, but also to the development of knowledge about specific types of maltreatment. Toward that end, Zuravin (1991) has suggested four general principles for formulating research definitions (classification system) of child abuse: (1) division of categories into subtypes, (2) conceptual clarity, (3) measurability of operational translations, and (4) purpose of the definition.

Division of Categories into Subtypes

Development of a classification system must begin with the division of behaviors or events into categories based upon core similarities (Zuravin, 1991). For example, Cicchetti & Barnett (1991) denoted five general categories of child maltreatment: physical abuse, physical neglect, sexual abuse, emotional maltreatment, and moral/legal/educational maltreatment. Behaviors included under physical abuse all involve physical aggression toward the child while behaviors included under physical neglect involve omissions in care. Despite the core similarities, behaviors within each category will frequently display considerable heterogeneity with respect to character, severity, chronicity, and potential consequences. This requires further division into more homogeneous subcategories or subtypes. Zuravin (1991) presented an example of detailed subtyping involving 14 proposed subcategories of physical neglect as shown in Table 1. She points out that :

Table 1: Neglect Subtypes

Refusal to provide physical health care	Abandonment/desertion
Delay in providing physical health care	Personal hygiene neglect
Delay in providing mental health care	Housing hazards
Supervisory neglect	Housing sanitation
Custody refusal	Nutritional neglect
Custody-related neglect	Educational neglect
Failure to provide a permanent home	Refusal to provide mental health care

Source: Zuravin, S.J. (1991). Research definitions of physical child abuse and neglect: Current problems. In R. Starr & D. Wolfe (Eds.), The effects of child abuse and neglect: Issues and research (pp. 100-128). New York: Guilford Press.

Failure to formulate separate conceptual and operational definitions for subcategories will subvert the development of knowledge by making it impossible to determine if clinically diverse phenomena subsumed within a single category are a function of different etiologies, lead to distinctive sequelae, and require unique treatments (Zuravin, 1991, p. 102).

Conceptual Clarity

In order for a classification system to be reliable and valid, it is critically important that conceptually clear definitions are formulated for each category and subcategory (Zuravin, 1991). This requires the specification of every criterion that a behavior must meet in order to be classified in a category, and that categories are distinctly defined. Failure to do either will impede the development of knowledge by making it impossible to determine whether the major categories of maltreatment and their respective subcategories differ with respect to etiology, sequelae, or treatment.

Measurability of Operational Translations

A third important consideration in the development of a classification scheme has to do with the measurability and observability of the behaviors or events used to operationalize the conceptual definitions (Zuravin, 1991). Without the ability to

operationalize conceptual definitions with observable behaviors that are measurable in terms of degree, frequency, and duration, even the most elegant classification system is of limited utility in empirical research . In other words, conceptual definitions must have a means of being converted into "specific behaviors that can be measured by observation, interview, or some other practical means" (NRC, 1993, p. 63). The NRC Panel on Research on Child Abuse and Neglect argues that standardized field instruments with documented psychometric properties are a necessity for real progress to be made in child maltreatment research.

Purpose of the Definition

The formulation of conceptual and operational definitions must take into consideration the specific objectives the definition must serve, for, "like theories, definitions are never assessed as true or false but, rather, as useful or not useful in attaining a goal" (Zuravin, 1991, p. 103). Ross and Zigler (1980) have observed that the current lack of agreement about maltreatment definitions can be partially attributed to the failure to recognize that no single definition can fulfill "all of the functions that social scientists and social service professionals would like" (p. 293). Concurring with this observation, Aber & Zigler (1981) suggested the development of separate and distinct sets of definitions for use in legal, case management, and research settings.

Zuravin (1991) proposes that for research definitions the purpose translates into what it is that we want to learn from longitudinal studies. After conducting reviews of the literature, she identified five specific objectives: determination of (1) the short and long term impact on the child's physical, cognitive and emotional adjustment; (2) the processes through which maltreatment leads to its various sequelae; (3) effective intervention strategies; (4) causes; and (5) whether different types of maltreatment or different combinations of type vary with respect to any of these four factors (Zuravin, p. 104).

Aber & Zigler (1981) recommended the formulation of broad research definitions in which the main principle of classification is the specific nature of parent/caretaker behaviors as opposed to child outcomes. In such a scheme definitions of the various types of maltreatment would involve little more than "descriptive compartmentalization" of behaviors (Zigler & Phillips, 1981, p. 618), and would not be linked to a particular etiology or type of sequelae.

Though not one of Zuravin's (1991) four general principles, the issue of "age-grading" is pertinent to the development of a child maltreatment classification system and further illustrates the complexity of developing such a system. The issue revolves around the question of whether operational criteria should differ as a function of the child's age and developmental level, and has often been raised by those researchers interested in the long term effects of maltreatment (Aber & Zigler, 1981; Cicchetti & Todd-Manley, 1990).

The focus here is on the possibility "that an act which may cause harm to a child at one vulnerable stage of development may not at another stage" (Aber & Zigler, 1981, p. 24). Zuravin (1991) points out that whether or not age-grading should be used with all categories of maltreatment remains open to debate, but suggests that it is clearly applicable with certain types of neglect (e.g., inadequate supervision). She further proposes that the key question researchers must address is "What criteria should we use for age-grading?" (p.105).

Specific Definitional Issues

In addition to the general principles for formulating a classification system, several specific issues must be considered in the development of operational definitions of child maltreatment. These include: examination of (1) consequences of the behavior for the child: demonstrable harm vs. endangerment, (2) maltreatment subtypes, (3) frequency/chronicity of the behavior, (4) perpetrator identity, (5) perpetrator intent/culpability for harm, (6) age/developmental level of the child, and (7) cultural issues (Zuravin, 1991; NRC, 1993). Each of these issues will be briefly discussed as they apply to operational definitions of physical abuse.

Demonstrable Harm Vs. Endangerment

Zuravin (1991) points out that an important distinction among existing operational definitions of child maltreatment is whether or

not they require "demonstrable harm" to the child or "endangerment" of the child in order for the case to be labeled as abusive or neglectful. Demonstrable harm definitions require that the child suffer some type of injury or impairment, while the endangerment definitions require that the behavior(s) increase the risk of potential injury/impairment. An example of a physical abuse definition which illustrates the demonstrable harm requirement is provided by Altemeier et al. (1984, p. 393): "an abused child is one who has incurred injuries (bruises, abrasions, cuts, burns, fractures, bites, and loss of hair) as a result of parental actions". An example of an endangerment definition is provided by the Second National Incidence Study (NIS-2) of 1986:

Child abuse is physical assault with or without a weapon by a parent or temporary caretaker. It includes hitting with a stick, strap, or other hard object, as well as scalding, burning, poisoning, suffocating, and drowning. It also includes slapping, spanking with a hand, hitting with fist, biting, kicking, shoving, shaking, throwing, nonaccidental dropping, stabbing and choking (NCCAN, 1988).

The NIS-2 definition includes behaviors that may not result in serious physical injury. However, such behaviors may in fact have a long term impact on the child's social and emotional well being and thus impair the child's ability to relate to others. Zuravin (1991) suggests that demonstrable harm definitions are inappropriate for

research purposes in that they are too restrictive and narrow. If the goals of maltreatment research include determining the long range impact of abusive behaviors on cognitive, social and emotional adjustment, then physically aggressive behaviors that do not result in actual physical harm must be included. Failure to do so precludes finding out if they have any adverse effects and the extent of those effects.

Maltreatment Subtypes

While there has been some development of models for subtyping neglect (Wolock & Horowitz, 1977; Zuravin & Taylor, 1987; NCCAN, 1988) similar models for physical abuse do not exist. Zuravin (1991) asserts that abusive behaviors can be differentiated in three ways: (1) their potential for serious/immediate harm, (2) the type and nature of the acts, and (3) whether or not the behavior represents a routine form of discipline or is infrequent and episodic. Given these differences, she suggests the creation of only two subtypes of physical abuse: discipline behaviors, and episodic behaviors due to explosive outbursts. The important issue to consider in determining appropriate subtypes is that of conceptual clarity, noted earlier. That is, are these subtypes complete and yet distinctive?

Frequency/Chronicity of Behavior

Many definitions of abusive behavior do not specify how frequently or chronically the behavior must occur before it is considered an abusive act (Widom, 1988). Others (Wolock & Horowitz, 1977; Zuravin & Taylor, 1987) require a recurrent pattern of minor injury, or a single incident of a severe injury, in order to establish that abuse has occurred. When a recurrent pattern is required, definitions often differ with respect to the number of times the behavior must occur before such a pattern is established (NRC, 1993).

Zuravin (1991) argues that the need to establish chronicity should be eliminated as "any act of abusive or neglectful behavior that results in an injury/illness/impairment, regardless of severity, should be considered maltreatment" (p.120). She also points out that while the short term effect of an abusive act may be limited to a minor injury does not necessarily eliminate the possibility of long term consequences for social and emotional development. Without the inclusion of minor injuries/impairments or single episodes in our definitions the ability to empirically test for differences in long term impact and etiology is lost.

Perpetrator Identity

Does it matter who commits the abuse: parent, stepparent, family friend, babysitter, and so on? With few exceptions, little systematic research has examined the causes or consequences of

abuse by a variety of perpetrators (Widom, 1988). Narrow definitions of abuse usually stipulate that the perpetrator be the parent or primary caretaker, usually an adult. Wider definitions include a variety of others such as temporary caretakers like babysitters, day care workers, or the mother's boyfriend. Zuravin (1991) suggests that definitions of physical abuse should adopt a broad perspective regarding perpetrator identity because "regardless of who does the abusing the child may be endangered physically, socially and emotionally" (p. 117). While parents or primary caretakers may represent the most frequent perpetrators, excluding abuse by others also leads to an incomplete understanding of the problem. This limitation is not only problematic for estimating incidence and prevalence rates, but also limits the ability to determine if the long term impact on the child varies with respect to perpetrator identity (Widom, 1988).

Perpetrator Intent to Harm

Zuravin (1991) has examined the issue of perpetrator intent to harm, a criterion that has been used mainly for physical abuse, and concludes that it is not contained in most recent definitions of abuse or neglect. She notes that elimination of unintended behaviors would compromise research interested in examining the effects of parent/caretaker behaviors (intended or not) on the child's adjustment, in determining etiologies, and identifying treatments.

Furthermore, she argues that the operational translation of intent to harm would be extremely difficult, if not impossible.

Age/Developmental Level

Numerous researchers have suggested a possible link between the child's age and developmental level at the time of maltreatment and long term effects (Aber & Zigler, 1981; Cicchetti & Todd-Manley, 1990; McGee & Wolfe, 1991; Polansky, Borgman, & DeSaix, 1972). Zuravin (1991) suggests, as noted earlier, that age-grading is necessary for certain types of maltreatment, and is more relevant to neglect than physical abuse. The issue involves labeling certain types of parent/caretaker behavior as maltreating based upon the age of the child. For example, leaving a three year old alone for a 5 hour period is clearly inappropriate, while leaving a 12 year old alone for the same amount of time is not (Polansky, Borgman, & DeSaix, 1972). Though many agree that age and developmental levels are important considerations, few research definitions actually contain age-graded operationalizations.

Cultural Issues

Noting a decided lack of information on the cultural parameters of child maltreatment, the NRC Panel (NRC, 1993) suggests that research must differentiate cultural norms from individual deviations from those norms in defining and identifying maltreatment:

The challenge of formulating culturally informed definitions of child maltreatment is to accommodate cultural variability in child care beliefs and practices while taking care not to promote different standards of care for children on the basis of race, ethnicity, or economic classhence definitions need to take into account sociological and ethnographic aspects of the problem and balance the scientific desire for comparability and uniformity of definition with the need to be sensitive to differences in cultural viewpoints (NRC, 1993. pp. 66-67).

Asbury (1993) rightly points out, however, that while researchers often refer to the importance of an ecological approach to research on child abuse (e.g., Spearly & Lauderdale, 1983), few seem to acknowledge that culture is an integral part of each child's environment. It is interesting to note, for example, that none of the definitions of abuse or neglect cited in the work by Zuravin (1991) make any mention of cultural factors and how they should be woven into the proposed classification system.

Incidence and Prevalence: Current Estimates

Between 1976 and 1990 reports of child maltreatment in this country increased from 416,033 per year to over 1, 700,000 per year (NCCAN, 1981,1988, 1992). Noting the increase in these figures over a 14 year period, the U.S. Advisory Board on Child Abuse and

Neglect (1990) declared an epidemic of child maltreatment in the United States and labeled the situation a national emergency.

Whether or not the increase truly represents an epidemic remains open to question due to significant methodological problems with data collection efforts (Daro, Casey, & Abrahams, 1990; Straus & Gelles, 1986). This section will briefly describe the major sources of information re: the incidence and prevalence of child maltreatment, followed by a discussion of the aforementioned methodological issues.

National Studies--American Humane Association

The Child Abuse and Prevention Treatment Act of 1974 (P.L. 93-247) mandated that the newly formed National Center on Child Abuse and Neglect (NCCAN) begin collecting data on the national incidence of child maltreatment (NCCAN, 1981). Toward that end, the American Humane Association (AHA) began a national study of child maltreatment reports, collecting data on various types of maltreatment from child protection personnel in cooperating states. AHA continued this process until 1987. Data collected during this period are reflective of the dramatic increases in reported cases of maltreatment noted above. However, the AHA studies are difficult to interpret for several reasons. First, they only reflect reports of maltreatment brought to the attention of official agencies (e.g., child protective services), and were therefore never intended to be studies of the true occurrence of child maltreatment. Second, since

no specific admission criteria were designated, varying agency definitions and individual caseworker applications of those definitions subject the data to multiple sources of bias. Third, the studies include all reported cases with no effort made to eliminate those which were duplicated or unsubstantiated. Fourth, the data contains historical inconsistencies. As an example, cases listed as unsubstantiated were either investigated and no evidence of maltreatment was found, or the case was still under investigation at the time of the study and had not yet been confirmed. Finally, the data was generated by a different set of participants each year (i.e., different states voluntarily participated each year) (AHA, 1981; NCCAN, 1992; NRC, 1993).

National Incidence Studies

In an effort to estimate the true occurrence of child maltreatment, rather than relying only on reported cases, NCCAN contracted a study of the incidence and severity of child abuse and neglect. The first National Incidence Study (NIS-1) was conducted in 1979-1980 and used a probability sample of 26 counties throughout the U.S. to gather data on reported and unreported cases of maltreatment (NCCAN, 1981). The data was collected from a wide variety of protective service, investigatory, and other community service agencies and professionals, and required that the injury or impairment caused by the maltreatment had to be rated as moderate or severe to be included. Two significant problems with this data

will be noted here. First, the data does not yield an estimate of the true occurrence of maltreatment because it only includes reports of cases known to service providers. Second, the inclusion of the moderate to severe demonstrable harm requirement meant that *fifty-three percent* of the cases which had been substantiated by child protection agencies did not meet the NIS-1 maltreatment definition. This resulted in a significant reduction the substantiated incidence rate (from 7.6 per thousand to 3.4 per thousand). When data from the other community agencies was added, the incidence rate increased to 10.5 per thousand children per year (NRC, 1993).

The second National Incidence Study (NIS-2) was completed in 1986 and used the same design as NIS-1 (NCCAN, 1988). To estimate the current incidence of maltreatment and to reflect changes in the frequency, type, and severity of maltreatment since the completion of NIS-1, NIS-2 utilized two sets of operational standards. The first set was identical to NIS-1 and required demonstrable harm in order to establish maltreatment. The second set of criteria was more broad and included endangerment as a qualifier for maltreatment to have occurred. When the demonstrable harm definition was used, the reported incidence of substantiated maltreatment was estimated to be 14.8 per 1000 children, a 66 percent increase over the NIS-1 figure. Utilizing the endangerment definition the reported incidence was 22.6 per thousand children (Sedlak, 1990).

National Child Abuse and Neglect Data System

The 1988 Child Abuse Prevention, Adoption and Family Services Act (P.L. 100-294) required that NCCAN revamp the national data collection and analysis system. What resulted is the National Child Abuse and Neglect Data System (NCANDS) which consists of two parts: a summary data component, and a detailed case component. Collecting information on reports from 49 states, 1 territory, the District of Columbia, and all branches of the armed forces, the 1990 NCANDS summary concluded there were 1.7 million cases of reported maltreatment involving 2.7 million children (NCCAN, 1992). The substantiation rates for the reports during this period were similar to those from previous studies, and remained in the area of 40 percent (NRC, 1993).

Private Sector Studies

Since 1972, the National Committee for Prevention of Child Abuse (NCPCA) has conducted annual 50-state surveys of child welfare administrators regarding trends in reporting, abuse fatalities, and child welfare policy (Daro, Casey, & Abrahams, 1990). This information is obtained via telephone interviews with the child abuse and neglect federal liaison officers in each state. During the 1980's data from these reports indicated not only a dramatic increase in reports of maltreatment, but also a growing number of child abuse fatalities (Daro & McCurdy, 1991). However, similar to previous studies based on official or unofficial reports, these data

are difficult to interpret because of definitional variation among the states and the inclusion of duplicated cases (NRC, 1993).

Population Surveys

In addition to studies which rely on report data, attempts have been made to estimate the incidence and prevalence of child maltreatment via the use of survey data. The most notable of these were the National Family Violence Survey's conducted by Straus and Gelles (1986) in 1975 and 1985, which addressed the use of physical and verbal aggression toward children. Violence was operationalized through the use of the Conflict Tactics Scales (Straus, 1979), which measure three categories of tactics used in interpersonal conflict within the family: reasoning, verbal aggression, and physical aggression. Using a national probability sample of 2,143 families (consisting of a married couple or a man and woman who identified themselves as living together in a family unit) the 1975 survey yielded a prevalence rate of 140 per 1000 children (ages 3-17) per year (Straus & Gelles, 1986). Strauss and Gelles (1986) repeated their survey in 1985 with an additional 3,520 families, again using the conflict tactics scales. Comparison with the rates generated by the 1975 survey revealed:

a statistically significant decrease in the index of severe violence against children (from 140 to 107 per 1000 children), a significant decrease in the very severe violence index (from 30 to 19 per 1000 children), but no

significant difference in the rate of minor violence, i.e. corporal punishment (NRC, 1993).

While these surveys used nationally representative samples and have received considerable attention, their findings must be reviewed with caution as they are subject to the limitations and biases inherent in survey research (i.e., social desirability, retrospective bias, single-perspective reporting, the nonrespondent problem, questionable validity)(Widom, 1988).

Methodological Problems re: Incidence Studies

Method-dependent bias is but one of the many methodological problems affecting prevalence and incidence research in the area of child maltreatment, and limit the usefulness of findings for drawing conclusions about the scope and etiology of the problem. The discussion that follows will address eight methodological issues: (1) definitional issues, (2) unreported abuse, (3) confusion over prevalence vs. incidence, (4) use of official agency records, (5) occurrence vs. reporting, (6) sampling and design issues, (7) measurement, and (8) the effect of mandatory reporting.

Definitional Issues

As noted in an earlier section, the wide disparity in definitions as to what constitutes child maltreatment has had a significant influence on estimates of the extent of the problem, with estimates ranging from as low as 60,000 cases to as high as

4.5 million cases (Besharov, 1990). The low estimates are usually based on more rigorous and narrow criteria, in contrast to the higher estimates which are based on broader and more encompassing definitions, such as those in the national surveys of family violence (Widom, 1988).

While a fair degree of agreement may exist with regard to nominal definitions (e.g., physical, sexual, and emotional abuse), operational criteria may differ greatly (NRC, 1993). As we have seen, operational definitions can be based upon the act itself, its consequences, the perpetrators intent, the child's age, relationships between victims and perpetrators, and social norms on appropriate behavior (Zuravin, 1991). Given these differences, the wide disparity in incidence rate across studies is not surprising (Besharov, 1990; Widom, 1988).

Unreported Abuse

Clearly, much child abuse and neglect does not come to the attention of official agencies which often serve as the sources of incidence and prevalence data. Parents may not take their child for medical attention, children may be reluctant to reveal abuse, repeat abusers may use different medical facilities, relatives and neighbors may not want to "get involved", and injuries may not be attributable to abuse (Widom, 1988). Thus, the 1975 National Family Violence Survey (itself vulnerable to under-reporting by the respondents) found a prevalence rate of physical abuse that is 21

times greater than the rate for cases reported to child protective services during the same period (Straus & Gelles, 1986).

Prevalence Vs. Incidence

Comparison of rates of child maltreatment across studies and over time is often complicated by the failure to distinguish between incidence and prevalence rates. Incidence and prevalence are measures commonly used by epidemiologists to count and outcome under study (Bertolli, Morganstern, & Sorenson, 1992):

Incidence, the number of new cases detected in a defined time period divided by the number of children who are eligible to become new cases, is the ideal measure for identifying etiologic factors. By using new cases, investigators can determine which features are related to the occurrence of maltreatment rather than trying to disentangle features related to the continuation of maltreatment. . . . Prevalence consists of the number of existing cases at any point in time divided by the total population from which the cases are identified. Using prevalence data causes confusion between risk factors that are associated with new cases and those that influence continuation of the problem (NRC, 1993, p. 87).

Use of Official Agency Records

Without question the vast amount of information available on the occurrence of child maltreatment is based upon official records from state child protective service agencies. However, the accuracy of the information contained in these records and its impact on incidence and prevalence rates is questionable for several reasons. First, they are subject to varying definitions, lack of standardized assessment tools, overburdened caseworkers, and missing data (Leventhal, 1990). Second, researchers have argued that certain segments of the population are subject to "unequal surveillance". That is, since community agencies are less likely to have contact with and/or intervene in middle or upper-class homes, estimates of child maltreatment based on official records are biased against minorities and the poor (Gelles, 1982; Newberger, Reed, Daniel, Hyde, & Kotelchuck, 1977). A reanalysis of data from NIS-1 by Hampton & Newberger (1985) concluded that class and race were not only the best predictors of whether a case was reported by hospitals, but also that poor African-American families were more likely to be reported than affluent European-American families *regardless* of the severity of the incident. This type of finding led Gelles (1982) to conclude that "factors causally associated with abuse become confounded with factors related to susceptibility or vulnerability to having an injury diagnosed as abuse" (p. 29).

Occurrence Vs. Reporting

Wolfner and Gelles (1993) posited that a significant amount of the increase in rates of maltreatment is likely due to increased reporting, resulting from expanded definitions, social programs, and public awareness. A recent study by Leventhal, Horwitz, Rude, & Stier (1993) found no difference in rates of maltreatment for two cohorts of adolescent mothers whose children were born between 1967-1970 and 1979-1981. The physicians who rated the abusive incidents used predefined criteria and were blind to the ethnic and socioeconomic characteristics of the mothers. Yet during the 14 year period encompassing these births, reports of maltreatment to the Connecticut Department of Children and Youth Services nearly tripled, suggesting that there may be little real difference between rates of occurrence, but significant differences in rates of reporting. Another recent study (McClain et al., 1993) has suggested that rate of deaths due to child maltreatment remained relatively stable from 1979-1988, even though the number has consistently underestimated due to misclassification.

In spite of these findings, it remains plausible that the rate of occurrence (vs. the rate of reporting) is increasing as well. The National Commission on Children (1991) has pointed out, for example, that the number of children living in poverty has significantly increased during the past 20 years and notes that poverty has frequently been cited as a potentiating risk factor for child maltreatment (Belsky & Vondra, 1989; Cicchetti, 1989;

Garbarino & Kostelny, 1992). Knudsen (1992) has suggested that in order to disentangle the increases in the rate of occurrence vs. the rate of reporting issue, information must be collected on changes over time for: (1) sources of reports, (2) victim and perpetrator characteristics, and (3) the proportion of reports for each type and severity of maltreatment. Unfortunately, data for each of these factors is currently very limited.

Sampling and Design

A number of researchers have pointed out the problems and difficulties associated with the sampling techniques and study designs frequently used in research on child maltreatment (Leventhal, 1982; Peters, Wyatt, & Finkelhor, 1986; Widom, 1988). Widom (1988) has noted that the literature on child abuse is reflective of two types of sampling biases: criterion-dependent and method-dependent. Criterion-dependent bias refers to the extent to which definitions or criteria for inclusion of subjects influence the findings of maltreatment research. Method-dependent bias (mentioned earlier) refers to the extent to which methods chosen for data collection influence outcomes in research on child maltreatment. Examples of each of these have already been mentioned with regard to determining incidence and prevalence rates (i.e., inadequacies and limitations of survey research, definitional variations, and the problems associated with the use of official agency records).

In the area of child abuse and neglect the most common study designs are cross-sectional and involve interviewing subjects regarding past experiences of maltreatment and risk factors of interest. Haugaard (1992) reports that three general categories of epidemiology studies have been conducted using this approach: those involving (1) community or national samples, (2) cases reported to official agencies, and (3) college students. Problems associated with the first two categories have already been addressed. The major disadvantage with the studies using college students is that they are generally not representative of the general population or of people their own age. It is possible that the effects of severe maltreatment may adversely affect the social and emotional development of victims such that they cannot compete academically, and are therefore under-represented among the population of college students. Therefore, the results of college student surveys may underestimate the prevalence of abuse in the general population, especially the most severe forms of maltreatment (Haugaard, 1992)..

In order to help compensate for the aforementioned design and sampling problems and to address issues of causality, Widom (1988) and others (Bertolli, Morganstern, & Sorenson, 1992; NRC, 1993; Starr, Maclean, & Keating, 1991; Zuravin, 1991) have recommended the use of prospective longitudinal studies, using random samples of children from different types of communities, ethnic groups, and socioeconomic backgrounds. In the ideal case, multiple measures would be used to assess "known and hypothesized risk factors for

abuse and neglect at birth and prespecified follow-up interviews, and all new cases of abuse and neglect would be identified as they occur with no loss to followup" (NRC, 1993, p. 90). Since child maltreatment is a low base-rate phenomena, a related strategy for future research involves studies of high-risk groups of children in which development can be studied directly. Such a strategy allows movement beyond the retrospective reconstructions of causal factors currently being employed (Widom, 1988).

Measurement

The major problem with measurement in child maltreatment research is the lack of reliable and valid instrumentation to measure the phenomena. Unfortunately, this can lead to misclassification bias, or the introduction of systematic error into the data because of mistakes in measuring or classifying subjects on the variables of interest (Bertolli et al., 1992; Eckenrode, Powers, Doris, Munsch, & Bolger, 1988). In many cases, research instruments are simply unavailable. Moreover, those that are used were frequently developed to assess normal child behavior or other problems in nonabuse samples (NRC, 1993). Straus (1992b) recently reviewed 617 articles from Child Abuse and Neglect spanning the period 1979-1989, and found that 86 percent did not use an instrument to measure any variable. While there was some increase in the use of instruments during the late 1980s, two-thirds used no quantitative measure at all. Once again, those that were used were generally

borrowed from other fields of study and were not developed specifically to study child maltreatment.

Mandatory Reporting

Though all 50 states have had mandatory reporting laws since the late 1960s, the provisions of those laws vary from state to state. For example, in some jurisdictions reporting to child welfare authorities is not required if the perpetrator is receiving therapeutic services (NRC, 1993). Variations such as this, as well as definitional differences as to what constitutes maltreatment, obviously have an impact upon studies of incidence and prevalence. Zellman (1990) conducted a survey of professionals (including family physicians, school principals, social workers, pediatricians, psychologists, psychiatrists, and child care center directors) to determine the extent of "discretionary reporting", i.e., reporting of some cases of maltreatment but not others. The findings indicated that 22 percent of the respondents failed to report known cases, either because they did not feel there was enough supporting evidence, they felt they could handle the problem better than the system, or the perceived costs (i.e., in terms of time) were too great. This figure was slightly less than that reported by Borsig and Kalichman (in press) who found that nearly a third of practicing psychologists failed to report. This becomes an important issue not only in terms of the impact on incidence and prevalence rates, but also because it impacts research on child maltreatment. Sieber

(1992) notes, for example, that mandatory reporting requirements may lead some potential subjects to decline to participate in research projects, while others may simply falsify their responses in an effort not to reveal reportable offenses.

Mandatory reporting has created a dilemma for researchers by placing them in the position of saying to their subjects: "If you respond truthfully, I may report you to the appropriate authority" (Seiber, 1992). Assurances of complete confidentiality are difficult to make given the requirements of mandatory reporting laws, and may place researchers in the position of having to choose between honoring confidentiality and upholding the dictates of the law. To date, there have been no published studies of the impact of mandatory reporting on research projects.

Etiological Theories of Physical Abuse

Starr et al.(1991) have proposed the use of a life-span developmental approach to maltreatment research. Central to this perspective is the conception of the individual as a complex but organized system, which undergoes qualitative reorganizations over the course of development. This "self-system" is composed of multiple interactive sub-systems (social, cognitive, affective, behavioral) which also change over time, and operates in dynamic interaction within various ecological settings, i.e., the family, the community, and the larger society (Starr et al., 1991). When applied to child maltreatment, this perspective suggests that abuse results

from complex constellations of correlated variables whose influence may increase or decrease during different developmental and historical periods. Further, this perspective recognizes that risk and protective factors are not static, but change over time as individuals, their life circumstances, and the society in which they live change.

This conceptual framework is but one of the many theoretical formulations for attempting to unravel the puzzle of child maltreatment. In this section, etiological theories of physical abuse will be reviewed in terms of their basic principles and empirical evidence which supports or disputes their theoretical underpinnings. As this review will show, no one model has been able to accurately predict the occurrence of physical child abuse. However, research aimed at testing various models has produced a growing body of knowledge regarding correlates and risk factors thought to be associated with the occurrence and recurrence of maltreatment. A much smaller body of research (discussed later) has examined some of these same correlates in relation to the prediction of injury severity.

Numerous alternative models of the etiology of physical child maltreatment have been proposed in the past twenty-five years. Until recently, few systematic reviews of these theories/models and the empirical evidence supporting have been done. Milner & Crouch (1993) provide a cursory overview of the models as they have developed from the early "single-factor" (or cause-and-effect)

models through the more recent approaches which consider multiple pathways and interactive effects among contributing factors. Table 2 lists 29 models/theories according to the organizational scheme of Milner & Crouch which includes 6 different categories.

A more comprehensive examination of 25 theories/models/perspectives for explaining physical child abuse was provided by Tzeng, Jackson, & Karlson (1991). This review grouped the theories (based upon common, as well as unique, characteristics) into 9 paradigms: (1) individual determinants, (2) offender typology, (3) family systems, (4) individual-environment interaction, (5) parent-child interaction, (6) sociocultural, (7) sociobiological, (8) learning/ situational , and (9) ecological. Further, these paradigms are characterized in terms of three bipolar continua as shown in Figure 1. For example, the individual-cultural continuum places the individual determinant paradigm on one pole and the sociocultural determinant paradigm on the other, with the individual-environment interaction paradigm as the combination mode. Theories representative of each of these nine paradigms will be reviewed to include a brief statement of basic principles, empirical evidence to support the theory, and a summary evaluation based upon the strengths and weaknesses of the theory.

Individual Determinants Paradigm

This paradigm includes theories/models which focus on the

Table 2: Examples of Physical Child Abuse Models/Theories

Early Single Factor Models

- Psychiatric Model (Kempe et al., 1962)
- Sociological Model (Gil, 1970)

Early Multifactor Organizational Models

- Three-Component Theory (Schneider et al., 1972)
- Social-Psychological Theory (Gelles, 1973)
- Social-Situational Model (Parke & Collmer, 1975)
- Symbiosis Theory (Justice & Justice, 1975)
- Social-Interaction Theory (Burgess, 1979)
- Ecological Model (Belsky, 1980)
- Transactional Model (Cicchetti & Rizley, 1981)

Biological Models

- Sociobiological Theory (Burgess & Garbarino, 1983)
- Neuropsychological Theory (Elliott, 1988)

Learning Models

- Two-Factor Theory (Vasta, 1982)
- Social Learning Theory (Tzeng et al., 1991)

Social/Cultural Models

- Resource Theory (Goode, 1971)
- Culture Theory (Gelles & Straus, 1979)
- Social Systems Theory (Gil, 1987)

Interactional Models

- Family Systems Theory (Straus, 1973)
- Choice Theory (Nye & McDonald, 1973)
- General Stress Theory (Farrington, 1980)
- Three-Factor Theory (Lesnik-Oberstein et al., 1982)
- Situational Theory (Wiggins, 1983)
- Cognitive Developmental Model (Newberger & Cook, 1983)
- Encounter Theory (Zimrin, 1984)
- Cognitive Behavioral Model (Twentyman et al., 1984)
- Coercion Theory (Stringer & LeGreca, 1985)
- Social Cognitive Model (Azar, 1986)
- Attachment Theory (Aber & Allen, 1987)
- Transitional Model (Wolfe, 1987)
- Social Information Processing Model (Milner, in press)

Source: Milner, J.S., & Crouch, J.L. (1993). Physical child abuse. In R.L. Hampton, T.P. Gullotta, G.R. Adams, E.H. Potter, & R.P. Weissberg (Eds.), Family violence: Prevention and treatment (pp. 25-55). Newbury Park, CA: Sage.

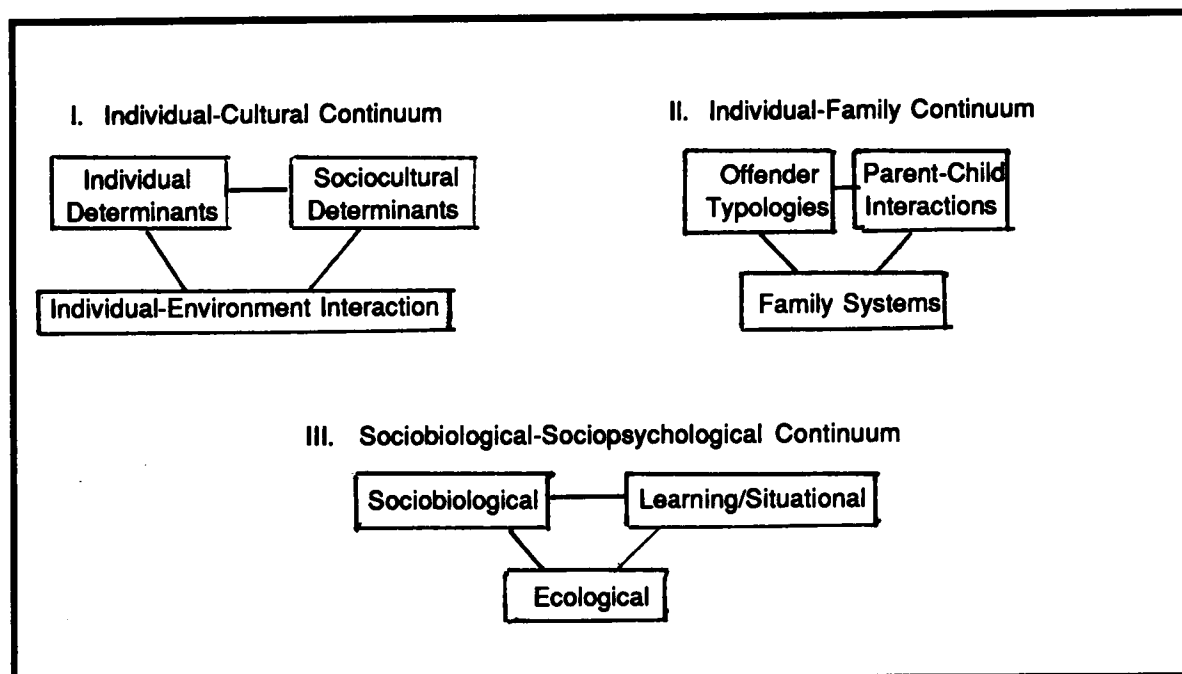


Figure 1. Three Paradigmatic Continua of Child Abuse Theorizations
Source: Tzeng, O.C., Jackson, J.W., & Karlson, H.C. (1991).
Theories of Child Abuse and Neglect. New York: Praeger.

characteristics of the individual perpetrator as opposed to characteristics of the family, community, or society. The psychiatric theory of child maltreatment (Kempe et al., 1962), for example, assumes that abusers have certain abnormal personality characteristics (resulting from either organic brain dysfunction or emotional difficulties) which are the root causes of abusive behaviors. This theory further presupposes that the perpetrators' personality traits or characteristics were likely to have been passed on to them by their parents (intergenerational transmission hypothesis).

A number of studies have identified personality features which are common among physically abusive adults (Elmer, 1967; Newberger & Newberger, 1981; Smith, 1984; Spinetta & Rigler, 1972), including low self-esteem, depression, learned helplessness, unmet dependency needs, low frustration tolerance, low intelligence, and power-authoritarianism problems. However, no single personality profile has been identified for all abusers, and there is little agreement across studies as to specific traits which contribute to abusive behavior (Gelles, 1973). In fact, recent estimates indicate that less than 10 percent of all physical child abusers have diagnosable psychiatric disorders (Milner, 1993; Tzeng et al., 1991).

The psychiatric theory of child maltreatment has stimulated much research and debate, and was one of the first attempts to systematically study the problem of abusive behavior. However, it

has a number of weaknesses which limit its explanatory and predictive power. These include: (1) failure to recognize the importance of contextual, sociological, and familial variables beyond the personality traits of the abuser, (2) dependence upon studies conducted in post hoc fashion, (3) use of nonrandom case studies of clinical populations without the inclusion of control groups, and (4) use of studies that fall into the "explaining by naming" trap (e.g., stating that physical abuse results from poor impulse control neither explains the behavior nor helps to predict it) (Tzeng et al., 1991).

Sociocultural Determinants Paradigm

In contrast to the individual determinants paradigm which considers factors within the individual, the sociocultural determinants paradigm focuses on social and cultural factors outside the individual as primarily responsible for abusive behavior (Tzeng et al., 1991). The social systems theory of physical abuse (Gil, 1970, 1987) is representative of this paradigm and stresses the importance of human needs and social systems. According to this theory, environmental and structural factors such as socioeconomic status, cultural norms, situational stressors, lack of community supports, and social isolation interfere with the fulfillment of basic human needs (Gelardo & Sanford, 1987). As a result natural drives and potentials are frustrated leading to various forms of aggression, including child abuse.

Gil (1970) surveyed 1,380 abusive families and found that 60 percent of the cases were from families on welfare (while only 3 percent had incomes over \$10,000), and that only 52 percent of the fathers had been employed during the one year period preceding the abuse. These and other findings led Gil to conclude that environmental stress, the culturally sanctioned use of force in child rearing, and a variety of social, physical, emotional, and intellectual dysfunctions were responsible for child abuse. Giovannoni (1971) conducted sociologically based studies as well, and concluded that parental mistreatment of children "is the result of noxious societal forces being thrust onto families"(p. 655). Thus, focusing on child abuse as an individual or family problem fails to recognize the root cause: broader societal violence. Both Gil (1970) and Giovannoni(1971) suggest that only through significant changes in the social, economic, and political systems can child maltreatment be substantially decreased.

The strength of the social systems theory of child abuse is its consideration of contextual and socioeconomic factors contributing to child maltreatment. Many researchers have linked child abuse with poverty (e.g., Gil, 1970; Kadushin & Martin, 1980; Pelton, 1978; Straus, Gelles, & Steinmetz, 1980), though others believe this may be due to lower socioeconomic status increasing the likelihood of being officially reported (Gelardo & Sanford, 1987; Newberger, Hampton, Mary, & White, 1986). However, most researchers are not in agreement with Gil's (1987) assertion that the *only* cure for

child abuse is the total reorganization of the socioeconomic and political structure of society. Further, based on Gil's assertion that an inequalitarian system creates child abuse one would expect that underdeveloped countries would have extremely high levels of child maltreatment, yet no evidence to support this position is provided (Tzeng et al., 1991).

Individual-Environment Interaction Paradigm

The basic premise of this paradigm is that child abuse results from factors within the individual *and* factors in the environment. The theories included here were developed out of a dissatisfaction with the one-dimensional theories which considered only individual or sociological variables (Milner, 1993). Three-component theory of physical abuse (Schneider, Pollock, & Helfer, 1972) represents this paradigm.

Three component theory proposes that the abuse potential of the parent (component 1) interacts with the negative perception of the child (component 2) and in a crisis (component 3) abusive behavior results (Schneider et al., 1972). The category of abuse potential includes how the parents were raised, their pattern of social isolation/interaction, the marital relationship, and how they perceive their child. Regardless of the parents abuse potential, this theory posits that abuse will not occur unless the child is perceived negatively by the parents as a result of being a "problem" (i.e., requires special attention for a variety of reasons) or of reminding

them of someone they dislike. The final requirement for abuse to occur is the crisis. This category includes inadequate problem solving skills, poor coping skills, and poor parenting skills.

While there is empirical support linking some of the elements within the three components with child abuse, supportive evidence for others has not been strong or consistent. Social isolation (Gelles, 1980), impulsiveness (Friedrich et al., 1982), and a variety of stressors (Gelles, 1980) have convincing support as being related to abuse potential. Research studies designed to specifically evaluate the three component theory (e.g., Hunka, O'Toole, & O'Toole, 1985) have been criticized for failure to employ control groups and small sample sizes (e.g., $n = 18$) which call into question the validity and reliability of the results.

Tzeng et al. (1991) comment that while three component theory provides an alternative to earlier unidimensional theories, it:

fails to make any concrete causal inferences. Cause and effect variables are not explicitly delineated. Correlations are established but do not generate causal relationships. Linkage between the components and their subcomponents needs to be clarified and predictive relationships established (p. 50).

Offender Typologies Paradigm

The offender typologies paradigm includes theories which classify abusers according to a set of criteria. Walter's (1975)

typology of physical abuser's is representative of this paradigm. This theory proposes that abusive behavior can be categorized into 10 types based on the major etiological factor whether it be individual, situational, or cultural (Tzeng et al., 1991, p. 70):

- Socially and parentally incompetent abusers--learned behavior intergenerational transmission assumed
- Frustrated and displaced abusers--redirect anger toward child
- Situational abusers--abusive only under stressful situations
- Neglectful abusers--subject children to danger via neglect
- Accidental or unknowing abusers--poor judgment, limited IQ
- Victim-precipitated abuse--child elicits aggression
- Subcultural abusers--found in cultures that especially condone the use of violence for discipline
- Mentally ill abusers--diagnosable psychiatric disorder
- Institutionally prescribed abuse--in schools, day care centers, detention facilities
- Self-identified abusers--aware their behaviors are deviant; usually socially successful and motivated for treatment

While this theory includes a number of relevant factors (intergenerational learning, frustration-aggression, situational influences, subculture of violence, child characteristics) across a number of ecological levels, no empirical studies has been cited to substantiate the validity or reliability of the types. All supportive evidence is presented in terms of clinical case examples and illustrations (Tzeng et al., 1991). Further, the typology falls into the previously mentioned "explaining by naming" trap (Newberger &

Newberger, 1981). Finally, the theory fails to consider the interactions and overlap between types, and provides little in the way of predicting or preventing maltreatment (Tzeng et al., 1991).

Family Systems Paradigm

The family systems paradigm considers the impact of the family as a social system interacting with other systems (individual, community, cultural) in the development of abusive behavior. The family systems theory of physical abuse (Straus, 1973) is representative of this paradigm

A basic assumption of the family systems theory is that the family is a goal-seeking adaptive unit. It follows then that abusive behavior as an output of the total family system is not simply a chance aberration, or the result of poor socialization or individual psychopathology (Steinmetz & Straus, 1973). As the family system becomes stressed through the interactions of its members (and with other systems), conflict or violent behavior may result. Straus (1973) outlined 8 propositions concerning family violence:

- Family violence has diverse causes--e.g., unreasonable expectations, marital conflicts, dysfunctional personality traits
- Family violence occurs at extremely high rates--relative to the reported rate
- Most violence is either denied or not labeled deviant by societal or family norms--i.e., the use of physical punishment
- Stereotyped imagery of family violence is learned in childhood from parents and siblings via modeling and imitation

- Stereotypes of family violence are continually reinforced through ordinary social interactions--e.g., high value placed on the tough male image
- Violent persons are often reinforced for their violent acts, thus increasing the probability of future use of violence
- When the use of violence to settle a conflict goes against family norms, a secondary conflict is likely to occur that tends to produce additional violence
- Family violence is more likely when the perpetrator's role expectation or self-concept is one of being violent or tough

While the family systems theory of physical abuse has had significant influence on intervention and treatment efforts, most of the supporting evidence has been in the form of clinical examples (Tzeng et al., 1991). In fact, Straus (1973) offers no empirical evidence to support the theory. The theory has also been criticized for spreading the blame for the violence among all family members, including the victim, thereby relieving the perpetrator of full responsibility (Tzeng et al.).

Parent-Child Interaction Paradigm

The parent-child interaction paradigm, primarily focuses on the parent-child relationship and its impact on later life development (Tzeng et al., 1991). The transactional theory of physical child abuse (Sameroff & Chandler, 1975; Vietze, O'Conner, Hopkins, Sandler, & Altemeier, 1982) is representative of this paradigm and has 3 basic principles: (1) child abuse is rooted in the early life of the child via a disturbance in the parent-child

relationship, (2) parental characteristics/traits influence the occurrence of abuse, and (3) environmental stressors also contribute to the development of abuse.

Vietze et al. (1982) attempted to empirically evaluate transactional theory via a prospective study of 498 expectant mothers. Classifying the mothers into high and low risk groups matched on a number of demographic variables, the researchers used observational measures at birth, 1-month, 6-month, 12-month, and 18-month followup intervals to assess newborn behaviors, mother-infant interaction, maternal perception of infant temperament, developmental level, and child maltreatment. Of the 498 families, 70 experienced maltreatment of various types. Seventy-six percent of these 70 families were identified previously as high risk. However, there were no significant differences between the groups in terms of physical abuse (9 high risk cases ; 3 low risk cases). While there were some differences between the groups at birth and one month followup, there were no significant differences between the groups at the 6-, 12-, or 18-month followup intervals in terms of parent-child interactions or parental perception of the infants temperament (Tzeng et al., 1991).

The strengths of the transactional model include its empirical orientation and its focus on multiple contributing factors in the development of abusive behavior (i.e., child characteristics, parent-child interactions, parent characteristics, and external stressors). However, in terms of its explanatory power regarding physical child

abuse there is little empirical support. Further weaknesses include the failure to address the role of other family members (i.e., fathers and siblings) and cultural/societal factors beyond socioeconomic status (Tzeng et al., 1991).

The study by Vietze et al. (1982) which examined maternal-child interaction raises the issue of the potential for gender bias in child maltreatment research. Margolin (1992) asserts that males responsibility for physical child abuse has been largely ignored in empirical research and cites evidence from an extensive literature review to support her claim. Margolin further suggests that a research strategy to obtain a more accurate picture of "by-gender" child abuse rates should include studies which control for men's and women's differential participation in child care and exposure to children (Margolin, p. 420).

Sociobiological Paradigm

The basic tenet of this paradigm is that factors originating in our evolutionary past and the laws of natural selection play a significant role in contemporary social behavior (Tzeng et al., 1991). The sociobiological theory of Daly and Wilson (1980) is representative of this paradigm.

Sociobiological theory is concerned with 3 basic principles related to child maltreatment: (1) inclusive fitness (transmission of genetic material to future generations), (2) parental investment (parental behaviors toward a child that improve the child's chances

of survival at the expense of the parent investing in other children), and (3) discriminative parenting (the amount and quality of parental care is related to the parents conscious or unconscious calculation of the return on his or her investment, i.e., will the child be able to pass on genetic material)(Daly & Wilson, 1980). These three principles imply that parental abuse is discriminative, and that step-children, adopted children, and special needs children are particularly at risk for maltreatment. Further, weak parent-child bonding and inadequate resources can further impinge upon inclusive fitness payoffs, setting the stage for abusive behavior (Tzeng et al., 1991).

While there is evidence that parent-child bonding (Ayoub & Milner, 1985; Daly & Wilson, 1980) and inadequate resources (Daly & Wilson; Burgess and Garbarino, 1983) are contributors to the development of abusive behavior, the sociobiological theory is not without its problems. First, the theory does *not* account for maltreatment of natural children except in the circumstances of inadequate resources and/or the child is in some way defective/inferior (Giles-Sims & Finkelhor, 1984). Second, the parental investment hypothesis is internally contradictory: abusive behavior is likely (except in cases of child fatalities) to result in an increase rather than a decrease on parental resources (Giles-Sims & Finkelhor).

Learning/Situational Paradigm

This paradigm applies empirically derived principles from general and social learning theories and applies them to the problem of child maltreatment (Tzeng et al., 1991).. Patterson's (1982) coercion theory is an example of the theories represented by this paradigm.

The basic premise of coercion theory is that lack of effective child management skills by the mother and/or the presence of psychosocial stressors may predispose the family to develop a coercive cycle of parent-child interactions (Tzeng et al., 1991). Figure 2 illustrates how "coercion traps" (negative reinforcement traps) develop (Atkeson & Forehand, 1981). In situation 1 the child's coercive behaviors are negatively reinforced when the mother withdraws the aversive stimulus (i.e., the command). In situation 2 the mother's escalating coercive behavior is reinforced by the child's eventual compliance. These examples clearly demonstrate how negative reinforcement can function to increase the probability of the use of aggressive control techniques by both the parent and the child:

As this 'training' continues over long periods, significant increases in rate and intensity of these coercive behaviors occur as both family members are reinforced by engaging in aggressive behaviors. Furthermore the child observes his or her parents engaging in coercive

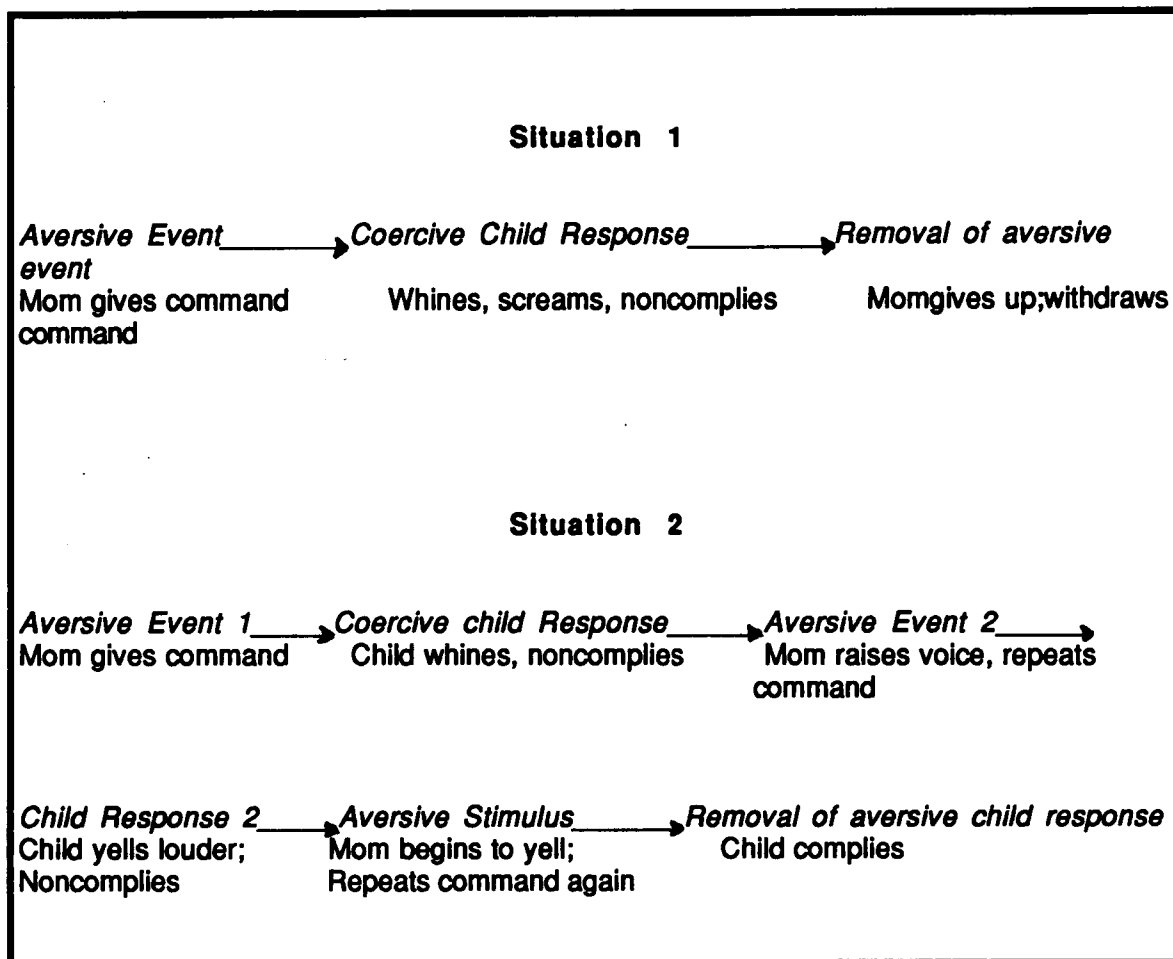


Figure 2 Negative Reinforcement (Coercion) Traps
 Source: Atkeson, B.M., & Forehand, R. (1981). Conduct disorders. In E.J. Mash & L.G. Terdal (Eds.), Behavioral assessment of childhood disorders (pp. 105-153). New York: Guilford Press.

responses, which provides opportunity for modeling of aggression to occur (Atkeson & Forehand, 1981, p. 189).

The primary strength of coercion theory its focus upon the interactional patterns between parent and child. An additional strength is that it links the coercion process between the mother and child to the continuum approach to child maltreatment (i.e., that abuse is a continuum of behaviors from mild physical discipline to severe forms of physical abuse) that considers the potential for abuse exists to some extent in all families (Tzeng et al., 1991).

Results of empirical studies which have attempted to test coercion theory of physical abuse are mixed, largely due to methodological problems including failure to control for confounding variables. Additional criticisms include the failure to consider other family members beyond the mother-child relationship, and the failure to integrate the role of stress and parenting skills into the process (Tzeng et al., 1991)..

Ecological Paradigm

This paradigm suggests that child maltreatment occurs as a result of influences from four different ecological levels: the individual, the family, the community, and the society. Such an approach was taken by Belsky (1980) who integrated elements of the aforementioned models into an "ecological" model of abuse. Belsky argues that child maltreatment is "...multiply determined by forces at work in the individual, in the family, and in the community and

culture in which the individual and family are embedded....that these determinants are ecologically nested within one another" (Belsky, p. 320).

Belsky's model proposes that the causative factors associated with abuse occur across four levels: (1) in the individual (ontogenetic), (2) the family (microsystem), (3) the community (exosystem), and (4) the culture (macrosystem). At the ontogenetic level, Belsky described characteristics which the parent brings into the family setting and the parenting role such as personality traits and socialization experiences (e.g., history of abuse, lack of nurturing/parental rejection, and inappropriate expectations for children). At the microsystem level he included characteristics of the family system or the immediate context in which the maltreatment takes place. These include dysfunctional interactions between family members, marital discord, single parenthood, or potential abuse-eliciting characteristics of the child such as negative behaviors or developmental problems. At the exosystem level, Belsky included work and social factors which may produce stress for the family and "trigger" maltreatment. For example, low socioeconomic status and/or unemployment, or lack of sufficient social supports which in turn leaves the family isolated from neighbors, extended family, or community social services. Without appropriate economic resources, emotional support, role models, or instructive feedback when community standards are violated, abusive behavior may occur. Finally, at the macrosystem level

Belsky described societal factors, such as the view of children as possessions or the acceptance of corporal punishment, as helping to foster abusive behavior through their influence on the ontogenetic, micro- and exosystems (Belsky, 1980).

The ecological model assumes that the various levels are embedded or "nested" within one another. More specifically, it outlines the relationship between individual, familial, community, and cultural factors that have been implicated by others as causal agents in the maltreatment process. For example, while abusing parents enter the microsystem of the family with developmental histories that may predispose them to maltreat their children (ontogenetic development), stress-promoting forces both within the immediate family (the microsystem) and beyond it (the exosystem) increase the likelihood that parent-child conflict will occur. The fact that a parent's response to such conflict and stress takes the form of child maltreatment is seen as a consequence both of the parent's own experience as a child (ontogenetic development) and "...of the values and child-rearing practices that characterize the society or subculture in which the individual, family, and community are embedded (the macrosystem) " (Belsky, 1980, p.330). As shown in the example, it is the interaction between factors at the various levels which Belsky believes will provide a more accurate explanation of the complex etiology of child maltreatment.

According to Tzeng et al. (1991) the ecological theory has two major strengths. First, it acknowledges that child maltreatment is

a complex phenomenon involving multiple variables and interactive processes. Second, it organizes "all pertinent data from four ecological levels" (p.105). What the model does *not* do, however, is detail the necessary and sufficient conditions for child abuse to occur. The three major weaknesses are: (1) failure to make direct and clear causal statements, (2) failure to generate or test specific hypotheses, and (3) failure to sufficiently link the four levels of analysis either theoretically or empirically (Tzeng et al., 1991; Milner & Crouch, 1993).

Evaluation of Etiological Theories/Models/Paradigms

In this review of etiological theories, models and paradigms, it is clear that the field has moved beyond the early single factor theories and begun to focus on more complex, interactive models with multiple levels of analysis. It is also clear that much work remains to be done in prioritizing the many etiologic factors that have already been identified, and specifying the necessary and sufficient conditions under which each may contribute to abuse. Azar (1991) has suggested that, ultimately, multiple models may be posited to explain the various types of physical child abuse (e.g., based upon setting events surrounding the abuse, chronicity, or the developmental period when the abuse began) rather than relying on one, all-encompassing model. Webster, Goldstein, and Segall (1985) came to a similar conclusion:

In the long run, the development of a typology of abusive parents seems to hold the most promise for increasing our understanding of this phenomenon. If distinct types of abusive parents can be empirically discerned, then explanatory models appropriate to each type can be formulated and tested. Efforts along this line are likely to be more productive than trying to develop 'the' model to explain child abuse (Webster et al., 1985, p. 315).

To test the explanatory value of alternative models of child abuse, Webster et al.(1985) examined 106 cases of confirmed physical abuse using frequency and severity of abuse as the dependent variables and 18 independent variables (as suggested by the four models under study: (1) the psychopathology model, (2) social-psychology model, (3) the social situational model , and (4) the cultural model). Data analysis occurred in two stages. First, bivariate analysis was used to test the individual hypotheses derived from each of the four models. Second, stepwise multiple regression was utilized to determine the relative importance of the independent variables in explaining frequency and severity of abuse. Results of the bivariate analyses did not provide consistent support for *any* of the models of child abuse. The results of the multiple regression analyses revealed that a relatively small number of independent variables could explain approximately one-third of the variation in each of the dependent variables. The authors acknowledge that while these results are encouraging, considerable

additional work needs to be done to account for the nearly two-thirds of the variation which remains *unexplained* .

Limitations of the study include: (1) the lack of a comparison group of non-abusive parents, which renders the authors conclusions about the effect of the independent variables on variations in the behavior of abusive parents tentative at best, and (2) given the small sample size, the large number of independent variables, and the use of stepwise multiple regression "...there can be a very serious capitalization on chance" (Cohen & Cohen, 1983, p. 124).

Methodological problems such as those noted above are commonplace in the literature pertaining to the etiology of child maltreatment in general, and physical child abuse in particular. Plotkin, Azar, Twentyman, and Perri (1981) reviewed 270 articles (published 1967-1980) on "causative factors" in child maltreatment to determine their scientific merit. Their findings indicated that: (1) only 25 percent of the studies were based on original data collected by the authors, (2) 66 percent did not use comparison groups, (3) those that did use comparison groups often failed to match the groups on important variables such as socioeconomic status, (4) 75 percent of the studies were expository in nature with no data presented, (5) only 10 percent of the studies utilized inferential statistics to determine if difference were significant, and (6) only 5 percent used inferential statistics appropriately. These findings led the authors to conclude:

Causative models can only be advanced by systematic investigations which lend incremental empirical support. This translates to the use of appropriate and varied multivariate experimental designs directed at specific hypotheses and predictions based upon the explanatory theme of the model (Plotkin et al., 1981, p. 455).

The scientific merit of etiological models of child physical abuse was also addressed by Tzeng et al. (1991) who evaluated all 25 models and their respective paradigms via a "process evaluation" of the properties of all theories in reference to the requirements for constructing a rigorous scientific theory. The authors concluded that all nine paradigms of physical child abuse: "were deficient in the areas of operationalism, accuracy, fruitfulness, integration/comprehensiveness, and falsifiability. This is definitely related to a lack of empiricism in the field" (Tzeng et al., 1991, p. 270).

Although no one model can accurately predict the occurrence of physical child abuse cases at this time, research has produced a growing body of knowledge regarding correlates and risk factors thought to be associated with maltreatment (see Table 3 for a review). The development of interactive models based upon a probabilistic risk assessment process and subjected to testing via rigorous scientific methodologies holds promise for future research efforts (NRC, 1993; Milner & Crouch, 1993; Plotkin et al., 1981).

Risk Assessment in Child Protection

As the previous discussion indicates, evidence about the causes of initial abuse is far from definitive, and there is much work to be done to develop instruments capable of reliably predicting when abuse will occur. Given that this is the case, the question has been raised as to whether it is any easier to predict recurrence than the initial abuse (Rodwell & Chambers, 1992). While some authors have rather emphatically argued that it is not (Rodwell & Chambers, 1992; Wald & Woolverton, 1990), a growing body of research has emerged in this area. In addition, most child protection agencies in the United States have begun to utilize some type of risk assessment system aimed at minimizing the risk of future harm (Berkowitz, 1991). The term "risk assessment" is used to define a number of different assessment and decision-making processes, but essentially is concerned with predicting whether or not a child will be maltreated at some future point in time (Pecora, 1991). The following discussion will review the major approaches to risk assessment currently in use in terms of their functions, strengths and limitations.

Because there is no standard definition or set of purposes for risk assessment it has been applied to many different procedures. The process usually involves an examination of the child and family situation to identify risk factors, family strengths and resources, and available agency services. This information is then used to help caseworkers determine the degree of risk the child faces, what

actions are necessary to protect the child (including whether or not the child should be removed from the home), and what intervention strategies are necessary to reduce the risk to the child (Pecora, 1991). In many agencies risk assessment instruments are *also* used to determine whether (and how soon) to investigate a report of abuse, whether to substantiate a report, whether to return a child to the parent from foster care, and whether to close a case (Wald & Woolverton, 1990).

Interestingly, the risk assessment systems in use throughout the country vary almost as much themselves as the purposes for which they are used. In her survey of State CPS agencies regarding the use of risk assessment Berkowitz (1991) found:

Fifteen States reported that they use the Illinois Risk Assessment Model (CANTS) or a modified version of this system. Four States indicated that they employed the Child at Risk Field and 2 noted that they used, or were about to implement, a risk assessment system adapted to their States' characteristics by the National Center on Crime and Delinquency. . . . Twenty-one states reported that they had developed their own risk assessment system or adapted other States' systems to their needs (p. 6).

Berkowitz also noted that less than half of the States (19) reported using risk assessment as a predictive tool, and of those only 42 percent considered prediction as a first priority.

Table 3: Examples of Perpetrator, Family, and Environmental Risk Factors

Perpetrator characteristics

Biological factors

neurological and neuropsychological factors
physiological reactivity
physical health problems

Cognitive/affective characteristics

self-esteem and ego strength
perceptions, attributions, and evaluations of child behavior
expectations of child behavior
life stress/distress
depression
other psychological factors

Behavioral characteristics

alcohol and drug use
social isolation
parent-child interactions
parental disciplinary strategies
inadequate coping skills

Family Characteristics

conflict, little support in family of origin
marital discord
poor communication skills
verbal and physical conflict
value the use of force
lack of cohesion
isolation
child factors

Sociological characteristics

Perpetrator demographics

nonbiological parent
single parent
age
education level
childhood history of abuse

Family demographic characteristics

lack of resources; socioeconomic status
large number of children

Social isolation

Multiple environmental stressors

Culturally sanctioned use of force

Source: Milner, J.S., & Crouch, J.L. (1993). Physical child abuse. In R.L. Hampton, T.P. Gullotta, G.R. Adams, E.H. Potter, & R.P. Weissberg (Eds.), Family violence: Prevention and treatment (pp. 25-55). Newbury Park, CA: Sage.

Table 4 illustrates the variability of several risk assessment systems currently being utilized by CPS agencies throughout the country. Of particular interest is the range of items/variables among the various systems, both in terms of number (i.e., from 13 to 64 variables) and type (e.g., child, parent, family, environmental, and intervention factors).

According to Pecora, four basic types of risk assessment systems have emerged: (1) the matrix approach, (2) the empirical predictors method, (3) the family assessment scales, and (4) the Child at Risk Field.

The matrix approach uses a table composed of a number of factors rated in terms of their severity or risk to the child. The ratings are accomplished via the use of descriptive scales anchored at between three and five points (e.g., 0 = Not applicable, 1 = Insufficient information, 2 = No/low risk, 3 = Intermediate risk, 4 = High risk). Factors chosen for inclusion in the matrix represent those cited in the literature as being associated with one or more forms of maltreatment (e.g., see Table 4, Washington State Risk Factor Matrix).

The empirical predictors method is modeled after the risk studies conducted in public health and juvenile corrections (Baird, 1988; Johnson & L'Esperance, 1984), and focuses on identifying a combination of risk factors most predictive of child maltreatment. Thus, characteristics of the child, parent, family, and environment

Table 4: Selected Risk Assessment Models

Model	Major Risk Factors	Method of Rating Items
Child At Risk Field	Child; Parent; Family; Intervention; Maltreatment	Elements within each risk force are identified on the basis of 14 open-ended questions
Utah Risk Assessment Scales	Child; Parent; Family Intervention; Maltreatment	22 primary and 24 secondary risk factors are rated using behaviorally anchored scales
Washington State Risk Factor Matrix	Child characteristics; Severity of CA/N; Chronicity of CA/N Caretaker characteristics; Parent/child relationship; Perpetrator access to child	Each of 32 variables are scaled as low, intermediate, or high risk
Illinois Risk Assessment Factor Sheet	Child factors; Caretaker factors	Each of 13 variables are scaled as low-intermediate-or high risk
Level of Risk Scale (Kentucky)	Allegation/Injury; Attitude/Behavior of caretaker; Caretaker attitude toward child; Attitude/Behavior of child; Crisis/Stress; History; Support Systems	60 indicators are rated using operational definitions of severity (strength, no problem, moderate, serious, critical)
Family Vulnerability Model (Iowa)	Family of origin; Individual factors; Family system; factors of abuse and disclosure; Precipitating stresses; Coping mechanisms and strengths	64 variables are rated using operational definitions of vulnerability (low, possible, moderate, serious, high)
Form DDS-1613 (Michigan)	Child care and management; General family functioning; Parents' functioning	16 problem areas are rated as to their severity and observability

Source: McDonell, J.R., & Tracy, E.M. (1991). Attributed responsibility in child welfare decision making. Paper presented at the Ninth National Conference on Child Abuse and Neglect. Denver, Colorado.

thought to be associated with child maltreatment are not included in the final set of risk factors unless they have been proven, empirically, to predict one or more types of child maltreatment (Pecora, 1991).

An interesting study of eight risk assessment systems widely used by CPS agencies (McDonald, 1990) illustrates the difference between these and empirically based models. In a review of the eight models McDonald found 88 separate variables categorized into seven different domains. To illustrate how little agreement there was between the eight models in terms of what information was important in assessing risk, it is interesting to note that only 15 of the 88 variables were used by more than half of the instruments. A review of the literature looking for empirical support for these 88 variables as predictors of recurrence of maltreatment revealed that only about half of the 88 identified variables could be matched with variables reported in the literature: "put another way, only half of the variables used in risk assessment instruments have been empirically tested by the weakest of research designs" (McDonald, 1990, p.63).

McDonald (1990) also discovered that of the 70 studies reviewed only three directly attempted to predict recurrence of maltreatment. These three studies yielded four prediction models, two of which predicted recurrence of physical abuse (Baird, 1988; Johnson & L'Esperance, 1984). In combination with data from his own research, McDonald was able to identify 29 different

variables as significant predictors of maltreatment across nine different multivariate prediction models. Table 5 compares the most common variables from the eight risk assessment models with the 29 empirically derived predictor variables according to domain. With regard to physical abuse, several variables stand out as significant predictors in multiple models: age, ability of the child; quality of mother's care; perpetrator's access to child; number of children in the home; and whether neglect was involved in combination with physical abuse.

A third approach to risk assessment is the use of family assessment scales, such as the "Child Well-Being" or "Family Risk" Scales developed by the Child Welfare League of America (Magura, Moses, & Jones, 1987). These scales measure concepts related to one or more physical, psychological, or social needs of the child, and the degree to which they are *not* being met is intended to help define an overall state of the child's well-being. Each scale has between four and six levels of descriptors for child, parent, family and household functioning ranging from an adequate level to increasing levels of inadequacy (Magura et al., 1987). Pecora (1991) rightly points out that this approach to assessing risk is more of a structured assessment system than a risk assessment system, because its primary focus is on child and family functioning not the identification of risk factors (p. 5).

The fourth and final approach to risk assessment is the Child At Risk Field (CARF) risk assessment and decision making system,

Table 5: Risk Assessment Instruments--Variables Used and Predictive Validity

Domain (88)	Most Frequently Used (15)	Empirical Support (29)
Child Characteristics (16)	Physical disabilities Appropriate clothing Personal hygiene	Age, ability of child
Caretaker Characteristics (21)	Mental and physical health Capacity for child care Physical health care of child Supervision of children	Parenting skills Capacity to use agency Caretaker abused History drug/alcohol abuse; Cooperation with agency; History of criminal behavior; Caretaker depression Cooperation with agency Caretaker neglected Age of youngest caretaker Motivation of caretaker Quality of mother's care
Environmental Characteristics (16)	Support for caretaker Physical safety in home	Negative social relationships; Filthy home; Number working utilities
Maltreatment Characteristics (17)	Sexual abuse Abusive physical discipline	Prior reports of abuse Prior placements Number of problems Prior reports of neglect Neglect involved; Sexual contact; Current or prior CPS case; Number children involved
Perpetrator characteristics (3)	Access to child	Access to child
Home characteristics (10)	None	Number adults in home Number children in home Biological mother present
Parent/child interaction (5)	Expectations of child	Expectations of child Mother's protection of child

Source: McDonald, T.P. (1990). Recurrence of maltreatment in relation to assessed risk. Paper presented at the Symposium on Risk Assessment in Child Protective Services. Washington, D.C.: National Center on Child Abuse and Neglect.

developed by ACTION for Child Protection. This system uses an ecological approach and is organized around five "force fields": child, parent, family, maltreatment and intervention (DePanfilis, 1993). A series of 14 open-ended questions and anchored rating scales are used to identify "risk influences" that may be operating in the family situation (Pecora, 1991). Though described as one of the most comprehensive approaches to risk assessment available (Pecora, 1991), a recent evaluation of the predictive validity of the CARF "was not able to validate the predictive validity of elements or variables represented in the CARF" (DePanfilis, 1993. p. 31) as none of the regression models fit the data well enough to successfully predict recurrence cases.

While the stated objective of most of the risk assessment systems is the prediction of future maltreatment:

a lack of validation and implementation data preclude definitive answers at this time regarding how much faith to place in the ability of these systems to predict the likelihood of future maltreatment. Many of the systems available need to be refined to be more culturally sensitive to particular ethnic groups, tested for gender bias. and adjusted for specific types of child maltreatment (especially if risk scores are calculated and used in case decisionmaking)(Pecora, 1991, p. 6).

A predictive instrument's performance is evaluated in terms of its accuracy, usually defined in terms of its ability to correctly

classify individuals (Balassone, 1991). Two measures, sensitivity and specificity, are usually used for this purpose. In the case of predicting child abusers, sensitivity refers to the probability that future child abusers will be correctly identified, and specificity refers to the probability that nonabusers will be correctly identified. Past research on risk factor models for predicting recurrence of abuse has indicated that sensitivity and specificity rates have been as high as 86 and 80 percent, respectively, but many models have done considerably worse (DePanfilis, 1993).

Associated with these probabilities are two types of errors in prediction: false positives and false negatives. A false positive occurs when abuse is predicted but does not happen. A false negative occurs when abuse was not predicted but actually did happen (Milner, 1986; Rodwell & Chambers, 1992). Both are examples of misclassification errors and are the subject of considerable debate with regard to the prediction of child abuse. Specifically, it has been argued that the cost of mislabeling parents as potential abusers outweighs the benefit of prediction instruments even if sensitivity and specificity rates were as high as 95 percent (Rodwell & Chambers, 1992; Wald & Woolverton, 1990). "Child abuser" is an extremely value laden-term with derogatory connotations. Solnit (1980) has suggested that the stigma of being called a "potential abuser", and the stress it places on parents, may actually increase the risk to the child. Being labeled a potential abuser may, in fact, create a self-fulfilling prophecy (Gelles, 1982).

The counter-argument is that risk assessment instruments are in fact tools intended only to aid and improve the clinical judgment of practitioners, not to replace them. Pecora (1991) has outlined a number of ways in which risk assessment systems have the potential to strengthen CPS practice, including: (1) focusing worker attention on the most critical factors, (2) structuring and standardizing worker documentation and decisionmaking (without sacrificing worker judgment), (3) reducing bias in decision-making, (4) encouraging careful documentation, (5) encouraging the assessment of risk not only at intake, but also throughout the life of the case, and (6) focusing on family strengths as well as limitations. An additional benefit to agencies and children alike is the accountability (through careful documentation and decisionmaking) which risk assessment systems may foster. Recent cases in which caseworker negligence has led to criminal proceedings have demonstrated this need. Decisions made by caseworkers on a daily basis can make the difference, in some instances, between life and death. Helping caseworkers with this tremendous responsibility is critical.

Researchers and practitioners are in agreement that further research is necessary to overcome the limitations of previous studies (e.g., low base rates of recurrence, multicollinearity of variables, small sample sizes, inability to control for the effect of intervention) and to develop risk assessment instruments with much greater sensitivity and specificity (DePanfilis, 1993). Wald and

Woolverton (1990) have offered a concise analysis of the prerequisites necessary for risk assessment to yield its promise:

Implementation of a risk assessment system can be a stimulus for major changes in a child protection system. If implementation is accompanied by clarification of goals, analysis of resource needs, increasing training of workers, good supervision, and high quality services, it will certainly result in a vastly improved system. But without the additional changes, risk assessment will be the emperor's new clothes (p. 505).

Predicting Injury Severity

After reviewing the literature on the causative factors associated with child abuse, Plotkin et al. (1981) concluded:

Research should continue to be directed at molecular and molar influences associated with child maltreatment. . . It is therefore imperative not to discount or abandon any area of investigation (i.e., psychiatric, sociological, and social-situational) insomuch as these influences interplay synergistically rendering certain combinations high risk for abuse (p.453).

In keeping with this suggestion, a small number of investigators have examined the effects of varying combinations of predictor variables on injury severity in cases of physical child abuse (Daly & Piliavin, 1982; Hampton, 1987; Rosenthal, 1988; Seaberg, 1977;

Zuravin, Orme, & Hegar, 1994). While relatively recent, these studies are of particular importance to the development of predictive tools (e.g., intake screening instruments) for evaluating the probability of severe injury. Because of the demands placed upon child protective services workers by increasing reports, staff shortages, and shrinking resources, such instruments could be invaluable to those making triage and case assignment decisions (Hegar, Zuravin, & Orme, 1994). Seaberg (1977, p. 64) has further suggested that an understanding of the variables antecedent to injury severity, in conjunction with a variety of experimental interventions with different "types" of perpetrators, could lead to more effective case management decisions (e.g., when to remove a child from the home).

In their review of the literature regarding the current state of knowledge about predictors of severe and fatal child abuse, Hegar et al. (1994) found only a handful of studies that used multivariate analytic techniques to predict severity of child abuse injury (Daly & Piliavin, 1982; Hampton, 1987; Rosenthal, 1988; Seaberg, 1977). Hegar et al. organized findings from these and other studies around characteristics of: (1) the child victim (age, gender, race), (2) the perpetrator (gender, relationship with the child), and (3) the source and allegations of the abuse report. These findings are reviewed below. It is important to note that this review discusses those variables which had previously been examined. As the previous

discussion of theories clearly indicates, there are many other key areas which could and should be examined.

Child Characteristics

There is general agreement in the literature that child's age is a significant predictor of severity of injury (Hegar et al., 1994). Studies by Seaberg (1977) and Daly and Piliavin (1982) both concluded that age was the most important child-related variable in predicting injury severity, with younger children suffering more serious physical harm. Rosenthal (1988) supported this conclusion, noting that more than 50 percent of the severe injuries (n=769) involved children under the age of three. A recent analysis of NIS-2 data (Sedlak, 1990) also concluded that both fatal and more serious injuries were more numerous among young children. These results are also consistent with the findings of the Second National Family Violence Survey (Wolfner & Gelles, 1993) which found that preschoolers were victims of abusive violence at least 1.5 times as much as were infants, toddlers and teens. Zuravin, Orme, & Hegar (1994) suggest, however, that another plausible explanation for these findings is that minor injuries to young children may be underreported. Since preschoolers are less visible to concerned adults than are school age children, underreporting of their minor injuries may help to explain their overrepresentation the severe abuse injury categories.

The relationship between child's gender and injury severity is much less clear (Hegar et al., 1994). Only one study (Rosenthal, 1988) found that gender made a significant contribution to predicting injury severity, concluding that male children were more at risk of severe injury than female children. Wolfner and Gelles (1993) cite evidence from their 1985 survey (subject to the limitations of survey research) indicating that male children were victims of abusive violence almost 35 percent more than female children. Support for this finding in other research is limited, with some studies showing nonsignificant trends in the direction of higher male fatalities (Jason & Andereck, 1983) and others reporting the opposite result (Anderson, Ambrosino, Valentine, & Lauderdale, 1983). Hegar et al. suggest that this variable requires further validation:

as does Rosenthal's (1988) evidence of an interaction between age and gender indicating that at highest risk for severe injury are preadolescent boys and adolescent girls. The possibility of such an interaction is intriguing because it suggests that adult caretakers' coping and disciplinary skills may be tried to the breaking point by boys and girls at different developmental stages (pp. 175-176).

Several studies of injury severity (Daly & Piliavin, 1982; Seaberg, 1977) and child abuse fatalities (Greenland, 1987; Jason & Andereck, 1983) indicate that victims of non-white perpetrators are

at greater risk for severe injury and that Black children are overrepresented in child abuse deaths. However, Hegar et al. (1994) comment that these results need to be interpreted with caution as some of the studies failed to control for social class variables. In addition, they also point out that these results may "be due to a greater willingness on the part of professionals to attach stigmatizing labels to families of color" (p. 177). Further exploration of the relationship between race and injury severity is needed.

Perpetrator Characteristics

While the child characteristic that most strongly predicts injury severity is the child's age, gender is the perpetrator characteristic that has been linked most frequently and consistently with severity of child abuse injury (Hegar et al., 1994). Daley & Piliavin (1982), for example, found that a male perpetrator was one of the five predictor variables directly associated with injury severity. The direction of that relationship indicates that victims of male perpetrators appear to suffer more serious injury. Child fatality studies (Jason & Andereck, 1983) and national incidence surveys (Gelles, 1989) have also suggested that males are more likely to kill or severely injure children than are females.

One of the most important, yet least studied, predictor variables regarding injury severity is the relationship of the perpetrator and victim (Hegar et al., 1994). The few studies that

have examined this issue have had difficulty operationalizing the concept of relationship, resulting in a failure to distinguish between biological parents, step-parents, parents' lovers, adoptive parents, and foster parents (Hegar et al., p. 14). The exception was a study by Rosenthal (1988) who found an interaction between perpetrator gender and perpetrator relationship to victim. Controlling for victim age, Rosenthal found that stepfathers and male nonrelatives were more likely to inflict serious injury than biological fathers and male relatives. On the other hand, biological mothers were more likely to inflict serious injury than stepmothers. Rosenthal also noted that a significant relationship was found between severe injury and "unspecified" perpetrators. He speculated that these unknown perpetrators were often the parents' lovers, a suggestion that has some support in the literature (Bergman, Larsen, & Mueller, 1986; Crane-Wider, 1991). In spite of findings such as these, Hegar et al. conclude that "on balance, surprisingly little is known about how the relationship between perpetrator and victim is linked with patterns of severe physical abuse"(1994, p. 16). They suggest that future research efforts could benefit from more precise operationalization of the concept of relationship.

Characteristics of Report Source and Allegations

Perhaps the least examined piece of information available to the child protection staff at intake is the source of the report and the nature of the allegations. Most of the studies reviewed by Hegar

et al. (1994) were concerned with report sources in terms of substantiation rates as opposed to their predictive ability regarding injury severity. For example, one study found that anonymous reports were more likely to be judged unfounded (Zuravin, Watson, & Ehrenschaft, 1987), while another found that reports by professionals are more likely to be substantiated than those by nonprofessionals (Jason & Andereck, 1983).

Methodological Issues

In their literature review, Hegar et al. (1994) found only four studies that utilized multivariate analytic techniques to predict severity of child abuse injury. As demonstrated in the earlier discussion of theoretical models, child maltreatment is a complex phenomenon with multiple correlates and risk factors. Use of simplistic statistical models which fail to control for the effects of other variables has limited progress in predicting injury severity.

Each of the four studies noted above used a different definition of injury severity, with classification systems ranging from a dichotomous (severe versus minor injury) scale (Rosenthal, 1988) to an 11 point severity scale (Daly & Piliavin, 1982; Seaberg, 1977) with numerical values assigned by injury type (e.g., bruises and welts received a 5.08 score while brain damage received a score of 10.22). Further, two studies used the same 11 point scale but used different scoring procedures to determine the degree of injury severity (Hegar et al.). As the earlier discussion of definitional

issues clearly indicates, these and other methodological differences make comparisons of the findings from the various studies difficult at best, particularly with regard to the interpretation of contradictory findings:

Conceivably, differences among samples with respect to victim's racial or ethnic identity, victim age, victim gender, or perpetrator gender underlie differences in main effects among studies. Examination of interactions between various predictors might help to clarify their usefulness. Given that very few of the studies examined interactions, future efforts need to begin to explore the possibility of such effects (Hegar et al., 1994, p. 180).

In an attempt to overcome some of the methodological deficiencies of earlier studies, Zuravin, Orme, and Hegar (1994) conducted the most comprehensive study of factors predicting severity of child abuse injury to date. Using ordinal probit regression, this study focused on predicting injury severity for 789 physically abused children (from the same number of families), utilizing *only* the information available to the protective service worker at the time of the initial report. The children were assigned severity codes (on the basis of their most severe injury) according to a four level scale: no injury, mild injury, moderate injury, and serious injury. Nine predictor variables were included in the analysis: (1) season the report was made, (2) source of the report, (3) severity of the allegations, (4) child's gender, (5) child's age, (6)

child's race, (7) perpetrator's gender, (8) perpetrator's relationship to the child, and (9) mother's age. The authors hypothesized that each of these variables would be related to injury severity when the effects for all other predictor variables were controlled. In addition, three interactions were hypothesized: (1) child's age and mother's age, (2) child's age and child's gender, and (3) perpetrator's gender and child's gender (Zuravin et al., 1994, p. 11).

Results of the ordinal probit regression are presented in Table 6 and are summarized here. First, the model which included the three interaction terms fit the data better than the main effects model. Second, of the nine predictor variables seven had main or interaction effects (the exceptions were child's race and perpetrator gender). Severity is judged to be greater when the allegations are more severe, the report is made by a medical professional, and the perpetrator is unknown. When the report is made in the summer, is anonymous or from a nonprofessional, and the perpetrator is a parent the injury is less severe. With the exception of severity of the allegations, these effects range from small to moderate. Third, the interaction between maternal age and child's age was significant and indicated that as the mother's age increased the inverse relationship between child's age and injury severity intensified. Fourth, The interaction between child's age and child's gender was also significant and indicated that for boys injury severity was associated with younger age, while for girls there was no association between age and injury severity. Fifth, the

Table 6: Predicting Severity of Child Abuse Injury: Probit Regression Results

Variables	Slope	Z	p (two-tailed)			
Child's Gender	.152	1.69	.091			
Child's Race	.174	1.71	.088			
Child's Age	.000	.00	1.000			
Mother's Age	-.015	-1.88	.061			
Perpetrator's Gender	.105	1.06	.28			
Perpetrator's Relationship to Child						
Unknown	.414	3.00	.003			
Non-relative	-.107	-.96	.335			
Relative	-.060	-.38	.701			
Parent	-.248	-2.92	.004			
Type of Reporter						
Anonymous	-.239	-2.21	.027			
Non-Professional	-.293	-3.57	≤ .001			
Other Professional	.000	.00	1.000			
Medical Professional	.533	6.66	≤ .001			
Season						
Fall	.029	.36	.717			
Winter	.035	.45	.649			
Spring	.109	1.51	.130			
Summer	-.173	-2.16	.033			
Allegations	.919	15.07	≤ .001			
Child Age x Mom Age	-.002	-2.00	.046			
Child Age x Child Gender	-.039	-2.44	.015			
Perpetrator Gender x Child Gender	.094	.52	.604			
	Kappa	t	p	95% CI	False +	False -
No Injury Vs. Mild/Moderate/Severe	.62	17.50	≤ .001	(.56 to .68)	12%	5%
No/Mild Injury Vs. Moderate/Severe	.25	8.58	≤ .001	(.17 to .35)	3%	14%

Source: Zuravin, S.J., Orme, J.G., & Hegar, R.L. (1994). Factors predicting severity of child abuse injury: An empirical investigation using ordinal probit regression. Social Work Research, 18, 131-138.

interaction between perpetrator's gender and child's gender was nonsignificant. Finally, the model with the interaction effects was quite successful in predicting whether or not a child had been injured (see Table 6), but not successful in predicting moderate or severe injury (Zuravin et al., 1994).

Zuravin et al. (1994) comment that the failure to adequately predict moderate and severe injury was disappointing because these are the most pressing outcomes which protective service workers need to identify. Explanation for this failure was attributed, in part, to the low rate of severe injuries in the data (36 cases out of 789 children) which makes prediction particularly difficult. This is so because as the base rate of a targeted behavior approaches either zero or 100 percent, prediction in any particular case that the outcome will resemble that of the modal group in that population will be more reliable than a prediction based on the most sophisticated device (Meehl & Rosen, 1955). Thus, if only 5 percent of children in a particular population subgroup suffer severe injuries, the best prediction for anyone in that group is that he or she will not suffer a severe injury. However, if 95 percent incur severe injury, the best prediction is that of a severe injury outcome.

Potential Predictor Variables

In addition to those noted above, a number of other variables have been suggested as potentially important in the prediction of injury severity. For example, Wolfner & Gelles (1993) found that

length of residence, number of children in the family, socioeconomic status (SES), and illegal drug use are associated with severe violence toward children. Seaberg (1977) found that parental mental health and substance abuse problems, social isolation, lower income, and unemployment of the father were modest predictors of injury severity. Seaberg also found that by controlling for victim age, a victim handicapping condition (e.g., premature birth, mental retardation, physical handicap, or chronic illness) was predictive of injury severity, but only for children under age three.

Zuravin et al. (1994) have suggested that SES, parental substance use, child mental health problems, and other family characteristics (such as those just mentioned) *may* be excellent severity predictors but are not good candidates for inclusion in screening tools as such information is not routinely available for every case referred to the screening unit. However, if factors such as these were empirically demonstrated to be associated with severe violence toward children their inclusion in screens could help guide intake workers in seeking appropriate information from reporters. As noted earlier, the prediction of injury severity is important not only at intake but also at various stages throughout the life of the case. As cases unfold and workers obtain information on some of the factors noted above, that information could be immensely helpful in assessing the probability of reabuse and injury severity, which could in turn be used to guide decision making about treatment regimen, out of home placement, or case closure.

Hypotheses

Based upon the evidence from studies noted above, the present study included a total of fifteen variables including four child characteristics (gender, age, race, handicapping condition), two family characteristics (number of children in the home, income), two report characteristics (source, season), and seven perpetrator characteristics (gender, age, race, relationship to the child, marital status, history of substance abuse, history of violence). With these variables in mind, the following nondirectional hypotheses were examined:

- (1) Each of the fifteen predictor variables will be related to injury severity when controlling for all other predictor variables.
- (2) The effect of child's age will be different depending on the child's gender (i.e., there is an interaction between child's age and child's gender).
- (3) The effect of the perpetrator's gender will be different depending upon the child's gender (i.e., an interaction between perpetrator's gender and child's gender).

The hypotheses were nondirectional because this area of research is relatively new and undeveloped, and because effects in any direction were felt to be important. The interaction in Hypothesis 2 was included in the present study because of consistent findings by Rosenthal (1988) and Zuravin et al. (1994) indicating that age did not influence the severity of injury for girls, but younger boys were

more likely to be severely injured than older boys. The interaction in Hypothesis 3 was included because of contradictory findings by Rosenthal (1988) and Zuravin et al. (1994). Rosenthal found a statistically significant interaction suggesting that women tend to abuse girls and men tend to abuse boys, perhaps due to family role division with regard to discipline. Zuravin et al. (1994) also included this interaction in their study, though their results showed it was statistically nonsignificant.

CHAPTER III

METHODOLOGY

Data Source

Families in the military are not immune to the problems of family violence. Over fifteen years ago the Air Force recognized a need to respond on behalf of its families and developed treatment programs and services to address child maltreatment and other forms of family violence (Mollerstrom, Patchner, & Milner, in press). The Air Force Family Advocacy Program (FAP) provides guidance and resources to prevent, assess, identify, report and treat families experiencing maltreatment or with exceptional medical or educational needs. Family maltreatment disrupts and drains resources and reduces the readiness capability of military members. The FAP goal is to provide services and support to families to reduce the incidence and impact of family violence, thereby enhancing the health, welfare and morale of Air Force families. Ultimately this impacts the service member's ability to perform assigned duties.

When an incident of alleged abuse or neglect occurs, the family is referred to the Family Advocacy Officer (FAO), usually a clinical social worker, for an initial evaluation. Referrals come from a variety of sources, including commanders, medical providers, neighbors, and school and child care personnel. The FAO reviews family medical records, contacts the family, arranges for appropriate medical appointments, and coordinates with civilian CPS

and law enforcement personnel as necessary. Individual and family interviews are conducted by the FAO. An interdisciplinary case management team meeting follows the initial evaluation, determines whether or not the case is substantiated, and if so, recommends specific treatment strategies and interventions to be offered to the family and individuals involved. It is important to note that immediate access to family medical records provides a wealth of information regarding past instances of abuse, handicapping conditions, etc., which would usually not be available to civilian CPS workers. Because of this, variables not included in earlier studies (because the information is not available at intake) were included in the present study.

The Department of Defense (DOD) (1986,1987,1992) requires that all of the military services collect information on reports of child maltreatment. Consequently, all suspected cases of child abuse and neglect are reported to the Air Force Central Registry, located at Brooks Air Force Base in San Antonio, Texas. All data are reported on a standard form (SF 2486, Child Abuse Incident Report), which identifies the type of maltreatment, source of the initial referral, and other demographic and descriptive data relevant to the case. If a case is substantiated by the multidisciplinary case management team, more detailed information is obtained regarding the victim, the victim's sponsor (military member), the perpetrator, and the circumstances related to the abuse or neglect. Detailed standards and instructions regarding the completion of this form are

provided to all FAO's and interdisciplinary case management team members.

U.S. Air Force central registry data show that during the period from Fiscal Year (FY) 90 through FY 94, there were 33,748 cases of child maltreatment reported, with 16,105 of those substantiated for abuse and neglect (Mollerstrom et al., in press). Table 7 reports the

Table 7 Substantiated and Unsubstantiated Child Maltreatment Cases in the Air Force Reported by Type and Fiscal Year

	FY 90	FY 91	FY 92	FY 93	FY 94	Total
Substantiated						
Physical Abuse	1,236	1,339	1,211	1,208	1,252	6,246
Neglect	1,039	1,150	1,117	1,306	1,113	5,725
Sexual Abuse	460	488	487	409	497	2,341
Emotional Abuse	373	275	323	255	385	1,611
Multiple	80	59	25	13	4	181
Total	3,188	3,311	3,163	3,191	3,252	16,105
Deaths	8	9	7	6	11	41
Unsubstantiated	3,275	3,314	3,565	3,617	3,872	17,643
Total (All Cases)	6,463	6,625	6,728	6,808	7,124	33,748
Substantiation Rate	49%	50%	47%	47%	46%	48%

Source: Mollerstrom, W.W., Patchner, M.A., & Milner, J.S. (in press).
 Child maltreatment: The U.S. Air Force's Response. Child Abuse and Neglect: The International Journal.

number of cases reported and substantiated by type of maltreatment during this five year period, as well as substantiation rates (by percentage) for each fiscal year. The overall substantiation rate of 48 percent compares to a reported civilian substantiation rate of 39

percent, which was determined by averaging the rates from 44 states that ranged from 15 to 63 percent (Daro & McCurdy, 1991).

The present study was conducted on a subset of observations from child abuse reports in the U.S. Air Force Central Registry. Data included selected variables from all substantiated cases of physical abuse from FY 90 through FY 94, approximately 6,250 cases (see Table 6). FY 90 was the first year that all substantiated cases of abuse and neglect included ratings of injury severity (determined by the case management team) according to the Severity of Maltreatment Grid as shown in Table 8. This rating procedure was initiated during FY 88 but was not routinely implemented at all USAF installations until FY 90. All team members receive annual training in the use of this grid to ensure consistent application at the numerous Air Force installations around the globe. Using case vignettes with FAO's who were trained in the use of the grid, interrater reliability of 95% was established by Mollerstrom (1989). It should be pointed out, however, that this is the observed percentage agreement and therefore provides an inflated estimate because it doesn't take into account chance agreement. Orme (1986) recommends the use of chance corrected measures, such as Kappa, to indicate the degree of agreement between actual and predicted classification of subjects:

Kappa is 1 when perfect agreement occurs, 0 when observed agreement equals chance agreement, and less than 0 when observed agreement is less than chance

Table 8: Air Force FAP Severity of Maltreatment Grid

	Low (Mild) 2	Intermediate (moderate) 3	High (severe) 4	Death 5
None 1				
Unsub- stantiated	Minor physical injury (DOD)*, or no medical treatment indicated.	Major/minor physical injury (DOD)*. Short term medical treatment (one visit) may be indicated.	Major physical injury (DOD)*, or long term medical treatment, or in-patient care, or alternate placement.	Death due to non-accidental injury.

* Indicates the Department of Defense definition being used (see p. 100)

Source: Mollerstrom, W.W. (1989). Program evaluation and family advocacy. In the office of the Surgeon General, Family advocacy program manual. Brooks Air Force Base, TX: Author.

agreement. Therefore, Kappa indicates agreement in excess of chance agreement (Orme, 1986, p. 2).

Unfortunately, the data used to compute the 95% interrater reliability figure noted above were unavailable to the author and thus Kappa could not be computed. The implications of the reliability of the Severity of Maltreatment Grid will be discussed in a later chapter.

Since the database used in the present study was devoid of personal identifiers, including names, social security numbers, or locations where the incidents took place, a certificate of exemption from review by the full Human Subjects Committee was granted by the University of Tennessee. The proposal was also submitted through appropriate Air Force research channels for approval subject to conditions and restrictions similar to those required by the University.

Definitions

The following definitions of terms used by the Air Force in dealing with child maltreatment are those specified in DOD instruction 6400.2 (1987). Physical child abuse is the maltreatment of a child under the age of 18 years, which results in a major or minor physical injury. A major physical injury:

includes brain damage, skull fracture, subdural hemorrhage or hematoma, bone fracture, dislocations, sprain (sic), internal injury, poisoning, burn, scald,

severe cut, laceration, bruise, welt, or any combination thereof, which constitutes a substantial risk to the life or well-being of the victim (DOD, 1987, p. 2).

A minor physical injury "includes twisting, shaking, minor cut, bruise, welt, or any combination thereof, which do not constitute a substantial risk to the life or well-being of the victim" (DOD, 1987, p. 2). Note that these definitions require "demonstrable harm" in order for a case to be classified as abusive. The implications of this requirement for the present study will be discussed below. A substantiated case is a case:

that has been investigated and the preponderance of available information (indicated) that abuse (had) occurred. This means that the information that (supported) the occurrence of abuse (was) of greater weight or more convincing than the information that (indicated) that abuse did not occur (DOD, 1987, p. 4).

Severity Predictors

Because the present study used an existing data set, the selection of predictor variables was limited by the information available on the SF 2486. Unlike the studies by Rosenthal (1988) and Zuravin et al. (1994), however, the present study was not limited by the requirement to utilize only predictors known at the time of the initial call to report the abuse. While such an approach is important to the development of intake screening tools, important information

regarding the predictive ability of other variables (e.g., perpetrator substance use, domestic violence, previous history of child maltreatment) may be lost. As noted earlier, assessing risk of injury severity is important not only for those who must prioritize cases for investigation, but also for those who must make critical decisions throughout the various stages of a case (e.g., out of home placement, case closure).

Similar to the strategy employed by Zuravin et al. (1994, p.133), selection of predictor variables was driven by two additional criteria: (1) to build knowledge regarding predictors of injury severity, a predictor was selected if prior research findings were inconsistent or contradictory, and (2) to improve prediction accuracy, a predictor was selected if prior research consistently resulted in an association between the variable and injury severity. A total of fifteen variables met these criteria, including four child characteristics (gender, age, race, handicapping condition), two family characteristics (number of children in the home, income), two report characteristics (source, season), and seven perpetrator characteristics (gender, age, race, relationship to the child, marital status, history of substance abuse, history of violence). Even though severity of abuse allegations made by reporters was found to be a significant predictor of injury severity by Zuravin et al. (1994), this variable was not included as this information is not consistently available on the SF 2486. Mother's age was also eliminated from inclusion for the same reason.

Operational Definitions of Predictors

Child handicapping conditions included in the data set were divided into five categories including physical, emotional, educational, and "multiple" disabilities, and no handicap. However, for purposes of data analysis these were collapsed into two categories, handicap and no handicap. This was done because the total number of children with handicapping conditions was relatively small (6.5%). As the number of cases within specific handicap types was even smaller (physical = 0.86%, emotional = 2.4%, educational = 1.6%, multiple = 1.6%) it was felt that any significant relationships with injury severity could be artifacts of these small sample sizes. This variable was included as a result of Seaberg's (1977) finding that a handicapping condition was predictive of injury severity in young children.

Perpetrator's relationship to the child was divided into five categories: (1) biological parent, (2) step/adoptive parent, (3) nonrelatives (e.g., baby-sitters, child care workers, teachers, neighbors, parents' lovers, or other unrelated persons who were acting in a caretaker capacity), (4) other relatives (e.g., grandparents, aunts, uncles, etc.), and (5) unknown. The division of the "parent figure" category used by Zuravin et al. (1994) into the biological parent and step/adoptive parent categories was intended to show possible differences in injury severity inflicted by biological versus step/adoptive parents. Marital status was included as a variable to further examine family structure as a

possible predictor of injury severity, and was divided into four categories: (1) single, (2) married, (3) divorced/separated, and (4) unknown. Information on those couples who were "living together" was not available in the data set.

Source of report and season of report were both categorized following the same scheme used by Zuravin et al. (1994). Source of report was divided into four categories: (1) anonymous, (2) nonprofessional (e.g., neighbor, relative, friend), (3) other professional (day care workers, teachers, law enforcement personnel), and (4) medical professional (physicians or other staff at medical facilities, including social workers). Season of report was categorized as fall (September, October, November), winter (December, January, February), spring (March, April, May), and summer (June, July, August).

Child and perpetrator race were categorized as follows: (1) White, (2) African American, (3) Hispanic, (4) Asian/Pacific Islander, and (5) Native American. For purposes of data analysis race was collapsed into three categories (white, African American, and other minority). As with child handicapping condition, this was necessitated by the relatively small number of cases involving victims and perpetrators in categories 3, 4, and 5 noted above (12% of perpetrators: Hispanic, 5.8%, Asian, 6.0%, Native American, 0.2%; 11.3% of child victims: Hispanic, 5.6%, Asian, 5.5%, and Native American, 0.2%).

Perpetrator history of violence was divided into three categories: (1) history of violence (previous involvement in an established case of child or spouse abuse), (2) no history of violence, or (3) history of violence unknown. Similarly, Perpetrator history of substance abuse was also divided into three categories: (1) alcohol and/or drug involvement, (2) no alcohol and/or drug involvement, and (3) alcohol and/or drug involvement unknown.

Family income was reported as a ratio variable, vis a vis the number of dollars per year. Income was determined on the basis of the sponsor's rank and military benefits (e.g., housing and separate rations allowances), and thus did not take into account part time jobs and spousal employment. Perpetrator age and child's age were treated as quantitative variables. Finally, perpetrator gender and child gender were treated as dichotomous variables.

Sampling Considerations

As noted previously, the number of substantiated physical abuse cases in the original data set was 6,246. These cases were divided into two parts; one sample (estimation sample) for the model building phase of the analysis, and a second sample for purposes of cross validation. While many writers have suggested that the general cross validation method requires the available sample to be randomly divided into two equal parts (Kerlinger & Pedhazur, 1973), this strategy has been criticized because it does not use all the data to estimate parameter values for the

independent variables (Camstra & Boomsma, 1992; Murphy, 1984). The criticism centers on the belief that underutilization of the information in the sample produces imprecise and inefficient coefficient estimates and correspondingly inefficient predictions, a situation that is particularly aggravated by small samples. To compensate for this problem, others (Cooil, Winer, & Rados, 1987; Picard & Cook, 1984; Thompson, 1994) have suggested that the data can be split into samples of disproportionate size with "substantially less than half of the data for validation" (Cooil et al., p. 272). The present study utilized this approach, with roughly 25% of the original sample held aside for purposes of cross validation. This was accomplished by sorting the cases by severity level and then randomly selecting 25% of the cases in each severity category. Thus, the resulting estimation sample ($n = 4,685$) was felt to be large enough to produce relatively precise parameter estimates, while the validation sample ($n = 1,561$) was also large enough to produce a reasonably reliable validation analysis.

Missing Data

A data check was completed to determine if data entry errors had occurred and to examine the extent of missing data. This check revealed that of fifteen predictor variables, 10 had no missing data, 4 had missing data ranging from 1.3% to 3.3%, and one (perpetrator age) had 9.1% missing data. Using a random assignment within subgroups procedure (Gibson, 1994), substitute values were assigned

by grouping the cases by injury severity and substituting for each missing value the nearest preceding nonmissing value for that item. Compared with mean substitution procedures which are commonly used, this procedure allows a more precise estimate of the missing value based upon use of data contained within the sample, while resulting "in expected variance that is unbiased both for the sample and within subgroups; thus the inflation of the association between variables is avoided" (Gibson: 6). Consideration was given to coding the missing data (Cohen & Cohen, 1983; Orme & Reis, 1991) to include information about the presence or absence of such data, but was ruled out as this procedure is not recommended when the proportion of missing data is less than .10 (Cohen & Cohen, p. 296).

Data Analysis

The data analysis consisted of three parts. First, frequency distributions and descriptive statistics were computed to check for data entry errors or other unusual occurrences in the data. Second, given the ordinal nature of the dependent variable (injury severity), ordinal logistic regression procedures were used to test hypotheses 1-3 above and to develop a prediction model (DeMaris, 1992). Third, the resultant prediction model was applied to the cross validation sample to test the accuracy of the model.

Ordinal logistic regression (OLR) is better suited than ordinary least squares (OLS) regression in the analysis of dependent variables with a limited number of ordered categories, such as injury severity

in the present study (DeMaris, 1992; Winship & Mare, 1984). The assumptions of OLR are as follows: (1) the dependent variable is categorical, with a limited number of ordered categories, (2) the observations are independent of one another, (3) the ordinal dependent variable is an indicator of an underlying continuous variable that has a logistic distribution, (4) the predictors are fixed by design (or can be treated as such), (5) the sample size is large, and (6) no exact colinearities exist among the explanatory variables (DeMaris, 1992).

Like OLS regression, OLR provides a regression slope for each independent variable and a test of statistical significance for each slope. The slope indicates the independent contribution of the predictor variable to the prediction of the dependent variable, while the sign of the slope indicates the direction of the relationship. As in OLS regression, OLR allows for dummy coding (or effect coding) of predictors, hierarchical entry of variables in sets, and testing of interactions using product terms. In OLR the overall fit of the model can be tested (using a likelihood-ratio χ^2 test) as can the incremental improvement in the model due to the addition or deletion of predictors. Finally, with OLR observed and predicted values of the dependent variable can be compared to determine model fit via the degree of agreement, such as the computation of the percentage of agreement, or Kappa.

Logistic regression models have the form:

$$p(\text{something}) = 1/(1 + e^{-z})$$

where $z = B_0 + B_1X_1 + B_2X_2 + \dots + B_kX_k$, and e = the base of the natural logarithm (a non-terminating, nonrepeating decimal which to five significant digits is 2.7182) (Morrow-Howell & Proctor, 1992).

Because the dependent variable has more than two categories, OLR produces multiple intercepts. The different intercepts give different probability estimates relative to different ways of dichotomizing the ordinal dependent variable. For example, in the present study the prediction model produces three intercepts. When the effects of the various independent variables are added to intercept 1, this produces a z value in $1/(1+e^{-z})$ that gives the probability that a case is in the mild injury severity category.

Similarly, when the effects of the independent variables are added to intercept 2 the resultant z value in $1/(1+e^{-z})$ gives the probability that a case is in the moderate, or lower, injury severity category.

When the effects of the independent variables are added to intercept 3 the obtained z value in $1/(1+e^{-z})$ gives the probability that a case is in the severe, or lower, injury severity category. Finally, to obtain the probability that a given case is in the death category, the probability that the case is in the severe or lower category (obtained by using intercept 3 as just described) is subtracted from 1 (i.e., $p[\text{death}] = 1 - [1/(1+e^{-z})]$, where $1/(1+e^{-z})$ uses intercept 3).

In order to minimize the possibility of a Type 1 error the Bonferroni inequality was used to set the individual test-wise alpha

(Cohen & Cohen, 1983; Stevens, 1986). To maintain a Type 1 error rate of .10 or less over the set of 20 statistical tests (15 independent variables, two interaction terms, and three intercept terms in the ordinal logistic model) the individual test level alpha was set at .005 (.10/20). According to the Bonferonni inequality this gives a Type 1 error rate of less than or equal to .09538 ($1-(1-.005)^{20}$) (Darlington, 1990).

Using a password protected computer account, all data were analyzed using Microsoft Excel, SPSS for Windows, and the SAS statistical package at the University of Tennessee Computing Center, Knoxville, Tennessee.

CHAPTER IV

RESULTS

Estimation Sample

Data from a total of 4,685 cases were analyzed and were organized according to injury severity, child characteristics, perpetrator characteristics, and other predictor variables as presented in Table 9. Nearly sixty-four percent (3009) of the children in the sample sustained mild injuries, twenty-nine percent (1379) moderate injuries, six percent (266) severe injuries, and 31 children (0.7 percent) died as a result of maltreatment.

The mean age for the child victims was 8.3 (SD = 4.9) with a range of 0.1 (approximately 1 month) to 17.9 years of age. There were 2,503 (53.4%) male children and 2182 (46.6%) female children in the sample. The racial composition of this group of children was 70.3% white, 18.7% African American, and 11.2% other minorities. Two-hundred-ninety-eight (6.4%) of these children had some type of handicapping condition. The mean number of children in victims' families was 2.38 (SD = 1.14) with a range of 1 to 8, while the mean family income was \$27,634 (SD = \$6,365) with a range of \$17,067 to \$94,236. Approximately 80% of these cases were referred by professionals (medical and other), while the remainder were referred by nonprofessionals (16.1%) or were anonymous (2.4%). As noted in table 9, the largest numbers of cases were referred during the spring and summer while the fewest were referred during the

Table 9: Descriptive Data and Severity Predictors for Estimation
 Sample (N = 4685)

Variable	%	n	M	SD
<u>Categorical Variables:</u>				
Injury Severity				
Mild	64.2	3009		
Moderate	29.4	1379		
Severe	5.7	266		
Death	0.7	31		
Child's Gender				
Female	46.6	2182		
Male	53.4	2503		
Child's Race				
White	70.3	3281		
African American	18.7	877		
Hispanic	5.2	244		
Asian/Pacific				
Islander	5.8	274		
Native American	0.2	9		
Handicap (Child's)				
Handicap	6.4	298		
No Handicap	93.6	4387		
Perpetrator's Gender				
Female	36.1	1692		
Male	63.9	2993		
Perpetrator's Race				
White	69.3	3248		
African American	19.2	899		
Hispanic	5.3	248		
Asian/Pacific				
Islander	6.1	285		
Native American	0.1	5		
Perpetrator's Relationship to Child				
Biological Parent	72.2	3382		
Step/Adoptive Parent	19.8	928		
Nonrelative	4.5	209		
Other relative	0.9	42		
Unknown	2.6	124		

Table 9: (cont.)

Variable	%	n	M	SD
Perpetrator's History of Violence				
No Violence	50.9	2383		
Violence	26.1	1222		
Unknown	23.0	1080		
Perpetrator Alcohol and Drug Involvement				
No Involvement	75.9	3558		
Involvement	5.0	235		
Unknown	19.1	892		
Perpetrator's Marital Status				
Single	4.4	207		
Married	80.5	3777		
Divorced/Separated	11.5	541		
Unknown	3.4	160		
Referral Source				
Anonymous	2.4	112		
Nonprofessional	16.1	752		
Other Professional	57.2	2679		
Medical Professional	24.4	1142		
Season of Report				
Spring	26.2	1228		
Summer	29.2	1370		
Fall	20.9	979		
Winter	23.6	1108		
<u>Continuous Variables:</u>				
Child's Age (Years)			8.34	4.90
Income, Child's Family (Dollars)			27,634	6,365
Number of Children in Family			2.39	1.14
Perpetrator's Age (years)			31.83	6.28

fall and winter.

The mean age for the perpetrators was 31.83 (SD = 6.28) with a range of 11.0 to 65.9 years of age. There were 2993 (63.9%) male perpetrators and 1692 (36.1%) female perpetrators in the sample. The racial composition of this group of perpetrators was 69.3% white, 19.2% African American, and 11.5% other minority groups. By comparison, figures from FY 92 show that racial composition of the entire Air Force was 78.8% white, 15.4% African American, and 5.8% other minorities (Mollerstrom, Patchner, & Milner, 1992). Nearly 72% of the children in the estimation sample were abused by a biological parent, 20% by a step/adoptive parent, 4% by a nonrelative, 3% by an unknown perpetrator, and less than 1% by another relative. The majority of the perpetrators were married (80.5%), followed by those who were divorced/separated (11.5%), single (4.4%), and those whose marital status was unknown (3.4%). While nearly one quarter (26.1%) of the perpetrators had a history of involvement in a prior child or spouse abuse case, half of the perpetrators (50.9%) had no prior history of violence, and the remainder (23.0%) had histories of violence that were unknown. In contrast, only 5% of the perpetrators had a history of known substance abuse, while 75.9% had no such history, and 19.1% had substance abuse histories that were unknown.

Cross Validation Sample

Data from a total of 1561 cases were analyzed and were also organized according to injury severity, child characteristics, perpetrator characteristics, and other predictor variables as presented in Table 10. Once again, nearly sixty-four percent (1003) of the children in the sample sustained mild injuries, twenty-nine percent (459) moderate injuries, six percent (89) severe injuries, and 10 children (0.6 percent) died as a result of maltreatment.

The mean age for the child victims was 8.4 (SD = 4.96) with a range of 0.1 to 17.8 years of age. There were 800 (51.2%) male children and 761 (48.8%) female children in the sample. The racial composition of this group of children was 69.7% white, 19.0% African American, and 11.3% other minorities. One-hundred-six (6.8%) of these children had some type of handicapping condition. The mean number of children in their families was 2.42 (SD = 1.14) with a range of 1 to 8, while the mean family income was \$27,755 (SD = \$6,865) with a range of \$18,305 to \$74,052. Approximately 82% of their cases were referred by professionals (medical and other), while the remainder were referred by nonprofessionals (15.2%) or were anonymous (2.7%). As noted in table 10, the largest numbers of cases were referred during the spring and summer while the fewest were referred during the fall and winter.

The mean age for the perpetrators was 31.90 (SD = 6.16) with a range of 14.1 to 55.0 years of age. There were 1029 (65.9%) male perpetrators and 532 (34.1%) female perpetrators in the

Table 10: Descriptive Data and Severity Predictors for Cross Validation Sample (N = 1561)

Variable	%	n	M	SD
<u>Categorical Variables:</u>				
Injury Severity				
Mild	64.3	1003		
Moderate	29.4	459		
Severe	5.7	89		
Death	0.6	10		
Child's Gender				
Female	48.8	761		
Male	51.2	800		
Child's Race				
White	69.7	1088		
African American	19.0	296		
Hispanic	6.7	104		
Asian/Pacific Islander	4.5	71		
Native American	0.1	2		
Handicap (Child's)				
Handicap	6.8	106		
No Handicap	93.2	1455		
Perpetrator's Gender				
Female	34.1	532		
Male	65.9	1029		
Perpetrator's Race				
White	66.9	1044		
African American	19.7	307		
Hispanic	7.2	113		
Asian/Pacific Islander	5.9	92		
Native American	0.3	5		
Perpetrator's Relationship to Child				
Biological Parent	72.3	1128		
Step/Adoptive Parent	19.7	307		
Nonrelative	4.4	69		
Other relative	0.5	8		
Unknown	3.1	49		

Table 10: (cont.)

Variable	%	n	M	SD
Perpetrator's History of Violence				
No Violence	51.3	801		
Violence	24.6	384		
Unknown	24.1	376		
Perpetrator Alcohol and Drug Involvement				
No Involvement	74.6	1164		
Involvement	5.4	84		
Unknown	20.1	313		
Perpetrator's Marital Status				
Single	4.6	72		
Married	80.8	1262		
Divorced/Separated	11.3	177		
Unknown	3.2	50		
Referral Source				
Anonymous	2.7	42		
Nonprofessional	15.2	238		
Other Professional	59.4	928		
Medical Professional	22.6	353		
Season of Report				
Spring	25.5	396		
Summer	29.4	459		
Fall	21.1	329		
Winter	24.2	377		
Continuous Variables:				
Child's Age (Years)			8.44	4.96
Perpetrator's Age (years)			31.90	6.16
Income, Child's Family (Dollars)			27,755	6,865
Number of Children in Family			2.42	1.14

sample. The racial composition of this group of perpetrators was 66.9% white, 19.7% African American, and 13.4% other minorities. Nearly 72% of the children in the estimation sample were abused by a biological parent, 20% by a step/adoptive parent, 4% by a nonrelative, 3% by an unknown perpetrator, and less than 1% by another relative. The majority of the perpetrators were married (80.8%), followed by those who were divorced/separated (11.3%), single (4.6%), and those whose marital status was unknown (3.2%). As in the estimation sample, nearly one quarter (24.6%) of the perpetrators had a history of involvement in a prior child or spouse abuse case, half of the perpetrators (51.3%) had no prior history of violence, and the remainder (24.1%) had histories of violence that were unknown. In contrast, only 5.4% of the perpetrators had a history of known substance abuse, while 74.6% had no such history, and 20.1% had substance abuse histories that were unknown.

Regression Results

The results of the ordinal logistic regression analysis of the estimation sample are presented in Table 11. The overall model was statistically significant [$\chi^2(30) = 415.66$, $p = .0001$]. However, as can be seen in Table 11, the child age-by-child gender interaction was statistically nonsignificant at the .005 level [$\chi^2(1) = 0.3660$, $p = .5452$]. This was also the case with the perpetrator gender-by-child gender interaction [$\chi^2(1) = 0.1611$, $p = .6881$], so hypotheses 2 and 3 were not confirmed.

Table 11: Results of Ordinal Logistic Regression Analysis of Injury Severity Data

Variable	df	B	Standardized Estimate	χ^2	p	Odds Ratio
Intercept 1	1	0.3745		2.5129	.1060	1.454
Intercept 2	1	2.6376		123.0843	.0001*	13.980
Intercept 3	1	5.0455		294.6211	.0001*	155.317
Income	1	0.000022	0.76644	12.2609	.0005*	1.000
Child Gender	1	-0.0216	-0.005929	0.0226	.8805	0.979
Child Age	1	0.0312	0.084269	8.9388	.0028*	1.032
Child Race (Set)	2			24.931	<.0001*	
Child Handicap	1	-0.2414	-0.032480	3.7762	.0520	0.786
Number of Children	1	-0.0496	-0.031308	2.9868	.0839	0.952
Perpetrator Gender	1	-0.2776	-0.073513	8.4312	.0037*	0.758
Perpetrator Age	1	0.00262	0.009072	0.1846	.6674	1.003
Perpetrator History of Violence(Set)	2			32.862	<.00001*	
Perpetrator Alcohol and Drug Involvement (Set)	2			24.093	<.00001*	
Perpetrator Marital Status (Set)	3			3.582	.3102	
Perpetrator Race	2			10.690	.0047*	
Perpetrator Relationship to Child (Set)	4			5.169	.2703	
Referral Source (Set)	3			122.681	<.00001*	
Season of Report (Set)	3			1.986	.5753	
Child Age x Child Gender	1	0.00781	0.021932	0.3660	.5452	1.008
Perpetrator Gender x Child Gender	1	0.0529	0.014025	0.1611	.6881	1.054

* p-value less than critical .005 level

Of the fifteen predictor variables in the model, 8 were statistically significant at the .005 level: income, child age, child race, perpetrator gender, perpetrator history of violence, perpetrator alcohol and/or drug involvement, perpetrator race, and source of referral. The remaining variables (child gender, child handicap, number of children, perpetrator age, perpetrator marital status, perpetrator relationship to the child, and season of report) were nonsignificant. As hypothesis 1 posited that all fifteen variables would be related to injury severity when controlling for all other variables, it too was not confirmed.

Examination of the regression coefficients for the significant quantitative and dichotomous variables (income, child age, perpetrator gender) reveals that as income increases the probability of more severe injury decreases. Similarly, as child's age increases the probability that more severe injury will occur decreases. In contrast, if the perpetrator is male the probability of more severe injury increases.

Table 12 contains the results of the ordinal logistic regression analysis for the components of the significant categorical variables (e.g., perpetrator history of violence) reported as sets in table 11. Since dummy coding was used to represent these variables in the analysis, each variable that was coded as a 1 appears first versus the reference group, which appears second. For example, the first variable reported in table 12 is perpetrator history of violence (coded 1) versus no history of violence (coded 0).

Table 12: Results of Ordinal Logistic Regression Analysis of Injury Severity Data for Significant Categorical Variables

Variable	df	B	Standardized Estimate	χ^2	p	Odds Ratio
Perpetrator History of Violence Vs. No History of Violence	1	-.04297	-0.104037	32.5165	.0001*	0.651
Perpetrator History of Violence Unknown Vs. No History of Violence	1	-0.2259	-0.052458	6.8487	.0089	0.798
Perpetrator History of Violence Unknown Vs. History of Violence	1	0.2038	0.047333	4.8962	.0269	1.226
Perpetrator's Alcohol and Drug Involvement Vs. No Involvement	1	-0.3957	-0.047621	7.9330	.0049*	0.673
Perpetrator's A & D involvement Unknown Vs. No Involvement	1	-0.3834	-0.083001	20.0915	.0001*	0.682
Perpetrator's A & D Involvement Unknown Vs. Involvement	1	0.0123	0.002656	0.0065	.9356	1.012
Perpetrator race African American Vs. White	1	0.5194	0.112783	10.8457	.0010*	1.681
Perpetrator race Other Vs. White	1	0.0665	0.011691	0.2561	.6128	1.069
Perpetrator race Other Vs. African American	1	-0.4529	-0.079622	6.4016	.0114	0.636

Table 12: (Cont.)

Variable	df	B	Standardized Estimate	χ^2	p	Odds Ratio
Child Race						
African American Vs. White	1	-0.7891	-0.169720	25.0629	.0001*	0.454
Child Race						
Other Vs. White	1	-0.0722	-0.012575	0.3032	.5819	0.930
Child Race						
Other Vs African American	1	0.7169	0.124902	16.2482	.0001*	2.048
Referral Source						
Medical Vs. Other Professional	1	-0.6855	-0.162283	87.5420	.0001*	0.504
Referral Source						
Nonprofessional Vs. Other Professional	1	0.2820	0.057069	9.0641	.0026*	1.326
Referral Source						
Anonymous Vs. Other Professional	1	0.0829	0.020801	0.9816	.3218	1.086
Referral Source						
nonprofessional Vs. Medical Professional	1	0.9675	0.195816	90.0058	.0001*	2.631
Referral Source						
Anonymous Vs. Medical Professional	1	0.9378	0.078988	18.5054	.0001*	2.554
Referral Source						
Anonymous Vs. Nonprofessional	1	-0.0297	-0.002499	0.0173	.8954	0.971

* p-value less than critical .005 level

In this instance, the regression coefficient reveals that if the perpetrator has a history of violence the probability of more severe injury increases ($B = -0.4297$, $p = .0001$) relative to a no history of violence group. The same is true in cases where the perpetrator history of violence is unknown versus cases where there is no history of violence, i.e., the unknown history increases the probability that the injury will be more severe ($B = -0.2259$, $p = .0089$) relative to the no history of violence group. In the third case, where the unknown history of violence by the perpetrator is compared with cases where the perpetrator has a history of violence, the unknown history decreases the probability of more severe injury ($p = .0269$) relative to the history of violence group. It should be noted that while the second and third comparisons are statistically significant at the .05 level, they fail to meet the more stringent .005 critical alpha level established earlier.

As was the case with the perpetrator history of violence variable, perpetrator alcohol and drug involvement increases the probability of more severe injury when compared with a group where the perpetrator had no such involvement ($B = -0.3957$, $p = .0049$). The same is true when a sample in which the perpetrator's alcohol and drug involvement is unknown ($B = -0.3834$, $p = .0001$) is compared with a group where the perpetrator had no such involvement. However, in situations where the perpetrator's history of alcohol and drug involvement is unknown are compared with those

in which there is perpetrator involvement with alcohol and drugs the resulting regression coefficient is nonsignificant ($p = .9356$).

In cases where the perpetrator is African American, the probability of more severe injury is lower ($B = 0.5194$, $p = .0010$) than it is when the perpetrator is white. When perpetrators of other minorities are compared to white perpetrators the result is statistically nonsignificant ($p = .6128$). The same is true in cases where perpetrators of other minorities are compared with African American perpetrators ($p = .0114$).

In contrast to the results reported above, in cases where the child is African American, the probability of injury severity being more severe is greater ($B = -0.7891$, $p = .0001$) than it is if the victim is white. The probability of injury severity of a particular level is the same for white and other minority victims ($B = -0.722$, $p = .5819$) though this finding is statistically nonsignificant. When the victim comes from some other minority group, however, the probability of more severe injury is lower ($B = 0.7169$, $p = .0001$) than it is for African American children.

Finally, of the six comparisons involving the source of referral, four were statistically significant. First, if the case was referred by a medical professional versus other professional the probability increases that injury severity will be more severe ($B = -0.6855$, $p = .0001$). When, however, nonprofessionals refer the case the probability that injury severity will be more severe is lower than when the case is referred by other professionals ($B = 0.2820$, p

= .0026) or medical professionals ($B = 0.9675$, $p = .0001$). This is also the case when anonymous referrals are compared with referrals by medical professionals ($B = 0.9378$, $p = .0001$).

Prediction Model

The re-estimation of model parameters with both the interactions and the nonsignificant predictor variables eliminated was done to develop the most parsimonious prediction model possible. The resultant model, shown in Table 13, is the model that was applied to the cross validation sample to test for prediction accuracy. The results are shown in Table 14. As is readily apparent, the model was unable to predict any cases in the severe injury or death categories. While examination of the row percentages in the table reveals that roughly 95% of the mild severity cases were accurately predicted, the percentage drops dramatically to only 10% when cases of moderate severity are considered. To determine the degree of agreement between actual and predicted values, Kappa was computed for the overall model ($Kappa = .06967$, $z = 4.3561$, $p = < .0005$, 95% CI = .038 to .101). The clinical significance of a Kappa of this magnitude is considered poor.

Table 15 represents the ability of the model to accurately predict cases of mild severity versus moderate, severe, or death. When Kappa is computed in this instance ($Kappa = .14164$; $z = 6.5888$; $p = < .0001$; 95% CI = .099 to .184) there is a slight increase in magnitude but the clinical significance remains poor.

Table 13: Parameter Estimates with Interactions and
Nonsignificant Predictors Eliminated (Prediction Model)

Variable	df	B	Standardized Estimate	χ^2	p	Odds Ratio
Intercept 1	1	0.3282		3.8371	.0501	1.389
Intercept 2	1	2.5640		213.4282	.0001*	12.988
Intercept 3	1	4.9436		405.8372	.0001*	140.276
Income	1	0.000021	0.073668	12.3352	.0004*	1.000
Child's Age	1	0.0375	0.101371	26.9100	.0001*	1.038
Perpetrator's Gender	1	-0.2349	-0.062221	12.5271	.0004*	0.791
Perpetrator History of Violence Vs. No History of Violence	1	-0.4265	-0.103259	32.7973	.0001*	0.653
Perpetrator History of Violence Unknown Vs. No History	1	-0.3055	-0.070950	13.3112	.0003*	0.737
Perpetrator's Alcohol and Drug Involvement Vs. No Involvement	1	-0.3957	-0.047621	7.9330	.0049*	0.673
Perpetrator's A & D involvement Unknown Vs. No Involvement	1	-0.3834	-0.083001	20.0915	.0001*	0.682
Perpetrator race African American Vs. White	1	0.5338	0.115903	10.8457	.0007*	1.705
Perpetrator race Other Vs. White	1	0.0587	0.010315	0.2012	.6537	1.060
Referral Source Medical Vs. Other Professional	1	-0.7264	-0.171969	100.0561	.0001*	0.484
Referral Source Nonprofessional Vs. Other Professional	1	0.2846	0.057610	9.3398	.0022*	1.329

Table 13: (Cont.)

Variable	df	B	Standardized Estimate	χ^2	p	Odds Ratio
Referral Source						
Anonymous Vs. Other Professional	1	0.2442	0.020572	1.3180	.2510	1.277
Child Race						
African American Vs. White	1	-0.8038	-0.172870	25.9933	.0001*	0.448
Child Race Other Vs. White	1	-0.0585	-0.010186	0.1997	.6549	0.943

* p-value less than critical .005 level

Table 14: Severity Observed by Severity Predicted in Cross Validation Sample (N = 1561)

		Predicted				
Frequency	Percent					Total
		2	3	4	5	
Row Pct	Col Pct	Mild	Moderate	Severe	Death	
2 Mild		955	48			1003
		61.18	3.07	0	0	64.25
		95.21	4.79			
		66.41	39.02			
3 Moderate		412	47			459
		26.39	3.01	0	0	29.40
		89.79	10.24			
		28.65	38.21			
4 Severe		65	24			89
		4.16	1.54	0	0	5.70
		73.03	26.97			
		4.52	19.51			
5 Death		6	4			10
		0.38	0.26	0	0	0.64
		60.00	40.00			
		0.42	3.25			
Total		1438	123	0	0	1561
		92.12	7.88			100.00

Note: Kappa = .06967, SE Kappa = .01599, z of Kappa = 4.3561,
p = < .0005, 95 percent confidence interval = .038 to .101

Table 15: Severity Observed by Severity Predicted with Moderate, Severe, and Deaths in Category 3

Frequency Percent Row Pct Col Pct	Predicted		Total
	2 Mild	3 Moderate, Severe, and Death	
2 Mild	900 57.66 89.73 67.57	103 6.60 10.27 44.98	1003 64.26
3 Moderate, Severe, and Death	432 27.67 77.42 32.43	126 8.07 22.58 55.02	459 29.40
Total	1332 85.33	229 14.67	1561 100.00

Note: Kappa = .14164; SE Kappa = .02150; z of Kappa = 6.5888;
 $p = .< .0001$; 95 percent confidence interval = .099 to .184;
the percentage of false negative cases is 77; the percentage
of false positive cases is 10.

In this case the percentage of false negative cases is 77, and the percentage of false positive cases is 10. Since there were no predicted cases of severe injury or death it was impossible to compute a Kappa value for the model's ability to predict severe injury or death cases versus mild or moderate injury cases.

Model Misspecification

As noted in the previous chapter, OLR assumes that the ordinal dependent variable is an indicator of an underlying continuous variable that has a logistic distribution (DeMaris, 1992). When this distributional assumption is false, both the parameters (B's) and the test statistics (χ^2 's) are distorted. Winship & Mare (1984) suggest that if a model is specified to have the correct probability distribution for the errors, the estimated parameters should be invariant (except for sampling variability) through the full range of the independent variable(s). If, however, there is significant variation in estimated parameters across different segments of the range of the independent variable(s) this is evidence that the model is misspecified. Such variation may indicate a number of misspecification errors including, but not limited to: (1) nonlinearities in the effects of the independent variables, (2) interactions among independent variables, and (3) improperly excluded independent variables (Winship & Mare, p. 519).

To test the invariance of the regression coefficients across various levels of the independent variables in the present study, the

following steps were taken. First, the range of each variable was truncated above and below the mean, creating two mutually exclusive segments. Second, a dummy variable was created and assigned a value of 1 for each observation above the mean, and a 0 for each observation below the mean. For example, if child age was less than 8.34 then $X_1=0$, and if child age was greater than 8.33 then $X_1=1$. Third, an interaction was created between the dummy variable (X_1) and the continuous variable (X_1 *child age, for example) and entered in the new model. If the test statistic for the interaction was significant, this was considered evidence that the functional relationship given by the original model was incorrect. This proved to be the case for three of the four variables tested, as shown in Table 16.

Bearing in mind the misspecification ills outlined above, the three significant variables (child age, perpetrator age, number of children) were tested for nonlinearities by entering quadratic terms in the model. Two of these, (number of children)² and (child age)², were statistically significant and thus were retained in the new model. In addition, a number of interactions were explored with four being retained in the new model: (child age)²-by-perpetrator age, child age-by-perpetrator age, African American vs. white perpetrator-by-perpetrator unknown vs. biological parent, and other vs. white perpetrator-by-perpetrator unknown vs. biological parent. The last two were discovered via an exploration of interactions between child race, victim race, and perpetrator relationship to the

Table 16: Results of Tests of the Distributional Assumption

Variable	χ^2	df	p
Child Age	41.6065	1	.0001*
Perpetrator			
Age	11.5476	1	.0007*
Income	0.5997	1	.4387
Number of			
Children	7.265	1	.007*

* p-value less than critical .005 level

child, in an effort to explain the puzzling and seemingly contradictory findings re: child's race and perpetrator's race noted earlier....The full model, with the 2 quadratic terms and 4 interactions, is shown in Table 17. Interestingly, the findings regarding the relationship between child race and perpetrator race and injury severity noted earlier are now statistically nonsignificant.

The results of the application of this new model to the validation sample are shown in Table 18. The new model was able to predict some (though not many) cases in the severe injury category, and the Kappa for the overall model improved slightly, from .06967 to .07646. Examination of the model's ability to distinguish between cases of mild severity versus moderate, severe, or death is shown in Table 19. In this instance Kappa also increased, from .14164 to .17543. Finally, the ability to distinguish cases in the mild or moderate injury severity categories versus severe injury or death cases is shown in Table 20. In this case Kappa = .07744. While the prediction accuracy of the new model remains poor from a clinical standpoint, it demonstrates the importance of including nonlinear relationships and interactions in future prediction models. The reader will note that the third misspecification problem (i.e., improperly excluded independent variables) was not addressed by the new model, and this may account, in part, for the failure of model to predict with greater accuracy.

Table 17: Prediction Model with 2 Quadratic Terms and 4 Interactions

Variable	df	B	Standardized Estimate	χ^2	p	Odds Ratio
Intercept 1	1	-2.0255		20.3829	.0001*	0.132
Intercept 2	1	0.3051		0.4640	.4958	1.357
Intercept 3	1	2.7772		33.7524	.0004*	16.074
Income	1	0.000022	0.076737	12.3436	.0004*	1.000
Child's Age	1	0.6616	1.789074	27.6284	.0001*	1.938
Number of Children	1	0.1644	0.103652	2.8744	.0900	1.179
Perpetrator's Gender	1	-0.1955	-0.051767	8.2315	.0041*	0.822
Perpetrator Age	1	0.0599	0.207226	16.1437	.0001*	1.062
Perpetrator History of Violence Vs. No History of Violence	1	-0.4379	-0.106008	33.5673	.0001*	0.645
Perpetrator History of Violence Unknown Vs. No History	1	-0.2313	-0.053714	7.1490	.0075	0.794
Perpetrator's Alcohol and Drug Involvement Vs. No Involvement	1	-0.3554	-0.042768	6.4117	.0113	0.701
Perpetrator's A & D involvement Unknown Vs. No Involvement	1	-0.3680	-0.079672	18.6140	.0001*	0.692
Perpetrator race African American Vs. White	1	0.0681	0.014782	0.1638	.6857	1.070
Perpetrator race Other Vs. White	1	0.0796	0.013989	0.3325	.5642	1.083
Perpetrator Relationship to Child (PRC)-Step/Adoptive Vs. Biological Parent	1	-0.0527	-0.011572	0.4132	.5303	0.949

Table 17: (Cont.)

Variable	df	B	Standardized Estimate	χ^2	p	Odds Ratio
PRC--Non-relative Vs. Bio. Parent	1	-0.0349	-0.003978	0.0511	.8211	0.966
PRC--Other Relative Vs. Bio. Parent	1	-0.4055	-0.021077	1.6206	.2030	0.667
PRC--Unknown Vs. Bio Parent	1	-1.2860	-0.113826	29.6608	.0001*	0.276
Referral Source Medical Vs. Other Professional	1	-0.6352	-0.150369	71.6682	.0001*	0.530
Referral Source Nonprofessional Vs. Other Professional	1	0.2908	0.058850	9.5283	.0020*	1.337
Referral Source Anonymous Vs. Other Professional	1	0.2066	0.017398	0.9283	.3353	1.229
Child Race African American Vs. White	1	-0.4061	-0.087350	5.9121	.0150	0.666
Child Race Other Vs. White	1	-0.0246	-0.004278	0.0336	.8545	0.976
Number of Children Squared	1	-0.0411	-0.159508	7.3783	.0066	0.960
Child Age Squared	1	-0.0308	-1.495926	17.2505	.0001*	0.970
Child Age Squared x Perpetrator Age	1	0.000723	1.326149	10.3758	.0013*	1.001
Child Age x Perpetrator Age	1	-0.0156	-1.657200	15.3386	.0001*	0.985
African American Vs. White Perpetrator x Perpetrator Unknown Vs. Bio. Parent	1	3.8891	0.149880	23.4531	.0001*	48.865

Table 17: (Cont.)

Variable	df	B	Standardized Estimate	χ^2	p	Odds Ratio
Other Vs. White Perpetrator x Perpetrator Un- known Vs. Bio. Parent	1	-1.2252	-0.046186	6.5580	.0104	0.294

* p-value less than critical .005 level

Table 18: Severity Observed by Severity Predicted in the Cross-Validation Sample for Model with 2 Quadratic Terms and 4 Interactions (N = 1561)

		Predicted				
Frequency	Percent	2	3	4	5	Total
Row Pct	Col Pct	Mild	Moderate	Severe	Death	
2 Mild		940	61	2		1003
		60.22	3.91	0.13	0	64.26
		93.72	6.08	0.20		
		67.14	41.22	15.38		
3 Moderate		405	48	6		459
		25.94	3.07	0.38	0	29.39
		88.24	10.46	1.31		
		28.93	32.43	46.15		
4 Severe		52	34	3		89
		3.33	2.18	0.19	0	5.70
		58.43	38.20	3.37		
		3.71	22.97	23.08		
5 Death		3	5	2		10
		0.19	0.32	0.13	0	0.64
		30.00	50.00	20.00		
		0.21	3.38	15.38		
Total		1400	148	13	0	1561
		89.69	9.48	0.83		100.00

Note: Kappa = .07646, SE = .01720, z of Kappa = 4.44469, p = < .0005

Table 19: Severity Observed by Severity Predicted for Model with 2 Quadratic Terms and 4 Interactions: Prediction of Mild Vs. Moderate, Severe, or Death (N = 1561)

Frequency Percent Row Pct Col Pct	Predicted		Total
	2 Mild	3 Moderate, Severe, and Death	
2 Mild	913 58.49 91.03 68.34	90 5.77 8.97 40.00	1003 64.26
3 Moderate, Severe, and Death	423 27.10 75.81 31.66	135 8.65 24.19 60.00	558 35.75
Total	1336 85.59	225 14.41	1561 100.00

Note: Kappa = .17543, SE = .02138, z of Kappa = 8.20545, $p = < .0001$; the percentage of false negative cases is 76; the percentage of false positive cases is 9.

Table 20: Severity Observed by Severity Predicted for Model with 2 Quadratic Terms and 4 Interactions: Prediction of Mild or Moderate Vs. Severe or Death (N = 1561)

Frequency Percent Row Pct Col Pct	Predicted		Total
	3 Mild, Moderate	4 Severe, Death	
3 Mild, Moderate	1455 93.21 99.52 93.93	7 0.45 0.48 58.33	1462 93.66
4 Severe, Death	94 6.02 94.95 6.07	5 0.32 5.05 41.67	99 6.34
Total	1549 99.23	12 0.77	1561 100.00

Note: Kappa = .07744, SE = .01536, z of Kappa = 5.04033, $p = < .0001$; the percentage of false negative cases is 6; the percentage of false positive cases 0.45.

Finally, the distributional assumption of OLR was tested again for the new model using the three continuous variables identified earlier. Results of this test are shown in Table 21. This time, all three of the interactions were statistically nonsignificant, indicating that the distributional assumption was met by the new model.

Table 21: Results of the Tests of the Distributional Assumption for the Model with 2 Quadratic Terms and 4 Interactions

Variable	χ^2	df	p *
Child Age	1.9618	1	.1613
Perpetrator			
Age	.034	1	.8537
Number of			
Children	.0776	1	.7806

*Critical alpha set at the .005 level

CHAPTER V

DISCUSSION AND IMPLICATIONS

Gottfredson & Gottfredson (1988) state that: reviewing the literature concerning the prediction of dangerousness and the propensity for violence shows that there is little evidence supporting our ability to make these predictions with acceptable accuracy. The prediction of violence is exceptionally difficult, and no one seems to have done it well (p. 252).

This also seems to be the case in the prediction of injury severity in cases of physical child abuse. The results of the present study, as well as those of the few that have preceded it, suggest that such predictions are extremely difficult and that a great deal of further research will be required to determine which variables, in what combinations, and under what circumstances will provide acceptable levels of prediction accuracy. This chapter will begin with a consideration of the findings of the present study in relation to the research hypotheses and the results of previous research. This will be followed by a discussion of limitations of the study. The chapter concludes with a consideration of the implications of the present study for future research, policy, and practice.

Research Hypotheses and Previous Research

As noted in the previous chapter, none of the three hypotheses in the present study were confirmed by the data. Hypotheses 2 (the effect of child's age will be different depending on the child's gender) and 3 (the effect of perpetrator's gender will be different depending upon child's gender) specified interactions that were statistically nonsignificant. Hypothesis 2 was included in the present study because of consistent findings by Rosenthal (1988) and Zuravin et al. (1994) indicating that age did not influence the severity of injury for girls, but younger boys were more likely to be severely injured than older boys. Hypothesis 3 was included because of contradictory findings by Rosenthal (1988) and Zuravin et al. (1994). Rosenthal found a statistically significant interaction suggesting that women tend to abuse girls and men tend to abuse boys, perhaps due to family role division with regard to discipline. Zuravin et al. (1994) also included this interaction in their study, though their results showed it was statistically nonsignificant.

The third hypothesis (that each of the fifteen predictor variables would be related to injury severity when controlling for all other predictor variables) was also unconfirmed when seven of the fifteen predictors failed to meet the .005 level for statistical significance (child gender, child handicap, number of children, perpetrator age, perpetrator marital status, perpetrator relationship to the child, and season of report). The remaining eight variables (income, child age, child race, perpetrator gender, perpetrator

history of violence, perpetrator alcohol and/or drug involvement, perpetrator race, and source of referral) were statistically significant. Each of the predictor variables, beginning with those that were statistically significant, will be discussed below in relation to findings from previous studies.

Child Age

Child age was found to be a statistically significant predictor of injury severity ($B = .0312$, $p = .0028$). While this result suggests that younger children are at greater risk for severe injury, the effect size is relatively small as measured by the odds ratio (1.032). Nonetheless, this finding is consistent with most previous research, leading Hegar et al. (1994) to conclude that the only predictor "found consistently to relate to severity of injury is child age" (p. 180). It makes intuitive sense that younger children are more vulnerable to severe injury due to their physical fragility and relative inability to protect themselves.

Income

Controlling for all other variables in the model, including race of victims and perpetrators, income also made a statistically significant ($B = .000022$, $p = .0005$) contribution to predicting injury severity though, once again, the effect size is quite small (odds ratio = 1.000). However, this needs to be interpreted in the context of the metric used, which was dollars per year. If income were

reported in thousands of dollars per year, perhaps a more meaningful metric, the odds ratio would be somewhat larger (1.022). This finding suggests that as income increases injury severity decreases. This direction is consistent with findings by Wolfner & Gelles (1993) that poor families report 1.5 times more abusive (severe) violence than more affluent families, and analysis of NIS 2 data which suggest that:

the rate of serious injury was almost seven times greater, of moderate harm nearly five times greater, and of probable injury seven times greater for children from lower-income than from higher-income families (NRC, 1993b, p. 236).

Of the multivariate studies specifically designed to examine injury severity as the outcome, none reported family income as a statistically significant predictor, and most did not include it as a study variable. This is especially interesting in light of the fact that lower income families tend to have higher rates of maltreatment (NRC, 1993) and a multitude of social and environmental stressors which increase risk to children. The most plausible and probable explanation is that income information is not routinely (or accurately) recorded in many of the databases which have been used for research in this area. In the case of the Zuravin et al. (1994) study, income was not included as it is not routinely available at the time of intake. Because Air Force families all have a military sponsor, whose rank is readily apparent, information on

income is immediately available when cases of child maltreatment are reported. However, it is important to remember that income was defined for the present study to include only the sponsor's basic pay and allowances. If income from second jobs and spousal employment were included in this variable it is possible that the results reported here would be different.

Perpetrator Gender

As reported in Hegar et al. (1994), numerous authors have found that, after age of the child, perpetrator gender is the predictor most clearly and consistently related to injury severity, with victims of male perpetrators suffering more serious injury. The present study also found this to be the case ($B = -0.2776$, $p = .0037$, odds ratio = 0.758), with male perpetrators 1.3 times as likely to inflict more severe injury than females. However, as was the case with child age and income, this effect size is considered small. Daley & Piliavin (1982, p. 79) comment that it is not surprising that male perpetrators show a tendency to inflict more severe injury, as males are, as a group, larger and physically stronger than their female counterparts.

Child Race

Results of the present study suggest that, when compared with white children, African American children are nearly 2.2 times as likely to suffer more severe injury ($b = -0.7891$, $p = .0001$, odds

ratio = 0.454). Similarly, when children of other minorities were compared with African American children, the African American children were twice as likely to suffer more serious injury ($B = 0.7169$, $p = .0001$, odds ratio = 2.048). As noted earlier, results of the comparison between children of other minorities and white children were statistically nonsignificant. Because of differences in the way that race has been defined and categorized among previous studies, as well as failure of some studies to control for SES, comparisons between studies should be interpreted with caution. Nonetheless, the findings of the present study are consistent with those of Hampton (1987) who found higher rates of serious and moderate injury among African American families, compared to whites and Hispanics. Similarly, studies of child abuse fatalities (Anderson et al., 1983; Greenland, 1987; Jason & Anderreck, 1983) have found that African American children are overrepresented in suspected and confirmed child abuse deaths.

Perpetrator Race

Contrary to results from previous studies, the present study found that African American perpetrators are more likely to inflict less severe injury than white perpetrators ($B = 0.5194$, $p = .0010$, odds ratio = 1.681). Put another way, white perpetrators are more likely to inflict more severe injuries than African American perpetrators. Given the findings regarding child race noted above, this result is surprising and counter-intuitive "because it is

reasonable to assume that the race of the child's family or the perpetrator will, in most cases, match the race of the child" (Hegar et al., 1994, p. 176). Aside from a data coding error (none was found) possible explanations for this finding include the absence of important unmeasured variables in the study, and/or the presence of as yet unspecified interactions or nonlinearities. For example, it is possible that perpetrator race and relationship to the child interact to influence injury severity (as was demonstrated by the model developed during the test of the distributional assumption).

Alternatively, a three way interaction between perpetrator race, child race, and perpetrator relationship to the child may provide clarification of this finding. Previous studies have not included both child race and perpetrator race as separate variables, choosing instead to classify only the race of the child, the family, or the perpetrator. As noted in the previous chapter, comparisons of perpetrators of other minorities with white and African American perpetrators were nonsignificant.

Perpetrator History of Violence

Only one of the comparisons involving perpetrator history of violence was statistically significant. This finding suggests that perpetrators with a history of violence are 1.5 times as likely to inflict more severe injury than those with no history of violence ($B = -0.4297$, $p = .0001$, odds ratio = .651). Since none of the prior studies of injury severity included this variable as a predictor,

comparisons with prior research are not possible. Because data on perpetrators' past involvement in established child and/or spouse abuse cases is often maintained by different agencies (e.g., CPS for child abuse reports, and law enforcement agencies for spouse abuse reports), compilation of accurate and complete data is problematic. This situation is less complicated in the Air Force where data on all types of family violence are maintained in one central registry, and is accessible (by telephone) with relative ease. Family Advocacy Officers have been trained to check the registry, at intake, for a past history of abusive incidents.

Perpetrator Alcohol and Drug Involvement

As with perpetrator history of violence, perpetrators with a history of alcohol and drug involvement are 1.5 times more likely to inflict more severe injuries when compared to those who have no such history ($B = -0.3957$, $p = .0049$, odds ratio = .673). Similarly, those whose alcohol and drug involvement is unknown are 1.5 times as likely to inflict more severe injury than those who have had no alcohol or drug involvement ($B = -0.3834$, $p = .0001$, odds ratio = 0.682). Once again, this variable was excluded from some of the more recent studies of injury severity (e.g., Zuravin et al. 1994) because this information is not routinely available at the time of intake. That alcohol and drug involvement may be related to injury severity is not surprising in light of the extensive evidence relating substance abuse to violent offending and victimization (NRC, 1993b,

Vol. 3), though the specific processes and mechanisms of those relationships are complex and as yet unspecified. It is also not surprising that those perpetrators whose alcohol and drug involvement are unknown would be more likely to inflict severe injury than those with no such involvement, since the "unknown" group would likely include some who did, in fact, abuse alcohol and/or drugs.

Referral Source

Finally, as noted in the previous chapter, four of the six comparisons involving source of referral were statistically significant, and suggested that injury severity is greatest when the case is referred by a medical professional (2 times more likely than those referred by other professionals). The remaining comparisons involving medical professionals suggest that when nonprofessional and anonymous reporters are compared with medical professionals the likelihood of more severe injury decreases dramatically (2.6 times less likely with nonprofessionals, and 2.5 times less likely with anonymous reporters). In the only prior study to examine referral source, Zuravin et al. (1994) also found that severity is greater when the source of referral is a medical professional. They suggest that this may be due to: "(1) the size and injury risk status of the child population seen daily by the medical profession, (2) their greater knowledge of abuse signs and symptoms, and (3) their heightened suspicion of injuries" (p.137). The fourth and final

significant comparison in the present study indicates that when cases are referred by nonprofessional reporters the likelihood of more severe injury is also lower, though the effect size is much smaller than in the comparisons noted above.

Summary

The probability of more severe injury is higher when: (1) the perpetrator is white, male, has a history of previous violence, a history of drug and alcohol involvement that is known (or unknown), (2) the child victim is younger, African American, with a lower family income, and (3) the case was referred by a medical professional. Conversely, the probability of severe injury is less when: (1) the perpetrator is African American, female, and has no history of violence or drug and alcohol involvement, (2) the child victim is older, white or another minority, with a higher family income, and (3) the case was referred by a nonmedical professional, a nonprofessional, or an anonymous reporter.

Predictor variables receiving limited support in previous research as being related to injury severity but not supported by the data in the present study include: child gender, child handicap, perpetrator relationship to the child, and season of report. Perpetrator age, number of children in the family, and perpetrator marital status (variables not extensively examined in past studies) were also unrelated to injury severity in the present study. All of these statistically nonsignificant variables were left out of the

final prediction model shown in table 12. As noted in the previous chapter, when this model was applied to the cross validation sample as a test of prediction accuracy it fared poorly, with only a 6.9% improvement on chance.

Discussion and Limitations

As noted by Zuravin et al. (1994), failure to predict severe injury and death as well as the poor ability to predict moderate injury is disappointing as these are the outcomes practitioners most need to identify. Why did the present study fail to develop a better model than previous studies? Any number of problems, alone or in combination, may account for this failure. Methodological differences between this and existing studies (e.g., population from which the sample was drawn, sample size, definitions of criterion and predictor variables, reliability of data collection efforts, point in time represented by the sample) make explanation of contradictory findings exceedingly difficult. "More to the point, empirical research designs are valid only to the extent that the substantive model under consideration is valid and properly specified" (Chaiken, Chaiken, & Rhodes, 1993). Such specification is difficult because, as discussed previously, theoretical models for predicting the occurrence of physical child abuse, let alone its recurrence or severity, are lacking. Absent such theories, the present study was an exploratory analysis of the correlates of physical abuse and injury severity based upon previous studies of a

similar nature. Possible explanations for the failure of this study to improve on, or replicate, the findings of previous efforts are discussed below.

Population Differences

The present study consisted of a retrospective, exploratory analysis of a large sample of substantiated cases of physical child abuse reported to the U.S. Air Force Central Registry between 1990 and 1994. Differences between this population and the civilian populations examined in previous studies may be substantial (e.g. differences in age, gender, racial composition, employment status, mobility). For example, Zuravin et al. (1994) reported that 71.6% of the children in their study population were African American, compared with 18.7% in the present study. Further, many military families experience unique stressors (e.g., family separations, geographic mobility, living abroad, lack of family support, lack of privacy, isolation) which may affect them differently than the unique stressors associated with life in a large metropolitan area such as Baltimore, Maryland (the population in the Zuravin et al. study).

Definitions

In the present study, substantiated cases included only those cases where actual physical injury had occurred, due to the "demonstrable harm" requirement in the definition of physical abuse.

However, the Zuravin et al. (1994) study included cases where no injury had occurred because of the "endangerment" requirement in their definition: "For *no injury* the child was the victim of unacceptable modes of physical discipline or aggression that endangered his or her well-being but did not result in physical injury" (p. 133). Definitional differences such as these with regard to what constitutes a substantiated case complicate the interpretation of differences across studies. Further, the present study included death as the highest level of injury severity whereas these cases were not included in the Zuravin et al. (1994) study. Other researchers have defined injury severity in still other ways including mild vs. serious (Rosenthal, 1988), probable vs. moderate, serious or death (Hampton, 1987), and according to an 11 point scale based upon specific injury type (Daley and Piliavin, 1982; Seaberg, 1977). Once again, these differences may contribute to differences in findings across studies, and point to the need to standardize definitions in future research efforts.

Interrater Reliability

In spite of efforts to ensure the reliability of the use of the FAP Severity of Maltreatment Grid as discussed earlier, it is entirely possible that different case management teams in different locations, and at different times might have adopted different criteria in its application. In this case the strength of relationships between the predictors and the criterion may have been attenuated

thus leading to diminished model fit. The same is true with regard to what constitutes a substantiated case. For example, in some instances the occurrence of a minor bruise or welt may not have led to a determination that a case was substantiated (in spite of clear direction otherwise) thus eliminating the case from consideration in the present study because detailed information on unsubstantiated cases is not maintained in the Air Force central registry.

Base Rate

Explanation for the failure to adequately predict moderate and severe injuries (not to mention deaths) can be attributed, in part, to the low rate of these injuries in the data. To illustrate, Table 22 contains categorizations of injury severity in four studies (including the present study) and the percentage of cases in each category. While the specific categories differ somewhat across studies, the percentages in the serious and severe categories all reflect the fact that the base rate for these injuries is relatively low, thus making prediction for these categories particularly difficult. This is so because as the base rate of a targeted behavior approaches either zero or 100 percent, prediction in any particular case that the outcome will resemble that of the modal group in that population will be more reliable than a prediction based on the most sophisticated device (Meehl & Rosen, 1955). Since the rates of serious/severe injury in Table 22 range from 3.9% to 9.2%, the best

Table 22: Rates of Injury Severity Across Studies

Study	Severity Categorization	%
Rosenthal (1988) (N = 37,801)	Mild	37.2
	Serious	3.9
	Sexual	21.4
	Neglect	45.3
Hampton (1987) (N = 4,253)	Probable	65.9
	Moderate	24.8
	Serious	9.2
	Death	0.2
Zuravin et al. (1994) (N = 789)	No Injury	37.0
	Mild	44.5
	Moderate	13.9
	Severe	4.6
Present Study (N = 6,246)	Mild	64.2
	Moderate	29.4
	Severe	5.7
	Death	0.7

prediction for anyone in those groups is that he or she will not suffer a serious/severe injury.

Unmeasured Variables

Finally, failure of the prediction model to adequately predict varying levels of injury severity may be due to the absence of some critical unmeasured variables, which, either alone or in combination, may improve the model's accuracy. As noted earlier, different combinations of variables may be able to distinguish between different levels of injury severity. The Zuravin et al. (1994) study indicated that their model was very good ($\kappa = .62$) at predicting cases in the no injury versus mild, moderate, and severe categories. Some of the variables from their study and those in the present study showed some improvement over chance in predicting mild versus moderate and severe injuries. As yet, no combination of predictors has been found to predict severe injuries or death. Important omissions from the present study's group of predictors include various contextual and environmental characteristics such as household transiency (particularly relevant to military families), housing and population density, and community social disorganization (as measured by density of friendship networks and participation in formal and voluntary organizations). These types of variables have been found to be associated with severe violence toward children (Gelles, 1989; Gelles & Wolfner, 1991), and with

violent victimization and offending (Sampson & Lauritsen, 1993) in general.

Implications for Research, Policy, and Practice

Research

That the model developed in the present study was unable to predict injury severity with an adequate level of accuracy is not surprising, in that the final prediction model was, essentially, a main effects model, not likely to be reflective of the complexities of real life. In addition, most of the variables included in the model were individual level variables (i.e., ascribed or achieved characteristics such as age, gender, race, marital status, income). Previous research efforts on child maltreatment, and violent behavior in general, have suggested, however, that failure to include situational variables (i.e., factors that influence the initiation or outcome of a violent event such as the presence of drugs or alcohol, family processes, victim resistance) and community level or contextual characteristics (e.g., household transiency, income inequality, population density) has limited our understanding of these complex phenomena (Sampson & Lauritsen, 1993). Situational and contextual level variables may be particularly important in military communities where frequent deployments, increased readiness postures, and household transiency are common occurrences.. Therefore, future research efforts need to consider a

multilevel perspective which includes examination of individual, situational, and community level variables:

We would urge that situational variables be collected, quantified, and analyzed. Researchers have repeatedly found that classification and prediction models are not stable when applied in environments other than those in which they were developed. However, by learning which environmental factors most effect classification and prediction and by controlling for them, it may be possible to apply the same instruments across different situations (Sampson & Lauritsen, 1993, p. 281).

In addition to the inclusion of multilevel variables, future research efforts need to consider interactions between variables both within and between various levels. Interactive models are much more likely to reflect the complexity of real life and should help to improve prediction accuracy. Examples of interactions that the data in the present study suggest as possibilities include an interaction between child handicap and child age (Seaberg, 1977, found that a handicapping condition was predictive of injury severity for children below three years of age), and an interaction between perpetrator age and child age (Zuravin et al., 1994, found a significant interaction between mother's age and child age). A third possibility, mentioned earlier, is the possible interaction of child race and perpetrator relationship to the child, which may help to explain the seeming contradiction that African American children

are more likely to incur a more severe injury, while white perpetrators are more likely to inflict more severe injury.

As with interactions, future research efforts need to consider the possibility that relationships between variables may be nonlinear. It is possible, for example, that child age has a curvilinear relationship with injury severity, or that the relationship between family income and injury severity is also nonlinear. Including such relationships in future prediction models should help to improve our understanding of this complex process and our efforts at prediction.

Sampson & Lauritsen (1993) have suggested that considerable clarification of past findings could be achieved by secondary analysis that goes back to the raw data from previous studies and defines comparable variables, both predictor and criterion. As noted earlier, definitional differences between studies have made comparison of findings difficult at best. Reanalysis of already collected data using standardized definitions may help considerably in understanding conflicting results. More important, however, is the need to standardize definitions for future studies. Zuravin (1991) comments: "If we fail to formulate agreed upon definitions, researchers will use their own definitions, and the field will continue to be faced with the problem of not being able to integrate findings across studies" (p. 101).

Policy

Implications of the present study for policy are twofold. First, Air Force and DOD planners and policy makers should carefully examine the current demonstrable harm definition of physical child abuse and consider adoption of an endangerment definition. The current definition is limiting to both researchers and practitioners, and is not consistent with definitions used in many civilian communities (e.g., Baltimore, Maryland). Researchers are limited because without an actual physical injury a case cannot be substantiated, and without substantiation complete data on a case is not routinely collected. Thus, comparisons between findings in the present study and those of Zuravin et al. (1994), for example, become problematic. Practitioners are limited as well because unsubstantiated cases must be closed and treatment services terminated once the case status is determined, leaving the child in a potentially dangerous situation.

Second, DOD policy makers should strongly consider redesigning the data keeping system to further enhance the capability for effective program evaluation and research. More detailed information on the SF 2486 would enable researchers to examine more complex and perhaps more realistic models for classification and prediction. Specifically, information on contextual and situational variables should be included. While this process is likely to be resisted by practitioners who must complete the forms, the investment of time and energy may lead to significant

long term benefits. At the same time, policy makers should make every effort to bridge the gap between researchers and practitioners by providing more opportunities for both groups to interact and share information in a meaningful and mutually beneficial manner.

Practice

Results of the present study suggest that practitioners need to continue efforts to train and educate nonmedical professionals and nonprofessionals in Air Force communities about the signs and symptoms of child maltreatment and the need to be inquisitive about injuries to children. Through enhanced educational and training programs cases may be identified and referred for treatment services before more severe injuries can occur. While such training is currently required for many nonmedical professionals (especially those who must interact with children, e.g., day care providers), opportunities exist to improve these efforts as well as to extend them to families who reside on military installations. Through Family Support Centers and orientations for newcomers almost all families can be reached for some type of educational/training experience.

Findings in the present study related to perpetrator history of violence are not surprising, especially since "the best predictor of future violent behavior is past violent behavior" (Chaiken, Chaiken, & Rhodes, 1993,p. 281). However, practitioners need to be reminded of the importance of this variable as a risk factor for more severe

injury. The same is true with regard to perpetrator alcohol and drug involvement. As the drug that is most consistently and seriously linked to many types of aggressive and violent behavior (Miczek, et al., 1993), alcohol involvement should serve as a red flag for practitioners, law enforcement officers, and others involved in the identification, investigation, and treatment of child abuse. While the relationship between drug abuse and violence is much less clear, there are reasons to believe that this too should serve as a marker for increased risk of more severe injury.

Concluding Statement

While the results of the present study were somewhat disappointing, the search for empirically derived predictive tools in child maltreatment remains a worthy goal for researchers. Once developed, such tools will be of immense value to those who must make decisions about when to investigate, open, and close cases, especially in light of budget cutbacks and shrinking resources.

Confirming hypotheses and replicating findings from previous studies is intrinsically satisfying, yet there is much (perhaps more?) to be learned when the opposite occurs. For as Will Rogers once said: "Ignorance lies not in the things you don't know, but in the things you know that ain't so." Hopefully, in the process of trying to determine why hypotheses or previous findings were not confirmed, researchers learn not only how to make their designs and methods more rigorous, but also discover what new areas need to be explored.

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VITA

Lieutenant Colonel Jeffrey B. Paddock was born in Columbus, Ohio, on October 5, 1950. As the son of an Episcopal minister, he lived in several towns and cities in Southern Ohio before graduating from Cincinnati's Anderson High School in June of 1968. He completed his Bachelor of Arts degree in 1972 at Baker University in Baldwin, Kansas, majoring in Sociology with a minor in Psychology. Following graduation he married his college sweetheart, Ruth Leitnaker (August 18, 1972) of Kingston, Tennessee, and began a three year tour with the U.S. Army as a social work/psychology specialist. Upon completion of assignments in the Republic of Panama and the state of Maryland, he was honorably discharged in August of 1975. Two years later he was awarded his Master of Social Work degree from the University of Kansas, and began work with the emergency services/crisis team at a comprehensive community mental health center in Gallipolis, Ohio. In 1979 he accepted a position as Director of Social Services at a 300 bed, acute care medical facility in the same community.

Commissioned an officer in the United States Air Force Biomedical Science Corps in November of 1981, he spent the next eleven years serving in assignments in Maryland, Germany, New Hampshire, and California. He is a distinguished graduate of the U.S. Air Force Squadron Officer School (1983) where he was awarded the Commandant's Trophy as the most distinguished graduate of 686 Air

Force Officers, and completed the Air Command and Staff College via correspondence in May of 1993. His military decorations include the National Defense Service Medal, two Air Force Commendation Medals, and two Meritorious Service Medals. Lt. Col. Paddock has two children, Brian Baxter Paddock (born April 12, 1980) and Katherine Maclean Paddock (born February 1, 1985).

In the fall of 1992, the author began Ph.D. studies at the University of Tennessee, Knoxville, in the College of Social Work, sponsored by the Air Force Institute of Technology. During this academic period at the University of Tennessee, the author was inducted into the Phi Kappa Phi national honor society and became a charter member of the Society for Social Work and Research.