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OCCURRENCE AND RECURRENCE OF PHYSICAL ABUSE IN YOUNG CHILDREN: A SECONDARY ANALYSIS OF NCANDS

By

Vincent John Palusci, M.D.

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ABSTRACT

OCCURRENCE AND RECURRENCE OF PHYSICAL ABUSE IN YOUNG CHILDREN:
A SECONDARY ANALYSIS OF NCANDS

By

Vincent John Palusci, M.D.

Child maltreatment report information for 1995-1999 from the Detailed Case Data Component of the National Child Abuse and Neglect Data System (NCANDS-DCDC) was used to study: (1) the first occurrence of physical abuse as compared to other maltreatment in children under three years, and (2) the recurrence of physical abuse in a cohort of children first physically abused during infancy.

Among 577,655 reports concerning children under three years of age, there were 27,367 first confirmed physical abuse reports in 16 states during 1995-1999 in NCANDS-DCDC. The mean annual incidence of first confirmed reports for physical abuse was 2.3 cases per 1,000. Physical abuse recurred before age three years in 5.8% of children at a rate of 0.024 cases per person-year. While caretaker problems with drugs (risk ratio, RR= 2.4; 95% confidence interval, 95%CI=[1.2, 4.8]) and emotional disturbance (11.7; [5.4, 25]) were positively associated with physical abuse recurrence in a cohort of children first abused during infancy, medical report source (RR=7.0), male gender (10.8), child medical problems (23.4), foster care services (0.0007) and time to post-investigation services (1.004/day) were associated with recurrence in multivariate proportional hazard models. These results should be interpreted with caution due to the limitations of these analyses and the substantial lack of information in certain fields in NCANDS-DCDC.

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This work is dedicated to the memory of Dr. Ray Helfer, to those who strive to improve the lives of children and families, and to those who support their work.

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INTRODUCTION

The physical abuse of young children caused injury and/or death in 166,626 U.S. children in 1999 (Administration on Children, Youth and Families, 2001). Despite the creation of reporting laws and governmental agencies for child abuse investigation, many surviving children are then re-abused (Alexander, Crabbe, Sato, Smith, Bennett, 1990; Benedict, Zuravin, Brandt, Abbey, 1994; DePanfilis, Zuravin, 1998). Young children and infants are at particular risk for severe physical injury and death given their small size, with 50% of fatal child abuse occurring during infancy and 75% occurring from birth to age three years (Hicks & Gaughan, 1995; Ellis, 1997). Shaken Baby Syndrome and other inflicted neurologic injuries during the first three years of life result in significant long-term disability and handicap in infants (Hennes, Kini and Palusci, 2001).

While much has been learned about the patterns of abusive injury in young children, little has been reported regarding the incidence and risk factors for abuse and re-abuse in large populations (DePanfilis & Zuravin, 1998). Understanding factors associated with re-abuse has the potential to save lives by improving our assessment of a family's risk for re-abuse, enhancing our measurement of the outcome of investigation and treatment programs, and efficiently targeting limited resources (Brayden, Altemeier, Dietrich, et al. 1993; Oates & Bross, 1995; Kasim, Cheah & Shafie, 1995).

This study assesses the frequency, incidence and risk factors associated with the occurrence and re-occurrence of physical abuse in infants and children under three years of age by secondary analysis of child maltreatment reports during 1995-1999 in the Detailed Case Data Component of the National Child Abuse and Neglect Data System.

History and definitions

In 1946, John Caffey described fractures and intracranial injuries in children that were caused by their parents, which Kempe and others later described as "the battered child syndrome" (Caffey, 1946; Kempe, Silverman, Steele, Droegmueller and Silver, 1962). With the adoption of the U.S. Child Abuse Prevention and Treatment Act in 1974, medical and other professionals were mandated to report suspected child abuse and neglect to governmental agencies. State child protective systems were created to collect and investigate such reports, and the National Child Abuse and Neglect Data System (NCANDS) began to compile data concerning reports from all U.S. states and territories as required by law (CAPTA, 1988). Child Protective Services agencies (CPS) were created in each U.S. county or other jurisdiction to receive child maltreatment reports, decide if investigation is necessary, investigate, then determine if investigated reports are substantiated or indicated (have credible evidence) or unfounded (are without credible evidence). CPS agencies may provide family preservation or family support services, or CPS may remove children from the home and/or petition courts to terminate parental rights based on state statutes (Administration on Children, Youth and Families, 2001).

The first NCANDS report was published in 1992 with summary information from 1990. In an effort to assess risk factors and service outcomes, state CPS agencies were later given the opportunity to voluntarily submit expanded information about child, family and services provided to the Detailed Case Data Component (DCDC) of NCANDS (Gaudiosi et al., 2001; Administration on Children, Youth and Families, 2001). Although precise definitions vary from state to state, child abuse and neglect reports in NCANDS

are generally defined based on federal guidelines to include the following (CAPTA, 1988; Sedlak, 1996; National Data Archive on Abuse Child Abuse and Neglect, 2000):

> Child physical abuse has been defined as non-accidental acts by their parents or caretakers that cause or could cause physical injury to children less than 18 years of age. This is operationalized to mean that physical abuse is characterized by physical injury (for example, bruises and fractures) resulting from punching, beating, kicking, biting, burning, or otherwise harming a child. Although the injury is not an accident, the parent or caretaker may not have intended to hurt the child. The injury may have resulted from over-discipline or physical punishment that is inappropriate to the child's age or condition.
>
> Child sexual abuse is the involvement of children under the age of 18 in sexual or incestuous acts they do not fully comprehend, cannot give legal consent to, and that violate criminal sexual conduct laws or social taboos. CAPTA defines sexual abuse as "the use, persuasion, or coercion of any child to engage in any sexually explicit conduct (or any simulation of such conduct) for the purpose of producing any visual depiction of such conduct, or rape, molestation, prostitution, or incest with children."
>
> Emotional Maltreatment / Psychological Abuse includes acts or omissions by the parents or other persons responsible for the child's care that have caused, or could cause, serious behavioral, cognitive, emotional, or mental disorders. In some cases of emotional/psychological abuse, the parental acts alone, without any harm evident in the child's behavior or condition, are sufficient to warrant CPS intervention; for example, the parents/caretakers use extreme or bizarre forms of punishment, such as torture or confinement of a child in a dark closet. For less severe acts, such as habitual scapegoating, belittling, or rejecting treatment, demonstrable harm to the child is often required for CPS (the public agency providing services to abused and neglected children and their families) to intervene.
>
> Child neglect is the physical neglect, child abandonment and expulsion, medical neglect, inadequate supervision, emotional neglect and educational neglect by parents, parent substitutes, and other adult caretakers of children.

Impact of physical abuse

There were 166,626 known victims of physical abuse (PA) in the U.S. in 1999 with 1,082 fatalities (Administration on Children, Youth and Families, 2001). Physical abuse consistently accounts for approximately one-fifth of confirmed reports to Child

Protective Services, and while other forms of maltreatment appear to be declining, the annual incidence of physical abuse has declined only 29% since its peak in 1995. This compares to the contemporaneous decline of 39% in sexual abuse substantiated reports during 1995-1999 (Jones, Finkelhor, Kopiec, 2001). Additional injuries are increasingly labeled as physical abuse as patterns of abusive injuries have become clinically apparent beyond those initially described in a 'battered child' (Gillenwater, Quan & Feldman, 1996; Goldstein, Kelly Bruton and Cox, 1993; Kasim, Cheah & Shafie, 1995; Oates & Bross, 1995; Rivara, 1985; Wolfner & Gelles, 1993).

Despite these declines, Reece & Sege noted that abuse accounted for a large proportion of serious head trauma, subdural hematoma, subarachnoid and retinal hemorrhage in children under six years of age. Higher mortality and longer hospitalizations have been noted among children with physical abuse as compared to children with accidental injuries (Reece & Sege, 2000; Thomas, Leventhal & Friedlaender, 2001). Infants are at particular risk; 'serious' forms of physical abuse including head trauma, bone fracture and other "grievous harm" accounted for nearly one-half of reported PA in Wales infants (Sibert et al., 2002). Marshall noted that while child abuse hospitalizations comprise less than 1% of pediatric hospital admissions and while only 0.2% of children reported to Child Protective Services require hospitalization, more than half of those hospitalized were infants and 15% died (Marshall, 1997). Children identified as 'high risk' for abuse by clinicians on the postpartum record in New Haven were hospitalized more often and for longer periods of time during the first four years of life than were children matched on socioeconomic status and other factors drawn from the same population (Leventhal, Pew, Berg & Garber, 1996). Among 5,446 children in three

cities, children were more likely to be reported to CPS for head trauma than for neglect, and poverty, young age of the child and single parent family were independently associated with increased frequencies of concern and reporting to CPS (Thyen, Leventhal, Yazdgerdi & Perrin, 1997).

Studies of physical abuse have been limited by small sample sizes. Large databases such as NCANDS and national registries offer opportunities to improve our understanding (Wissow & Wilson, 1988). For example, DiScala noted that child abuse accounted for 10.6% of all blunt trauma in children under age five years in the National Pediatric Trauma Registry over a 10 year period and that abused children were mainly injured by battering (53%) and by shaking (10.3%), with head injuries accounting for more than 60% of those affected, followed by extremities, thorax, abdomen, face and skin (DiScala, Sege, Li & Reece, 2000). Bertolli (1995) has suggested that analyses using several designs with large populations offer the most promise for understanding child maltreatment.

Risk factors

Several risk factors have been identified in families who maltreat children. Low maternal education (odds ratio, OR=2.6), low religious attendance (OR=2.2), young maternal age (OR=3.5), single parent (OR=2.3) and poverty (OR=3.7) were all statistically associated with increased risk for abuse in New York City in 1992 (Brown, Cohen, Johnson & Salzinger, 1998). Other family characteristics such as early parental separation, dissatisfaction, illness, pregnancy complications, child disability and low parental involvement were also significantly associated with abuse (Brown et al., 1998). In one of the few case-control studies of disability and maltreatment, Crosse noted that

'disabled' children were 1.7 times more likely to be maltreated than were non-disabled children, with neglect thought to be more common than physical abuse, and disabled children being older and having higher levels of emotional abuse (Crosse, 1993). Physical abuse has been also associated with young maternal age in several studies (Connelly & Straus, 1992). Among children assessed in the neonatal period, maternal depression, poor education, disability, alcohol consumption, poverty, and maternal separation from their own mothers were significant predictors of child maltreatment reports through the fourth year of life (Kotch, Browne, Dufort & Winsor, 1992). Furthermore, parental education, psychiatric illness, sexual abuse as a child, and absence of the father has also been associated with abuse in the U.K. (Sidebotham, Golding, ALSPAC, 2001). The presence of violence between the parents has been shown to limit the positive impact of home visitation programs designed to prevent child maltreatment (Eckenrode, et al., 2000).

The Third National Incidence Study of Child Abuse and Neglect (NIS-3) surveyed 'sentinel' child welfare professionals in 83 U.S. counties in 1992-1993 to identify all cases of child abuse and neglect in child protective services, criminal justice, healthcare and social service systems. Using a weighted, randomized county selection process designed to be nationally representative, NIS-3 identified poverty and family size but not race/ethnicity as risks for all forms of maltreatment, although there is controversy regarding sample selection bias and potential racial differences in child abuse reporting (Ards and Harrel, 1993; Ards, Chung and Myers, 2001; Cappelleri, Eckenrode and Powers, 1993; Sedlak and Broadhurst, 1996; Sedlak, Bruce & Schultz, 2001). Rates of physical abuse were found to be 21.3 per 1,000 in NIS studies, compared to 35.5 per 1,000 in disabled children. More physical abuse was likely to be reported to Child

Protective Services (CPS) agencies in NIS-3 among younger children as compared to other forms of abuse, but race, gender and income were not predictive of physical abuse (Sedlak & Broadhurst, 1996; Administration on Children, Youth and Families, 2001). The relationship of abuse to poverty remains incompletely understood, and physical abuse in infancy and young childhood was not specifically addressed in NIS-3 (Ards et al., 1993; Drake et al., 1996).

Recurrence of physical abuse

Despite CPS reporting and investigation, physical abuse recurs. Small studies of abusers have reported re-abuse rates ranging from 16-67%. Alexander noted that 71% of children with Shaken Baby Syndrome had evidence of prior abuse or neglect, with one third having prior shaking injury (Alexander, Crabbe, Sata, Smith & Bennett, 1990). Ferleger noted that physical abuse can recur in the form of excessive corporal punishment, or other maltreatment such as emotional abuse can continue or escalate despite a decrease in physical abuse after investigation and treatment termination by Child Protective Services (Ferleger, Glenwick, Gaines & Green, 1988). Levy noted a 16.8% frequency of re-abuse among 304 children discharged from an inpatient assessment and treatment program over 5-6 years (Levy, 1995).

It is difficult to predict which families will reabuse their children. In a review of 53 studies of abuse recurrence in cases reported to CPS, more recurrence was noted with increasing 'risk' as determined by CPS, ranging from 1-2% for 'low risk' families to over 50% for 'high risk' families over five years (DePanfilis & Zuravin, 1998). 'Risk' is variably identified during case investigation by CPS agencies and is often used to determine the

level of services provided to 'reunify' children with their families (Chaffin, Bonner, Hill, 2001). Marital status and poverty were associated with recurrence in some studies, and there was a tendency for re-abuse to occur with more frequency among children not reported to CPS. A careful review of risk assessment data from several CPS state agencies noted that White children had greater risk for abuse recurrence than did Black children, who were more likely to be neglected (Baird, 1999).

Child maltreatment can recur during investigation or after removal of the child from the parents (DePanfillis, 1999). Delays in removal from the caretakers or petition for juvenile court jurisdiction may also be associated with repeat abuse. In a small sample, Ferleger noted that 18 of 45 parents during treatment were cited for re-abuse, only 2/3 of whom were reported to CPS. Physical abuse has been shown to recur after a child is placed into foster care, albeit at low rates (Benedict, Zuravin, Brandt & Abbey, 1994). Lower rates of recurrence are noted after unsubstantiated as compared to substantiated physical abuse reports (Thompson et al., 2001).

Given the serious morbidity and mortality of physical abuse in infants, recurrence of physical abuse is of great concern (Brown, et al., 1998; Leventhal, et al., 1996). Repeat physical abuse may be inflicted on a child with additional physical and mental disabilities as a result of the first physical abuse. Placement of a child into foster care improves a child's function over a 12-month period (Horwitz, 2001), and clinicians are concerned about properly identifying physically abused infants in order to take steps to prevent such recurrence during young childhood when the risk is greatest for serious neurological and developmental impairment (Alexander et al., 1990).

National Child Abuse and Neglect Data System

The National Child Abuse and Neglect Data System (NCANDS) collects data from all U.S. States as mandated by the Child Abuse Prevention and Treatment Act (CAPTA, 1988; Administration on Children, Youth and Families, 2001). NCANDS collects regarding cases in which local child protective service agencies investigate suspected maltreatment. When CPS agencies find credible evidence that abuse or neglect has occurred, the report is labeled 'substantiated' or 'indicated'; if not, the report is labeled 'unsubstantiated'. Aggregate information about all reports from all states is collected by NCANDS and reported in the annual NCANDS Summary Data Component (SDC). Substantiated and indicated reports are combined as 'confirmed' cases for analyses.

Additional case-level information is provided voluntarily by some States to the NCANDS Detailed Case Data Component (DCDC). The DCDC is archived and maintained in the National Data Archive in Child Abuse and Neglect (NDACAN) at the Family Life Development Center in the College of Human Ecology of Cornell University under a cooperative agreement with the Children's Bureau, Administration on Children, Youth and Families in the U.S. Department of Health and Human Services. It is important to note that NCANDS-DCDC contains only 'numerator' data, i.e. frequencies of reported child maltreatment cases, although comparisons have been made to State populations in published NCANDS analyses. Most States have not provided five sequential years of data for NCANDS-DCDC during 1995-1999.

During 1995-1999, NCANDS-DCDC included over 2.8 million total reports of suspected child abuse and neglect, with 936,999 confirmed reports. NCANDS-DCDC

contained information from 16 states with over 30% of the U.S. child population during 1995-1999. There were 577,655 total reports concerning children under age three years, and of these, over 30,000 were confirmed with child physical abuse. DCDC case-level data includes fields with information concerning child age, gender, race, ethnicity, CPS report date, source and disposition, services provided, type(s) of abuse or neglect, child factors (such as special medical needs, developmental delays, drug exposure, impairments, disabilities, behavior and medical problems) and caretaker characteristics (such as drug or alcohol problem, mental or physical problem, mental retardation, emotional disturbance, disability, medical problems, violence between caretakers, receipt of financial assistance, or problems with finances or housing) (Appendix). For unsubstantiated reports, only state of residence, CPS report date and disposition, report source, child age, gender, race, and ethnicity are included. Coded child identifiers are used by NDACAN to protect privacy while allowing assessment of maltreatment recurrence (Gaudiosi, et al, 2001). Records with fatality have been excluded, although other records prior to death for a particular child remain in the dataset (Elliott Smith, personal communication, 2002).

OBJECTIVES and HYPOTHESES

The principle objectives of this study are to describe the incidence of first physical abuse occurrence and risk factors associated with physical abuse recurrence in a large population of young children and families reported to state Child Protective Services agencies (CPS) for suspected maltreatment.

After describing child, family and system response factors noted among children with physical abuse less than 3 years of age, several hypotheses are tested regarding the relationship of risk factors to occurrence and recurrence in an overall conceptual model (Figure 1):

Figure 1 Conceptual model

Physical Abuse Recurrence:

Prior Physical Abuse before age 1 year +

Family Factors +	Child Factors +	System Response Factors →	Recurrence
Substance Abuse	Age	Post-Investigation Services	before age
Alcohol	Gender	Time to services	3 years
Drugs	Race	Family Support Services	
Mental Illness	Ethnicity	Family Preservation Services	
Retardation	Substance Exposure	Foster Care	
Emotional	Alcohol	Time to Removal	
Learning Disability	Drugs	Juvenile Court Petition	
Physical Illness	Mental Illness	Time to Court Petition	
Sensory Impair	Retardation		
Physical Disability	Emotional		
Medical Illness	Learning Disability		
Violence	Behavior Problem		
Betw Caretakers	Physical Illness		
Poverty	Sensory Impairment		
Inadequate Housing	Physical Disability		
Financial Problems	Medical Illness		
Receipt of Assist			

The following hypotheses will be tested in this study:

I. Child factors

A. Less than 5% of physically abused infants will have recurrence;

B. Infancy, non-White race, male gender and disability place children at increased risk for recurrence of physical abuse;

II. Family factors

A. Poverty will not be associated with increased risk of recurrence of physical abuse;

B. Geographic differences in recurrence rates will not be noted among states with higher proportions of their children living in urban settings;

III. System response factors

A. Removal to foster care and juvenile court petition will be associated with lower rates of physical abuse recurrence but increasing time to removal or petition will be associated with higher rates;

B. Medical source of report and post-investigation, family support, and family preservation services will be associated with higher rates of physical abuse recurrence as compared to other forms of maltreatment.

METHODS

Study design

Several study designs were used to assess the first occurrence and recurrence of physical abuse (PA) in infants and young children. For occurrence, a case series was constructed consisting of all confirmed physical abuse reports for children less than three years of age in NCANDS-DCDC, and the frequency of confirmed physical abuse was compared with other confirmed maltreatment types. Frequencies of child, family and system response factors (Figure 2) were calculated comparing PA to other maltreatment types. Effect of urban population was assessed by creating a new variable representing an estimate of the percent of the state's child population living in urban metropolitan areas as noted in U.S. Population Estimates (U.S. Census Bureau, 2000).

In a second study design, report dispositions were stratified by State, year and abuse type, and confirmed first physical abuse reports were linked state-by-state and year-by-year with census data on the age-specific population of children at risk. Physical abuse rates per 1,000 children were calculated by state and child age over the five-year study period in this population-based incidence rate series.

For recurrence, a cohort was constructed from records of children aged less than 1 year with confirmed physical abuse in those states and years with data from three or more consecutive years in NCANDS-DCDC. Within this cohort, records of children with repeat confirmed PA reports were compared to records of children with no additional confirmed physical abuse reports in a cohort analysis using risk ratio calculations and proportional hazards models. An event or case of physical abuse recurrence was defined

Figure 2. NCANDS Variables

Child Factors	Age in years
	Gender
	Race
	Hispanic Ethnicity
	Problem / exposure to Alcohol
	Problem / exposure to Drugs
	Mentally Retarded
	Emotionally Disturbed
	Visual or Hearing Impaired
	Learning Disability
	Physically Disabled
	Behavior Problem
	Other Medical Problem
Family and Caretaker Factors	Caretaker Problem with Alcohol
	Caretaker Problem with Drugs
	Caretaker Mentally Retarded
	Caretaker Emotionally Disturbed
	Caretaker Visual or Hearing Problem
	Caretaker Learning Disability
	Caretaker Physically Disabled
	Caretaker Other Medical Problem
	Violence Between Caretakers
	Inadequate Housing
	Family Financial Problems
	Family Receives Public Assistance
Report & System Response Factors	Report ID
	Child ID
	State
	Report Date
	Disposition Date
	Report Disposition
	Report Source
	Post Investigation Services and Date
	Family Support Services Provided
	Family Preservation Services Provided
	Foster Care Services and Removal Date
	Juvenile Court Petition and Date
	Physical Abuse Disposition
	Neglect Disposition
	Medical Neglect Disposition
	Sexual Abuse Disposition
	Psychological Abuse Disposition
	Other Abuse Disposition
	Unknown Maltreatment Disposition

as a second confirmed report for physical abuse occurring in the same state for the same child before age three years. Risk ratios with 95% confidence intervals were calculated for the child, family and system response factors listed in Figure 2 to assess whether factors in first reports were associated with physical abuse recurrence. Chi square analysis was used to assess the statistical significance of the association of the risk factor with physical abuse recurrence in these analyses (Figure 3).

Figure 3. Calculation of risk ratios and 95% confidence intervals

In a two by two contingency table of risk factor exposure by outcome:

	Disease		Totals
Exposure	+	-	
+	A	B	$A + B = n_1$
-	C	D	$C + D = n_2$
Total	A+C	B+D	$A + B + C + D = n_1 + n_2 = N$

Where: A= Number exposed with the outcome of interest
B= Number exposed without the outcome
C= Number not exposed with the outcome
D= Number not exposed without the outcome
p_1 = probability of developing disease for exposed individual = A/n_1
p_2 = probability of developing disease for non-exposed individual = C/n_2

Estimate of Exposure Risk Ratio = $RR = p_1 / p_2 = [A/(A + B)]/[C/(C+ D)] = (A/n_1)/ (C/n_2)$
95% Confidence Interval (95%CI) for Exposure Risk Ratio (c_1, c_2):
c_1 is the lower bounds of the 95%CI = $e^{[\ln(RR) - Z\ 1-\alpha/2\ \sqrt{(b/an1\ +\ d/cn2)}]}$
c_2 is the upper bounds of the 95%CI = $e^{[\ln(RR) + Z\ 1-\alpha/2\ \sqrt{(b/an1\ +\ d/cn2)}]}$
Where Z is the inverse normal function, α is the estimate of type I error (set at 0.05 to obtain 95%CI). Statistical association calculated using chi square or Fishers exact test.

Valid with normal distribution, $[n_1 * p_1 * (1-p_1)] \geq 5$ and $n_2 * p_2 * (1-p_2)] \geq 5$.

Adapted from Rosner (1995), pp. 362-364.

Statistical power (1-ß) was calculated to assess the adequacy of the sample size of this cohort (Figure 4). Time to recurrence of physical abuse was calculated for cases, and

time elapsed to provision of post-investigation services, juvenile court petition and removal to foster care were also calculated using the date of the confirmed PA second report. Controls in the cohort analyses consisted of all records with complete information in children in the cohort who did not have PA recurrence.

Figure 4. Calculation of statistical power

Statistical power $(1 - \beta)$ comparing two proportions in a cohort can be calculated from

$$Z_\beta = [(N (d^*)^2 R)/((R+1)(p)(1-p))]^{0.5} - Z_{\alpha/2}$$

Where: R = ratio of unexposed / exposed records for the selected exposure
RR is the estimate of the Risk Ratio, based on the cohort
N_T = total number in cohort = $N_1 / (RR)$
N_1 = number of cases in the cohort with the selected outcome = $(N_T)RR$
p = weighted average of the proportion of the entire cohort with the selected outcome (p_0) and the proportion of those exposed with the selected outcome (p_1) such that $p = [p_1 + R(p_0)] / [1 + R]$
d^* = difference of proportions between exposed and overall cohort = $p_1 - p_2$
$Z_{\alpha/2} = Z_{0.025} = 1.96$ for $\alpha = 0.05$
Power $(1 - \beta)$ can be read from Z in Table 12-14, in Kelsey et al. (1996), p.331.

Adapted from Kelsey, et al. (1996), pp. 331-335.

Cox regression models (Allison, 1995; Kelsey, 1996) were used to calculate proportional hazard rate-ratios for risk factors and their association with time to a second episode of confirmed physical abuse in a right-censored model, with recurrence date up three years after first occurrence among children in the cohort (Figure 5). These models are useful when exact person-years at risk are unavailable in the data or inappropriate to use (Kelsey, p. 168). Cox regressions model exposure hazard rates as varying functions of time which is considered a continuous variable, and they do not assume that rates are constant within exposure categories. All risk factors and elapsed times for services were entered into the model, and variables with the highest variance were removed one at a

time and the model re-calculated until all remaining variables had $P<0.05$. Changes in model P were monitored to assure model convergence. The null hypothesis that the risk ratio of the factor was equal to 1.0 was rejected if the probability (P) of the association was found to be less than 0.05 in these analyses ($\alpha=0.05$). Risk ratios with 95% confidence intervals were calculated for the variables remaining in the adjusted, final model.

Figure 5. Cox proportional hazard models

Cox regression models use estimates of maximizing partial likelihood in a proportional hazards model:

$$h_i(t) / h_j(t) = e^{(\beta 1(xi1 - xj1) + \ldots + \beta k(xik - xjk)}$$

in which the type of function, $\alpha(t)$, does not have to be chosen *apriori,* the estimates are consistent and asymptotically normal, and depend on ranks of event times.

$$95\%\ \text{CI for factor}_i = [\, e^{[\ln(\text{hazard ratio}, \beta i) - Z\alpha/2 * \text{standard error (hazard ratio}, \beta i)]}, \; e^{[\ln(\text{hazard ratio}, \beta i) + Z\alpha/2 * \text{standard error (hazard ratio}, \beta i)]}\,]$$

Adapted from Allison (1995), pp. 113-115.

The Investigator obtained Dataset #75 and its updates from the National Data Archive on Child Abuse and Neglect (NDACAN). NDACAN datasets are available to researchers for $75 for non-commercial statistical research and teaching and have personal identifying information removed to protect individual confidentiality. Costs associated with dataset acquisition were paid for by research funds available to the Investigator.

Study subjects

Records in NDACAN Dataset #75 represent de-identified reports to Child Protective Services during 1995-1999 which were collected by the participating states and entered into the National Child Abuse and Neglect Data System (NCANDS).

Data management

NCANDS-DCDC report files contain administrative data entered by CPS caseworkers about the child and family, with other case and service characteristics as determined by investigation (Appendix). NDACAN Dataset #75 (1995-1997) and its updates (1998-1999) contain 14 variables in the 'J' files pertaining to all reports and 62 variables in the 'K' files pertaining to those reports in 'J' that were 'confirmed' (National Data Archive on Child Abuse and Neglect, 2000). Several variables such as child or family 'problems' with alcohol or drugs reflect the worker's determination as to the presence or absence of a factor identified by the state CPS agency as needed case information. The 'J' and 'K' files can be matched and combined using the fields common to both files, with children matched using a unique child identification code.

The Investigator used SAS statistical software package, version 8.1 for data management and analysis (SAS Institute Inc., Cary, NC). Individual files provided by NDACAN are provided for each state and year in SAS transport file format. Two files for each state are provided by NDACAN containing information about all reports (unsubstantiated and substantiated) and substantiated reports only (J and K files, respectively). Transport files for each year and state were imported using SAS code provided by NDACAN and were combined for the years 1995 through 1999. Duplicative

records and reports occurring on the same day were deleted using a 'roll up' procedure provided with the dataset, and records for children ages three years and older were removed. The resulting dataset contained records that pertained to unique child ID-report date pairs for children less than three years of age, and substantiated and indicated reports have data additional fields available after CPS investigation.

Records were sorted by state, disposition and year in the dataset and compared with published information to assess overall dataset integrity (Gaudiosi, 2001). Variable ranges were reviewed to assure consistency with permitted dataset entries (NDACAN, 2000). Records were then sorted by state, child ID and type of maltreatment, and the number of unsubstantiated, substantiated and indicated reports were calculated for each State and form of maltreatment. Substantiated and indicated reports were combined for further analyses as 'confirmed' reports. A variable was created indicating report year, and flag variables were created to indicate type of abuse and records of children with confirmed physical abuse. Counter variables were created to calculate the number of confirmed reports for physical abuse, sexual abuse, neglect, medical neglect, psychological abuse and other abuse and the total number of all reports for each unique state-child ID pair.

Values in all variable fields were assessed to determine whether they were categorical or continuous in nature. The distribution of continuous variables was assessed. The frequency of 'unknown' or missing responses was counted for each variable, and steps were taken to assess patterns of missing data to determine if methods should be used to exclude cases or fields or impute data using standard methods (Frongillo & Rowe, 1999). Once the dataset was finalized, the frequencies of responses

for categorical variables, and the means and standard deviations for continuous variables were assessed.

Protection of human subjects

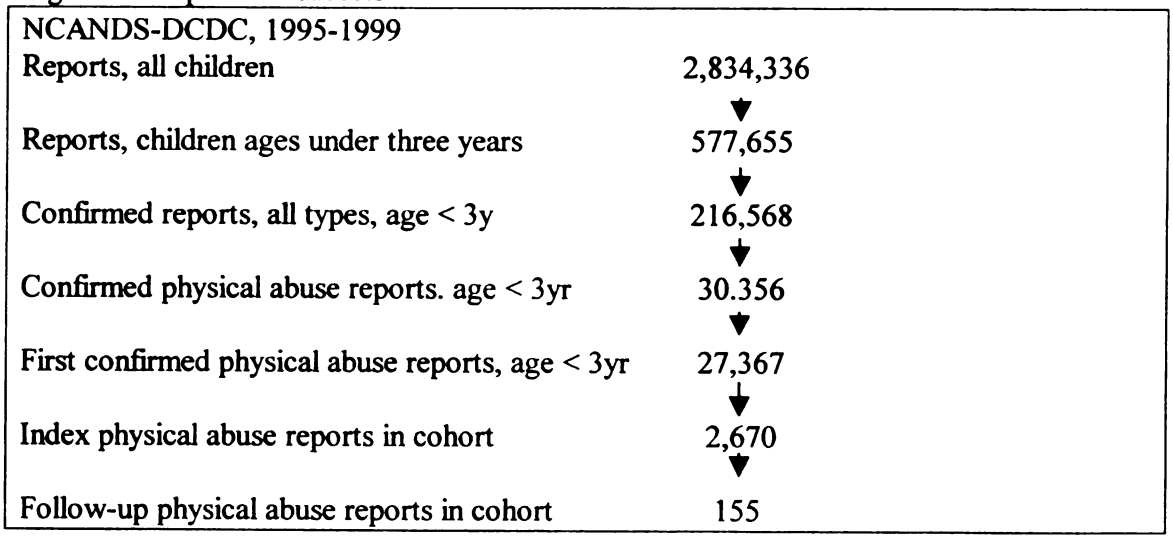
The dataset provided by NDACAN has been protected with safeguards such as encrypted case identifiers and removal of fatality information. The User's Agreement required several standards for dataset use, including maintaining data security, limiting others' access to data, preserving confidentiality, and corresponding with NDACAN and the Children's Bureau before publication. The investigator complied with these standards and kept the dataset and analyses in password-protected files on a computer separate from the institutional network. No patient names were used, and all reports of study outcomes and conclusions use aggregate information only. The study protocol (#02-046) was reviewed and approved 1/23/2002 by the Michigan State University Committee on Research Involving Human Subjects (UCRIHS) and the Spectrum Health Research Committee.

RESULTS

Assessment of the dataset

The Detailed Case Data Component of the National Child Abuse and Neglect Data System (NCANDS-DCDC) contains 2,834,336 records from 1995-1999, including 577,655 reports of suspected or confirmed abuse among children less than three years of age (Figure 6). Confirmed PA records made up 14% of all confirmed reports among children ages less than 3 years, and more than 90% of these records were first confirmed reports. Values in all variable fields were categorical in distribution, except for child age in years, date fields and calculated fields counting the number of reports. Variable responses conformed to published dataset parameters (NDACAN, 2000) and published reports (Administration on Children, Youth and Families, 1997-2001).

Figure 6. Population subsets



All NCANDS files provided by NDACAN were combined and duplicate records removed, resulting in a single file with reports from 16 U.S. states, with 8-14 states

reporting for each of the included years (Table 1). Additionally, 7 of 16 states did not report data for three or more consecutive years. Colorado, Florida, Kentucky, Massachusetts, Oklahoma, Rhode Island, Utah, Vermont, and Wyoming (whose state populations amounted to 53% of the total number of NCANDS-DCDC reports) reported data for at least one consecutive three-year period during 1995-1999.

Table 1
NCANDS Child Abuse and Neglect Reports, by State and Year, Children Under 3 Years

State	1995	1996	1997	1998	1999	Total
Arkansas	*	*	*	*	3,975	3,975
Colorado	1,045	1,118	1,226	1,098	*	4,487
Delaware	969	1,366	*	1,786	1,803	5,924
Florida	34,403	33,149	33,127	31,848	30,223	162,750
Kentucky	9,362	*	8,524	11,749	11,110	40,745
Louisiana	*	*	*	27,229	7,244	34,473
Massachusetts	11,030	10,859	11,323	*	*	33,212
Missouri	14,561	*	*	*	10,545	25,106
N. Carolina	11,418	14,762	*	23,029	23,454	72,663
Oklahoma	*	9,654	10,272	12,340	12,441	44,707
Rhode Island	*	*	2,491	2,294	2,120	6,905
Texas	34,370	*	*	34,018	38,865	107,253
Utah	4,293	3,985	4,423	4,803	5,065	22,569
Vermont	328	311	313	270	410	1,632
Washington	*	*	*	*	9,577	9,577
Wyoming	*	*	167	736	774	1,677
Total	121,779	75,204	71,866	151,200	157,606	577,665

*not reported to NCANDS-DCDC; Total reports, all ages, 1995-1999 = 2,834,336

Among children less than 3 years of age, there were 156,301 substantiated and 60,267 indicated reports of abuse or neglect (Table 2). These were considered 'confirmed' reports for further analyses, resulting in 216,568 child-event records of confirmed maltreatment and 361,086 reports which were unsubstantiated, had 'no finding" or had another non-confirmed outcome (one report did not include disposition

Table 2
NCANDS Report Disposition for Confirmed Reports, by Type of Abuse and Year, Children Under 3 Years

Type* Year:	1995	1996	1997	1998	1999	Total
Physical Abuse						
Substantiated	5,907	2,394	3,042	6,195	7,420	24,958
Indicated	1,276	1,121	1,297	991	713	5,398
Unsubstantiated	1,052	873	1,082	1,834	1,915	6,756
Other**	14	87	101	388	484	1,074
Sexual Abuse						
Substantiated	620	248	235	393	513	2,009
Indicated	244	164	167	127	97	799
Unsubstantiated	146	116	109	241	276	888
Other	0	24	25	74	116	239
Neglect						
Substantiated	24,228	16,746	16,031	25,792	29,321	112,118
Indicated	8,205	6,764	6,912	5,717	4,529	32,127
Unsubstantiated	923	1,050	1,255	1,691	1,655	6,574
Other	40	68	40	210	215	563
Medical Neglect						
Substantiated	1,799	867	776	1,778	1,829	7,049
Indicated	790	727	609	491	404	3,021
Unsubstantiated	347	293	316	470	539	1,965
Other	14	31	14	95	119	273
Psychological Abuse						
Substantiated	830	606	927	1,491	1,515	5,369
Indicated	178	153	276	138	93	838
Unsubstantiated	121	120	174	255	285	955
Other	21	56	37	102	113	329
Other /Unknown						
Substantiated	2,184	1,852	2,746	3,102	3,660	13,544
Indicated	4,713	4,936	5,883	5,729	5,555	26,816
Unsubstantiated	994	919	1,051	921	860	4,745
Other	14	28	4	21	19	86

Totals: Substantiated	164,687
Indicated	68,999
Unsubstantiated	21,883
Other	2,564

*Reports may have 1 or more types; **Other = Closed no finding, other and unknown

information). Of note, the total number of confirmed maltreatment events (258,133) was greater than the total number of confirmed records (206,274) because a record could have one or more confirmed maltreatment types. Among reports for all types of maltreatment, less than 1% of reports had disposition outcome of "no finding", "other" or "unknown" in the dataset (2,564 out of 258,133 reports).

The percent of the state's child population living in urban metropolitan areas was calculated based on U.S. population estimates for state urban population (U.S. Census Bureau, 2000). Using these 1990 estimates, the following percentages of the population living in urban settings were entered into the dataset:

Arkansas 53.5%	Massachusetts 84.3%	Utah 87.0%
Colorado 82.4%	Missouri 68.7%	Vermont 32.2%
Delaware 73.0%	North Carolina 50.4%	Washington 76.4%
Florida 84.8%	Oklahoma 67.7%	Wyoming 65.0%
Kentucky 51.8%	Rhode Island 86.0%	
Louisiana 68.1%	Texas 80.3%	

Florida, Massachusetts, Rhode Island and Utah were placed in the highest quartile, and Arkansas, Kentucky, North Carolina and Vermont were placed in the lowest quartile.

First occurrence of physical abuse

As compared to children with non-physical abuse reports (neglect, medical neglect, sexual abuse, psychological abuse and other abuse), children with confirmed physical abuse were disproportionately more young (more infants aged less than 12 months), male, Black/African-American and Hispanic (Table 3). They also had more alcohol and drug exposure and more pre-existing medical problems. While there are

many more cases reported overall from States with a higher percentage of urban population, those states had disproportionately less confirmed physical abuse.

Table 3
Comparison of Child Factors in Confirmed Reports, Physical Abuse (PA) vs. Non-Physical Abuse (Non-PA) (N=206,274)

Factor	Physical Abuse (%*)	Non-PA (%*)	(% Missing/Unk)
Age: < 12 months	14,262 (47)	67,004 (38)	(<1)
12-23 months	7,561 (25)	54,037 (31)	(<1)
24-35 months	8,454 (28)	54,528 (31)	(<1)
Gender: Male	16,723 (55)	90,811 (52)	(<1)
Race: White	16,780 (56)	100,697 (58)	(6)
Black	51,294 (30)	7,564 (25)	(6)
Ethnicity: Hispanic	4,261 (18)	15,424 (13)	(35)
Urban State Population:			
Highest Quartile	10,866 (36)	96,638 (56)	(0)
Lowest Quartile	4,040 (13)	34,001 (19)	(0)
Exposure to Alcohol	277 (2)	308 (1)	(71)
Exposure to Drugs	2,080 (14)	1,793 (4)	(69)
Mentally Retarded	0 (0)	0 (0)	(66)
Emotionally Disturbed	23 (<1)	101 (<1)	(55)
Visual or Hearing Impaired	105 (<1)	253 (<1)	(55)
Learning Disability	49 (<1)	169 (<1)	(60)
Physically Disabled	114 (<1)	363 (<1)	(55)
Behavior Problem	142 (<1)	469 (<1)	(59)
Other Medical Problem	497 (4)	1,466 (3)	(66)
Total Records	30,356 (100%)	175,918 (100%)	

*Percentage of total reports, children less than 3 years, NCANDS-DCDC 1995-1999

Children with confirmed physical abuse were disproportionately more likely to have caretakers with problems with drugs or alcohol or have more violence between the caretakers (Table 4). There was disproportionately less inadequate housing and receipt of public assistance. Substantial proportions of variables were labeled as 'unknown' or had missing responses, particularly in fields regarding child and family factors, ranging up to

81% for missing or 'unknown' responses in the caretaker 'other medical problem' field. These missing fields resulted from individual states variably providing only certain data fields for confirmed reports to NCANDS.

Table 4
Comparison of Family and Caretaker Factors in Confirmed Reports, Physical Abuse (PA) vs. Non-Physical Abuse (Non-PA) (N=206,274)

Factor	Physical Abuse (%*)	Non-PA (%*)	(% Missing/Unk)
Problem with Alcohol	1,393 (10)	3,152 (7)	(71)
Problem with Drugs	3,337 (23)	4,781 (11)	(71)
Mentally Retarded	111 (<1)	642 (1)	(72)
Emotionally Disturbed	297 (2)	805 (2)	(74)
Visual or Hearing Problem	29 (<1)	98 (<1)	(74)
Learning Disability	125 (<1)	470 (1)	(74)
Physically Disabled	89 (<1)	285 (<1)	(74)
Other Medical Problem	254 (3)	917 (3)	(81)
Violence Between Caretakers	2,575 (23)	6,177 (17)	(73)
Inadequate Housing	793 (7)	6,502 (18)	(77)
Financial Problems	1,729 (16)	5,475 (16)	(78)
Receives Public Assistance	3,968 (26)	14,173 (30)	(69)
Total Reports	30,356 (100%)	175,918 (100%)	

*Percentage of total reports, children less than 3 years, NCANDS-DCDC 1995-1999

Most children in the dataset (83.3%) had only 1 record with an unconfirmed or confirmed report of maltreatment, and over 90% of those with physical abuse reports had no prior confirmed or unconfirmed reports (Table 5). Children with confirmed physical abuse were disproportionately more likely to reported to CPS by medical sources and were offered more family preservation and foster care services after investigation. They were offered less family support services but their cases resulted in more juvenile court petitions. A large proportion of the variables regarding system response factors was

missing or reported as 'unknown' having less than 30% of fields with data available regarding one or more of these service variables.

Table 5
Comparison of Report and System Response Factors in Confirmed Reports, Physical Abuse (PA) vs. Non-Physical Abuse (Non-PA) (N=206,274)

Factor	Physical Abuse (%*)	Non-PA (%*)	(% Missing/Unk)
Confirmed Reports			
1	27,442 (90)	152,015 (86)	(0)
2	2,339 (7)	19,226 (11)	
Non-Confirmed Reports			
0	27,737 (91)	154,358 (88)	(0)
1	1,987 (7)	16,938 (10)	
Total Reports			
1	25,554 (84)	136,488 (78)	(0)
2	3,283 (11)	27,429 (16)	
3	1,003 (3)	7,940 (4)	
Medical Report Source	11,159 (38)	43,333 (21)	(3)
Post Investigation Services	18,273 (62)	108,968 (63)	(2)
Family Support Services	1,576 (14)	9,738 (17)	(66)
Family Preservation Services	3,881 (20)	9,460 (12)	(52)
Foster Care Services	6,896 (30)	25,087 (24)	(37)
Juvenile Court Petition	3,908 (18)	13,198 (13)	(42)
Total Records	30,356 (100%)	175,918 (100%)	

*Percentage of total reports, children less than 3 years, NCANDS-DCDC 1995-1999

Population-based incidence rates of first physical abuse

The first occurrence of physical abuse for an individual child less than 3 years of age was noted in 27,367 records in NCANDS-DCDC during 1995-1999. Age-specific crude rates by state for first physical abuse for children 0, 1 and 2 years of age were calculated using State population estimates for the years included in the NCANDS-DCDC dataset (U.S. Census Bureau, 1999). Wide variation was noted among the states, with 0.5 to 4.8 confirmed physical abuse cases per 1,000 children (Table 6). Overall, the

Table 6
First Confirmed Reports of Physical Abuse, by State and age, rates per 1,000 for age-specific populations

State		Age:	0 years	1 years	2 years	Rate*
Arkansas:	+Reports		95	75	99	2.5
	**Population		35799	35393	35478	
Colorado:	Reports		202	266	264	1.1
	Population		221352	217668	217286	
Delaware:	Reports		91	52	70	1.8
	Population		40226	39637	39628	
Florida:	Reports		1996	1862	2173	2.1
	Population		938947	935401	945985	
Kentucky:	Reports		971	753	800	4.1
	Population		209085	206386	207138	
Louisiana:	Reports		185	139	155	1.3
	Population		128834	126373	124135	
Massachusetts:	Reports		564	435	545	2.2
	Population		235780	236294	241084	
Missouri:	Reports		268	215	257	1.7
	Population		144901	143705	145508	
North Carolina:	Reports		334	218	214	0.5
	Population		523051	515927	516630	
Oklahoma:	Reports		1414	611	644	4.8
	Population		187437	182761	180054	
Rhode Island:	Reports		353	51	54	4.2
	Population		36550	36368	36878	
Texas:	Reports		6546	1390	1403	3.2
	Population		982193	969593	964919	
Utah:	Reports		318	455	305	1.8
	Population		209379	202199	197082	
Vermont:	Reports		30	29	34	0.9
	Population		32486	32753	33675	
Washington:	Reports		177	61	72	1.3
	Population		77940	77663	77662	
Wyoming:	Reports		58	31	33	2.2
	Population		18161	18104	18326	
TOTALS++	Reports		13602	6643	7122	2.3
	Population		4022121	3982268	3065543	

*Crude rate, mean number of reports per 1,000 population, 1995-1999, ages 0-2
+Mean number of reports during 1995-1999, NCANDS data, by age
**Mean population estimates for years with report data, for single ages, U.S Census
++Column totals, summary rate weighted by population; total population = 11,069,932.

population-weighted rate for the 53 state-years in the dataset was 2.3 per 1,000. Infants had the highest age-specific rates as compared to older children, with an overall rate of 3.4 cases per 1,000 (13,602 out of 4,022,121 children age 0 years) as compared to 1.7 and 2.3 per 1,000 children, ages 1 and 2 years, respectively. First physical abuse rates varied by State from 0.6 to 9.7 cases per 1,000 for infants, and by year, with overall mean rates ranging over all ages from 2.5 in 1995 to 1.9 per 1,000 in 1996. The States and years in NCANDS-DCDC account for 11,980,614 (21.1%) of the 56,828,285 total U.S. population ages 0-2 years during 1995-1999.

Recurrence of Physical Abuse

To more closely examine physical abuse recurrence, a cohort was constructed using records of children with a first confirmed report of physical abuse (index cases) during infancy (age < 12 months). Recurrence was defined as a second confirmed physical abuse report occurring at least one day later in the same state, for the same child before age three years. To ensure availability of follow-up until age three years, index cases for the cohort were selected from States during years immediately followed by two or more consecutive years of data in NCANDS-DCDC. Index cases for the cohort were therefore chosen from:

Colorado in 1995, 1996
Florida in 1995, 1996, 1997
Kentucky in 1997
Massachusetts in 1995
Oklahoma in 1996, 1997
Rhode Island in 1997
Utah in 1995, 1996, 1997
Vermont in 1995, 1996, 1997
Wyoming in 1997

States in these years contained 157,515 records of 577,655 total records (27.5%) of children less than 3 years of age (Table 4). Recurence cases could occur in the same year as their first occurrence or during follow-up years, which included Colorado in 1997-1998, Massachusetts in 1996-1997, and Florida, Kentucky, Oklahoma, Rhode Island, Utah, Vermont and Washington in 1998-1999. These follow-up periods provide 150,689 maltreatment reports for potential recurrence. Using the index case selection criteria, 2,670 first confirmed physical abuse reports were entered into the recurrence cohort (Table 7), representing 9.8% of the 27,357 children less than three years of age available in the dataset with PA.

Within the physical abuse recurrence cohort, almost half were reported to CPS by medical sources, 55% were male, 67% were White and 11% were Hispanic (Table 7). Small numbers (0-2%) of index cases were noted to have child mental or physical health problems. Among caretakers, alcohol or drug problems were noted in 6% and 7%, respectively, but there were low levels (0-1%) of other physical and mental illness recorded. Violence was noted between the caretakers in 7%, 4% of the families had financial problems, 12% received public assistance and 2% had inadequate housing. Over 60% had received some type of post-investigation service pertaining to their first confirmed physical abuse report, with 41% receiving foster care services, 8% family preservation services, 14% family support service, and 30% juvenile court petition. While report source, child gender, race, urban location, and number of prior confirmed reports and whether post-investigation services were provided were readily available, the majority of variables in the physical abuse recurrence cohort had 60% or more of the fields missing or had 'unknown' responses.

Table 7
Variable Responses for Index Cases in Physical Abuse Recurrence Cohort (N=2,670)

Variable*	Responses	(% missing)**
Report Source	Medical= 1,150; Non-medical= 1,370	(6)
Child Gender	Male=1,462; Female =1,201	(<1)
Child Race	White=1,739; Other=840	(3)
Child's Hispanic Ethnicity	Hispanic=117; non-Hispanic=961	(60)
Percent Urban Population	Highest quartile=1,665; Lowest=290	(0)
Number prior unconfirmed reports	0=2578; 1=78; >1=92;	(0)
Child Problem with Alcohol	Yes=2; No=1.050	(61)
Child Problem with Drugs	Yes=5; No=49	(61)
Child Mentally Retarded	Yes=0; No=986	(63)
Child Emotionally Disturbed	Yes=0; No=986	(63)
Child Visually or Hearing Impaired	Yes=11; No=975	(63)
Child Learning Disability	Yes=2; No=984	(63)
Child Physically Disabled	Yes=9; No=977	(63)
Child Behavior Problem	Yes=2; No=947	(64)
Child Other Medical Problem	Yes=9; No=375	(86)
Caretaker Problem with Alcohol	Yes=56; No=926	(63)
Caretaker Problem with Drugs	Yes=71; No=878	(64)
Caretaker Mentally Retarded	Yes=1; No=882	(67)
Caretaker Emotionally Disturbed	Yes=5; No=878	(67)
Caretaker Visually/Hearing Impaired	Yes=2; No=881	(67)
Caretaker Learning Disability	Yes=1; No=882	(67)
Caretaker Physically Disabled	Yes=0; No=883	(67)
Caretaker Other Medical Problem	Yes=0; No=281	(89)
Violence Between Caretakers	Yes=28; No=385	(85)
Inadequate Housing	Yes=8; No=339	(87)
Family Financial Problems	Yes=15; No=333	(87)
Family Receives Public Assistance	Yes=121; No=869	(63)
Post-Investigation Services	Yes= 1,625; No=1,042	(<1)
Family Support Services	Yes= 62; No=383	(83)
Family Preservation Services	Yes= 86; No=974	(60)
Foster Care Services	Yes= 605; No=856	(45)
Juvenile Court Petition	Yes= 399; No=950	(49)

*All variables categorical except child age in years; total records=661
**Missing or labeled 'Unknown'; NA=not applicable, all labeled as 'yes' or 'no'

From among these 2,670 children, there were 155 (5.8%) cases of second confirmed physical abuse before three years of age (Table 8). While most states had consistent decreasing recurrence in follow-up years, some states had few recurrences

recorded (Colorado, Rhode Island), no recurrences at all (Vermont) or no index cases (Utah). Using rates for individual states from Table 8, the 95% confidence interval for recurrence can be calculated as [0.0%, 16.4%] (data not shown).

Table 8
Initial reports in Cohort and Physical Abuse Recurrence Reports, by State and Year

State	Year:	1995	1996	1997	1998	1999	Total
Colorado:	*Index Reports	54	49	-	-	-	103
	+Recurrence	0	4	0	0	-	4
Florida:	Index Reports	453	427	432	-	-	1,312
	Recurrence	11	19	19	11	3	63
Kentucky:	Index Reports	-	-	271	-	-	271
	Recurrence	-	-	9	5	2	16
Massachusetts:	Index Reports	221	-	-	-	-	221
	Recurrence	32	3	3	-	-	38
Oklahoma:	Index Reports	275	327	-	-	-	602
	Recurrence	0	10	13	2	-	25
Rhode Island:	Index Reports	-	-	132	-	-	132
	Recurrence	-	-	1	1	0	2
Utah:	Index Reports	0	0	0	-	-	0
	Recurrence	0	0	0	0	0	0
Vermont:	Index Reports	9	5	5	-	-	19
	Recurrence	0	0	0	0	0	0
Wyoming:	Index Reports	-	10	-	-	-	10
	Recurrence	-	0	1	0	-	1
TOTALS	Index Reports	737	756	1,177	0	0	2,670
	Recurrence	43	32	43	30	7	155

*First confirmed physical abuse before age 1 year in index States and years
- State and year not selected
+Second confirmed physical abuse before age 3 years in follow-up States and years

Cohort analysis

Relative risk ratios were calculated to compare the child, family and system response factors among children with and without physical abuse recurrence in the cohort (Table 9). In these bivariate analyses, variable responses of interest were compared to

those without the response while excluding missing or 'unknown' responses. Only two associations were statistically significant at $P < 0.05$. Significant factor associations with second confirmed physical abuse reports were noted in children in families with caretaker drug problems (risk ratio, RR=2.4) and caretaker emotional disturbance (RR=11.7):

Table 9
Bivariate Association of Factors with Physical Abuse Recurrence (N=2,670)

Significant factor associations	N*	RR**	95% CI***	P
Caretaker Problem with Drugs	949	2.4	1.2, 4.8	0.02
Caretaker Emotionally Disturbed	883	11.7	5.4, 25	<0.001

*Remaining factors with P> 0.05, N=cases and controls with complete data;
**Risk ratio
***95% Confidence Interval

Statistical power calculations (Table 10) indicate that the entire cohort has a power $(1 - \beta)$ greater than 0.80 to detect a risk ratio (RR) of 2.0 for factors with greater than 6% (R=14) exposed cases (report source, gender, race, percent urban population, prior unsubstantiated reports and whether post-investigation services were provided). When only half (50%) of the data is present, statistical power is greatly diminished and declined to less than 0.3 for the many child and family factors with less than 10% exposure.

Analysis of time to physical abuse recurrence

Mean time to physical abuse recurrence was 250 days (range, r= 1-1084 days; 95% confidence interval, 95%CI= [210, 291]). For recurrence cases, mean time from first report to provision of foster care services was 41 days (r= 0-868 days [16, 67]), time to post-investigation services was 153 days (r= 0-2,019 days [112, 194]), and time to juvenile court petition was 11 days (r= 0-804 days [0, 25]). The crude hazard rate for

Table 10
Statistical power calculations

Percent Exposed to factor (R)*	Full Cohort Z	Full Cohort Power**	50% Cohort Z	50% Cohort Power
50 (1)	2.94	>0.99	0.55	0.71
33 (2)	2.92	>0.99	0.53	0.70
25 (3)	2.66	>0.99	0.35	0.64
20 (4)	2.39	>0.99	0.16	0.56
17 (5)	2.15	0.98	-0.02	0.49
14 (6)	1.93	0.97	-0.17	0.43
13 (7)	1.75	0.96	-0.30	0.38
11 (8)	1.58	0.94	-0:41	0.34
10 (9)	1.44	0.93	-0.52	0.30
6 (14)	0.91	0.82	-0.89	0.19
5 (19)	0.56	0.71	-1.13	0.13
4 (24)	0.32	0.63	-1.31	0.10
3 (32)	0.04	0.52	-1.50	<0.08
2 (49)	–0.32	0.38	-1.76	<0.08
1 (99)	–0.79	0.22	-2.09	<0.08

*Full cohort N_T=2,670, target RR=2.0, R = [1/percentage exposed - 1]
**Power $(1 - \beta)$ can be read using Z_β in Table 12-14, in Kelsey et al.(1996), p.331.

physical abuse recurrence can be calculated by dividing the total number of cases (155) by the sum of the person-years at risk for the cases and controls. Assuming that cases were at risk for 250 days (0.68y) and controls were at risk during one-half of the year of first occurrence (6 months) plus the two years of follow-up, the hazard rate (HR) is given by: (the number of cases) / (person-years-cases + person-years-controls) = 155 / [(155 *0.68) + (2,515*2.5)] = 155 / 6,393 = 0.024 cases/person-yr (Kelsey, p. 315). This indicates that there are approximately 2.4 cases of recurrent physical abuse per year for each 100 children physically abused during infancy.

Cox regression models were used to calculate proportional hazard rate-ratios for child, family and system response factors. All factors plus times elapsed between first and second confirmed physical abuse reports for post-investigation services, removal to foster care and court petition were entered into an initial model of the form (Figure 7):

Figure 7. Proportional hazards equation for full recurrence model

$$h_i(t) / h_j(t) = e [\beta 1(\text{Medical Report Source- Non-medical source}) + \beta 2 (\text{Percent urban population}) + \beta 2 (\text{Male - female gender}) +$$
$$\beta 3 (\text{White - non-White race}) + \beta 4 (\text{Hispanic - non-Hispanic ethnicity}) + \beta 5 (\text{Number of prior unconfirmed reports}) +$$
$$\beta 6 (\text{Child problem with alcohol - No problem}) + \beta 7 (\text{Child problem with drugs - No problem}) +$$
$$\beta 8 (\text{Child visual/hearing impairment - No impairment}) + \beta 9 (\text{Child learning disability - No disability}) +$$
$$\beta 10 (\text{Child physical disability - No disability}) + \beta 11 (\text{Child Behavior problem - No problem}) +$$
$$\beta 12 (\text{Child other medical problem - No problem}) + \beta 13 (\text{Caretaker alcohol problem - No problem}) +$$
$$\beta 14 (\text{Caretaker drug problem - No problem}) + \beta 15 (\text{Caretaker mentally retarded - Not retarded}) +$$
$$\beta 16 (\text{Caretaker emotionally disturbed - Not disturbed}) + \beta 17 (\text{Caretaker visually impaired - Not impaired}) +$$
$$\beta 18 (\text{Caretaker learning disability - No disability}) + \beta 19 (\text{Violence between caretakers - No violence}) +$$
$$\beta 20 (\text{Inadequate housing - Not inadequate}) + \beta 21 (\text{Financial problems - No problems}) +$$
$$\beta 22 (\text{Public assistance - No assistance}) + \beta 23 (\text{Post-investigation services - No services}) +$$
$$\beta 24 (\text{Time to PI services}) + \beta 25 (\text{Family support services - No services}) +$$
$$\beta 26 (\text{Family preservation services - No services}) + \beta 27 (\text{Foster care services }) + \beta 28 (\text{Time to FC services}) +$$
$$\beta 29 (\text{Juvenile court petition - No petition}) + \beta 30 (\text{Time to petition})]$$

Variables with P values > 0.05 were removed one at a time beginning with the highest P, resulting in a final, adjusted model (Table 11). Medical report source, male gender, child medical problems and time in days to post-investigation services were significantly associated with an increased hazard rate of recurrence while use of foster care services was associated with decreased recurrence in a model which had only 152 records because of missing data. Among those records in the model, 16 were recurrence cases and 136 were censored because of non-recurrence.

Table 11
Final Cox regression model comparing time to second confirmed physical abuse reports with child, family and system response factors in recurrence cohort

Significant Factor Associations*	β**	HRR	95% CI	P
Medical Report Source	1.945	7.0	1.0, 50	0.05
Male gender	2.379	10.8	1.3, 90	0.03
Child Medical Problems	3.151	23.4	1.3, 927	0.03
Removal to Foster Care	-7.224	0.0007	$2x10^{-6}$, 0.3	0.02
Time to Post-Investigation Services	0.0043	1.004 / day	1.000, 1.007	0.05

*Model Statistics: 16 recurrence cases, 136 records censored (no recurrence); -2 Log L=59.256; Likelihood ratio P=0.008

**β= Parameter estimate; HRR=Hazard Rate Ratio

DISCUSSION

Physical abuse occurrence

This study has identified that child factors of infancy, male gender, Black race, Hispanic ethnicity and drug exposure are noted in a higher proportion of children with a first confirmed record of physical abuse in NCANDS-DCDC during 1995-1999. Medical reporting source and family factors of alcohol and drug problems and violence between caretakers are also associated with increased first confirmed physical abuse. Children with first confirmed physical abuse have fewer prior unconfirmed reports or have received fewer family support services compared to children with other types of maltreatment. They were more likely to have used foster care services, received family preservation services or juvenile court petition. Differences in rates were noted by state, although no differences were noted based on percent urban state population or among other child or family factors.

Differences in maltreatment reporting rates related to race or ethnicity have been found in some national incidence studies (Ards, 2001). In Michigan and California, African-American families have been found to have decreased rates of CPS reports for physical abuse as compared to white families, whereas white families have decreased rates of CPS reports for neglect. The overall effect is thought to 'cancel out' any effect of race on CPS reporting, report confirmation or confirmation of additional reports by CPS when overall maltreatment statistics are evaluated (Baird, 1999), which may explain these results.

There were state-to-state differences in mean annual incidence rates of physical abuse, varying from 0.5 cases per 1,000 children in North Carolina to 4.8 cases per 1,000 in Oklahoma. The overall rate of 2.5 cases per 1,000 is much lower than the rates noted in NIS. Given its use of 'sentinel' sources, NIS is thought to include more cases than those only known to CPS (Sedlak, 1996). However, this rate is double the rate of physical abuse in infants in a recently reported population-based study in Wales, suggesting marked international differences in PA occurrence (Sibert et al., 2002).

Children living the U.S. in the present study in states with higher rates of urban population actually had less physical abuse than other forms of maltreatment (Table 3). The reasons for this are unclear but may relate to how state urban populations were characterized (the percent of children living in urban settings was assumed to be the same as that of the total state population) or to how child maltreatment reports are handled in more urban states (CPS may confirm fewer numbers of physical abuse in face of more neglect in urban settings). This may also reflect decreasing national rates of urban violent crime overall, dropping over 30% to 33 violent crimes per 1,000 persons age 12 or older in 1999 (Bureau of Justice Statistics, 2000). Much still remains to be understood regarding the state-to-state variation in child maltreatment reporting and intervention as was suggested by Murray Straus in 1990 (Straus & Moore, 1990).

Young children with first confirmed reports of physical abuse have few or no prior unconfirmed reports in this study. This may reflect the CPS response to reports of physical abuse in young children (which have been noted to be more likely to be confirmed than reports of other maltreatment) and which can be influenced by the harm or potential harm to the child (in whom physical abuse causes physical injuries which are

thought to be more apparent and may be perceived as more harmful than neglect or other forms of maltreatment). This has resulted in reports that consistently show that younger children with abuse are more likely reported to CPS than are older children (Ards, 1993).

A medical source of confirmed physical abuse reports has been associated with increased first confirmed physical abuse reports in this study. Given the young age of the child and the injuries associated with these reports, it appears logical that these would be more likely to come from medical sources such as physicians or nurses rather than from school or legal professionals. However, it is particularly interesting to note that the null hypothesis could not be rejected in that no statistically significant differences could be found in other system response factors such as juvenile court petition, or other post-investigation, family support, and family preservation services. One might expect the system to have a greater response to serious harm in young children, yet these differences could not be confirmed in the models.

This study has noted an increased rate of PA recurrence in families with caretakers with 'drug problems.' Others have noted caretaker problems with drugs or other medical problems and violence between the caretakers have an association with increased risk of physical abuse. In a longitudinal study of 14,138 children over 6 years in the U.K., 162 were abused and the factors associated with this abuse were maternal age less than 20 years, lower educational attainment, history of maternal sexual abuse, abuse of the father, psychiatric illness, paternal age less than 20 years and prior parental foster care (Sidebothem, 2001). Connolly adds that a crucial factor is the age of the mother at birth and not at the time of maltreatment which predicts physical abuse (Connolly, 1992).

This suggests that NCANDS-DCDC variables do not get to the heart of the mechanisms by which maltreatment affects the child. Brown found that that attachment, maladaptive personalities, parental history of personal abuse, single parenting, sociopathy, marital quality and prenatal and perinatal factors have higher associations with physical abuse before age 4 years (Brown, 1998). Kotch identified infants at birth who were at increased risk for abuse based on maternal education, maternal depression, presence of the mother's mother during childhood and total life events and social well-being (Kotch, 1999). In a study of U.S. infant mortality using linked birth and death certificates over 8 years, Brenner noted that the highest rate of homicide was noted in infants born less than 2500 grams and to mothers with little or no prenatal care, young age, or who were single, Black or Native American (Brenner et al., 1999). Other than race and ethnicity, NCANDS does not provide this type of information and is therefore not an ideal source of data for these analyses.

Calculation of physical abuse occurrence is also hampered by removal of child fatality information. While records other than the fatal event for an individual child have been left in NCANDS-DCDC, the actual entire record for the confirmed maltreatment report leading to death has been removed (Elliott Smith, NDACAN, personal communication, 2002). Using published reports of child maltreatment fatality (Table 12), one can estimate the revised rates of first confirmed physical abuse, assuming: (1) 50% of maltreatment fatalities occur because of physical abuse; (2) 50% of maltreatment fatalities occur during the first year of life; (3) an additional 25% of child maltreatment fatalities occur during the second and third year of life; and (4) more than 95% of children will have had no prior reports or confirmation of physical abuse. This calculation results in

fewer than 5% additional reports in NCANDS States, resulting in small changes in the overall crude rates in Table 6. This is not inconsistent with the estimated 1.5 per 100,000 children who die annually as the result of maltreatment (Herman-Giddens et al., 1999).

Table 12
Child Maltreatment Fatality Reports, by State and Year

State	1995	1996	1997	1998	1999	Total	Mean
Arkansas	16	7	12	10	8	53	10.6
Colorado	23	20	24	28	32	127	25.4
Delaware	6	10	*	3	3	22	5.5
Florida	68	49	78	54	57	306	61.2
Kentucky	24	22	*	18	5	69	17.3
Louisiana	16	22	19	27	21	105	21.0
Massachusetts	9	3	1	11	*	24	6.0
Missouri	43	36	*	28	36	143	35.8
N. Carolina	17	43	*	23	21	104	26.0
Oklahoma	34	29	42	45	47	197	39.4
Rhode Island	4	4	3	2	4	17	3.4
Texas	96	110	*	176	143	525	131.3
Utah	14	9	7	12	7	49	9.8
Vermont	0	1	3	0	4	8	1.6
Washington	9	*	9	8	6	32	8.0
Wyoming	3	2	4	3	1	13	2.6
Total	382	367	202	448	395	1,794	25.3

*not reported to NCANDS-DCDC
Source: ACYF Child Maltreatment Reports, 1995-1999

Hypotheses regarding physical abuse recurrence

Among the 2,670 children in the cohort, 155 (5.8%) had a second confirmed report of physical abuse before age three years (95CI= [0%, 16.4%]). While this was more than the hypothesized rate of <5%, the null hypothesis cannot be disproved given the wide 95% confidence interval. Caretaker problems with drugs and emotional disturbance were significantly associated with recurrence. Financial problems, receipt of public

assistance, and inadequate housing were not significantly associated with recurrence. A null hypothesis of no difference in recurrence based on percentage urban population could be rejected with greater than 0.9 power.

Given that the present study looked at physical abuse in young children, these findings are understandably different from published analyses of NCANDS which have reported that 7.5% of children of all ages with substantiated abuse or neglect in the first six months of 1999 were noted to have additional confirmed reports of any type of maltreatment during the second half of that year (Administration on Children, Youth and Families, 2001). Children with substantiated reports early in 1999 were almost three times more likely to experience recurrence during the six months following their first victimization than children without a prior history of victimization, and neglected children were 44% more likely than physically abused children to experience recurrence of any form of maltreatment. There was more recurrence of neglect than for physical abuse during 1999, but recurrence outcomes over longer periods were not addressed (Administration on Children, Youth and Families, 2001).

The relatively low recurrence rate of maltreatment in this population of children under three years of age is reassuring given the high rates of recurrence or recidivism noted in other studies where reported re-abuse rates varied from 16% to 66.8%. The true incidence of re-abuse is not known because there are thought to be discrepancies between official reporting and actual occurrence. More recurrence is thought to be associated with more than one type of initial maltreatment and with neglect as compared to physical or sexual abuse, although this was not measured in the present study (Ferleger, 1988). Alexander notes a recidivism rate for all abuse of 33% in Iowa and found that 71% of

infants with shaken baby syndrome (a serious form of physical abuse) had evidence of prior abuse, neglect or both (Alexander, 1990). In the National Child Abuse Evaluation Program, 30% of 1700 children were re-abused during treatment and 58% were felt to be no less likely to abuse their children at the end of treatment. Higher rates of recurrence were noted after physical abuse in children under age 3 years, 69% of whom were hospitalized and 75% of whom were removed from their parents care (Rivara, 1985).

Time to recurrence in proportional hazard models was significantly associated with medical report source, child male gender, medical problems, removal to foster care and time to post-investigation services. Power calculations for other variables in proportional hazards models are beyond the scope of this study. In the present study, time to recurrence averaged over 8 months. NCANDS data in 1999 noted that the highest risk for re-abuse is within 6 months after the initial event, but again, that analysis only included recurrence during the same year (Administration on Children, Youth and Families, 2001). This differs from results in small clinical samples where the risk for recurrence is thought to be increased for up to 5 or six years after treatment (Levy, 1995).

Factors associated with physical abuse in prior NCANDS studies were child age less than three years (highest rates among all age groups), White race, and reports from non-medical professionals. Weak but statistically significant associations with maltreatment recurrence were noted in NCANDS in 1999 for children requiring petition to juvenile court or placed in foster care (OR=1.17) and families receiving post-investigation services such as family support and family preservation counseling, parenting classes or other services (OR=1.16) (Administration on Children, Youth and Families, 2001). While this may indicate the inefficacy of such programs, these low-level associations may also

indicate the selective provision of these services to high-risk families or other confounding factors (Heneghan, Horwitz, Leventhal, 1996). Differences were also noted in recurrence rates by region, but remarkable similarities in recurrence have been noted across states (Fluke et al., 1999; Gaudiosi et al., 2001).

In this study, use of foster care services was associated with a greater than 99.9% decrease in recurrence risk and increased time to post-investigation services was associated with small but statistically increased risk of subsequent physical abuse. No differences in recurrence risk in proportional hazards models were found depending on the source of the report or whether family preservation, or juvenile court services were provided at the time of the first confirmed physical abuse report. This suggests that a 'delay' in providing foster care or post-investigation services could cause recurrence; however, the causal relationship (if any) remains to be proven. While Fluke assumed that recurrence would be low in foster care and controlled for foster care placement, the present study's findings highlight the powerful effect of foster care services in preventing physical abuse recurrence (Fluke et al., 1999).

It is not surprising that provision of services to families after physical abuse is not linked to a decrease in recurrence. Not only are services selectively provided to families at high risk for recurrence, several studies have suggested some services are not effective in preventing future child maltreatment (Chaffin, 2001). Family support services are community-based prevention activities designed to alleviate stress, promote parental competence, and improve nurturing to enable families to better use existing resources and social supports, and DePanfilis has suggested that it is the number of sessions attended rather than service characteristics which is most predictive of maltreatment recurrence

(Depanfilis & Zuravin, 2002). Family preservation services are short-term, home-based services provided after CPS referral to help stabilize families and reduce the risk of removal to out-of-home placement. Evaluation of these services is thought to be relatively difficult given surveillance effects, and the few studies done have not shown reductions in the removal of children at risk for maltreatment (Henegian, 1996). Eckenrode noted that some family preservation services such as home visiting have been associated with decreased abuse, yet these effects are moderated by domestic violence which reduces or eliminates their effectiveness (Eckenrode, 2000).

Any proposed relationship between the provision of foster care or post-investigation services with PA recurrence is provisional and should be interpreted with caution. Missing data can potentially bias these results in several ways (Figure 8). For

Figure 8. Effects of missing or 'unknown' data

Removal to Foster Care	Recurrence	Non-recurrence	TOTALS
Data Present	96	1365	1461
Data Missing/Unknown	59	1150	1209
TOTALS	155	2515	2670
Percentage of records with data missing/unknown =			45%
OR for recurrence for data present/ missing-unknown =			1.37
	95% Confidence Interval =		0.98, 1.91
	chi square (Yates) p =		0.0756

Child Medical Problems	Recurrence	Non-recurrence	TOTALS
Data Present	18	366	384
Data Missing/Unknown	137	2149	2286
TOTALS	155	2515	2670
Percentage of records with data missing/unknown =			86%
OR for recurrence for data present/ missing-unknown =			0.77
	95% Confidence Interval =		0.27, 1.27
	chi square (Yates) p =		0.377

example, data concerning removal to foster care was absent in 45% of the records in the cohort, and 'unknown' or missing data was noted in 86% of records concerning child 'other medical problems'. Some States reported little or no data regarding foster care placement and child factors, potentially biasing any association with abuse recurrence. While neither association of absent or missing data is statistically significant in Figure 8, it is interesting to note that child records with missing data regarding foster care were more likely to have recurrence (odds ratio, OR= 1.37) and less likely to have recurrence regarding other child medical problems (OR=0.77). It is unclear whether data could be reasonably imputed for missing fields given the high rates of 'unknown' or missing data, and future analyses could be directed toward assessing the impact on these results from using various imputation strategies.

Limitations

This study using NCANDS-DCDC offers a unique opportunity to evaluate child maltreatment reports from large populations of young children in several states but has some important limitations. NCANDS contains information obtained from state CPS agency administrative data systems, and any secondary analysis of NCANDS therefore suffers from the fact that the data were not collected prospectively for the analysis. CPS practices regarding assessing and recording variables in NCANDS has not been standardized, and CPS acceptance and investigation of reports varies across states and may vary over time, leading to several potential differential and non-differential biases. Cases of suspected or confirmed abuse reported to CPS do not necessarily represent the entire population of maltreated children because a significant proportion of maltreatment is

never reported to CPS (Sedlak, 1996; Spano & Eckenrode, 1998). Thus, the NCANDS-DCDC sample is not referable to the entire population of physical abuse cases, some of which are not known to CPS. Given the significant health effects of physical abuse (which are more likely to result in CPS report), this may be less important in physical abuse in young children than in other forms of maltreatment.

While large, the DCDC sample is not designed to be nationally representative and analyses cannot be extrapolated to the entire U.S. population of children reported for suspected maltreatment. Age-specific child populations in states and years for which data were reported to NCANDS amounted to only 21% of the matched age-specific state populations because most states did not report data for all years during the study period. Family and child factors were often not reported by States to NCANDS-DCDC, and many caretaker and child-specific variables were missing or 'unknown' in the data. Such 'missing' information decreased statistical power and may have lead to differential misclassification of effect. Only nine states contributed data for at least three consecutive years to the DCDC during 1995-1999, and substantial data is missing. The subtype of physical abuse is also not specified in the DCDC. Different types of injuries resulting from physical abuse are postulated to have differing rates of occurrence and recurrence, and the impact of these specific injuries cannot be assessed.

Less important is the fact that DCDC data specifically excludes records concerning child fatalities, an important outcome of physical abuse. The absence of fatality data affects our ability to study the most severe forms of abuse but probably has little effect on overall comparisons since fatalities represent less than 5% of physical abuse cases in NCANDS-DCDC and less than 2% of physical abuse overall (Ellis, 1997).

CONCLUSIONS

Several conclusions can be made about the occurrence and recurrence of physical abuse among infants and young children included in the National Child Abuse and Neglect Data System Detailed Case Data Component (NCANDS-DCDC) for 1995-1999:

1. Overall mean rate of physical abuse was 2.3 per 1,000 children under age three years. Rates of first confirmed physical abuse occurrence vary widely state to state, from 0.5 to 4.8 cases per 1,000 children. This underestimates the true incidence given the fact that NCANDS-DCDC does not include child fatality records. However, fatality incidence is low and only marginally increases the calculated rate.
2. NCANDS-DCDC contains no information about the type or severity of the confirmed physical abuse in maltreatment reports. This prevents further analysis of specific forms of physical abuse such as Shaken Baby Syndrome, although many of the reports concerning infants are presumed to include SBS and other serious head injuries;
3. While most infants and young children with a first confirmed report of physical abuse receive post-investigation services, most do not receive family support services, family preservation services, foster care services or petition to juvenile court;
4. Factors associated with increased first confirmed physical abuse as compared to other forms of confirmed maltreatment include: medical reporting sources,

infancy, male gender, Black race, Hispanic ethnicity, child exposure to alcohol or drugs, caretaker problem with alcohol or drugs, and family violence;

5. Factors associated with decreased first confirmed physical abuse as compared to other forms of confirmed maltreatment include: inadequate housing, receiving public assistance, and urban location;
6. Overall, the rate of confirmed physical abuse recurrence in the cohort is low (5.8%) before age three years among children first physically abused in infancy, with 0.024 cases per person-year. However, less than 10% of children who were physically abused in infancy could be followed until age three years in the dataset because most states have not consistently provided information to NCANDS-DCDC. Steps should be taken to improve reporting by the States to NCANDS-DCDC to benefit future analyses of recurrence;
7. Analysis of confirmed physical abuse recurrence in infants and young children in NCANDS-DCDC is problematic because of missing variables that were not reported by the States. In the limited information available, caretaker problems with drugs and emotional disturbance were associated with increased risk of confirmed physical abuse recurrence before age three years. Medical report source, male gender, child medical problems and time to post-investigation services were associated with decreasing time to recurrence in proportional hazard models, and removal to foster care was associated with less risk of recurrence. However, these results should be interpreted with caution given the limitations of this study and the high frequency of missing data in NCANDS-DCDC;

8. Limitations in the data collection and reporting by the States suggest that NCANDS-DCDC is not representative of all children reported for suspected maltreatment and is not referable to the whole U.S. population of reported children. Furthermore, given the idiosyncrasies of child maltreatment reporting to CPS, it is suspected that the results of analyses of data in NCANDS-DCDC are not referable to the whole U.S. population of maltreated children. Further studies should be directed at evaluating the referability of NCANDS-DCDC reports to the entire population of maltreated children, regardless of whether reported to CPS;
9. It would be ideal to replicate these analyses in a large, nationally-representative dataset with additional maternal child variables linked to birth and death certificates, and further research can be directed toward comparing the results of this study with:
    a. The occurrence and recurrence of physical abuse in older children;
    b. The occurrence and recurrence of other forms of maltreatment in infants and young children;
    c. The recurrence of other forms of maltreatment after infants and young children are first physically abused;
    d. The effects of multiple forms of maltreatment co-occurring with physical abuse in infants and young children.

APPENDICES

Appendix 1 Data Use Agreement Form

Appendix 2 List of NCANDS variables

Appendix SAS Code

NCANDS Terms of Use Agreement

This agreement outlines the specific terms under which data obtained from the National Data Archive on Child Abuse and Neglect (hereafter referred to as 'the Archive") may be used. A hard copy of this agreement must be signed and returned to the Archive before data can be released. Data and explanatory documentation provided by the Archive for the **National Child Abuse and Neglect Data System, 1995-1999** are hereafter referred to as 'the materials'.

I intend to use the materials for the following research purposes:

_____

_____

_____

I hereby agree:

(1) Purpose.- To use the materials only for the noncommercial statistical research purposes listed above and teaching.

(2) Confidentiality: To act at all times so as to preserve the confidentiality of individuals and institutions recorded in the materials. In particular I agree not to use or attempt to use the materials alone or in combination with any other data to derive information relating specifically to an identified individual or institution nor to claim to have done so, nor to match any datum contained in the materials with any other data or data sets. Additionally, no listings of information from individual records will be published or otherwise released.

(3) Acknowledgment: To acknowledge in any publications, whether printed, electronic, or broadcast, based wholly or in part on such materials, the U. S. Department of Health and Human Services, Administration on Children, Youth and Families, Children's Bureau, and the Archive. To declare in any such work that those who carried out the original collection and analysis of the data bear no responsibility for their further analysis or interpretation. To use the following citation in all published works:

> The data utilized in this publication were made available by the National Data Archive on Child Abuse and Neglect, Cornell University, Ithaca NY; and have been used by permission. Data from the National Child Abuse and Neglect Data System were supplied by state child protective service agencies to the Children's Bureau or the Administration of Children, Youth and Families, U.S. Department of Health and Human Services Funding for NCANDS was provided by the Children's Bureau, U.S. Department of Health and Human Services. The National Child Abuse and Neglect Data System was implemented by Walter R. McDonald & Associates, Inc. Neither the participating state agencies; Walter R. McDonald & Associates, Inc.; the Children's Bureau, Administration on Children, Youth and Families, U.S. Department of Health and Human Services, the Archive, Cornell University, or its agents or employees bear any responsibility for the analyses, opinions, or interpretations presented here.

(4) Publications: To supply a draft of any manuscript or report based wholly or in part on these data to John Gaudiosi, Children's Bureau, Administration on Children, Youth and Families, 330 C Street SW, Washington, D. C. 20013. I will not submit the manuscript for publication until 60 days following submission to the Children's Bureau. I authorize the Children's Bureau to submit copies of the manuscript to the state representatives at any time. Finally, I will deposit with the Archive two copies of any published work or report based wholly or in part on these data.

(5) Copyright: Not to make any claim to copyright ownership of the materials provided, not to distribute copies of the materials to others, nor to make copies, except as necessary to carry out non-commercial statistical research and teaching.

(6) Access to others: To store the data securely, and to restrict access to the data to registered users who have received written permission from the Archive, for the specified purposes. In particular, I will not store the data set on a file server or in any other computational domain where it could be accessed by others. in the case of datasets for which my purpose of use is teaching to give access only to students who have signed the student Terms of Use Agreement and to provide the Archive with copies of the Students' Agreements.

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Appendix 2
NCANDS Variables

The 'J' and 'K' files can be matched and combined using the following twelve fields (with their variable names and 'Y/N' response type) in both files:

Report ID (YSRPTID): Unique identification label assigned to each report of maltreatment in each state;
Child ID (YSCHID): Unique identification label assigned to a child in each state;
State (STATERR): U.S. State in which report was received and where child lives;
Report Date (RPTDT): Date maltreatment was reported;
Disposition Date (RPDISPDT): Date a decision was reached concerning the disposition of alleged maltreatment(s);
Report Disposition (RPTDISP): Conclusion reached by responsible agency concerning report of alleged maltreatment;
Report Source (RPTSRC): Role of person who reported alleged maltreatment;
Child's Age (CHAGE): Child's age in years in date of report;
Child's Sex (CHSEX): Child's gender recorded at time of report;
Child's Race (CHRACE): Primary racial group which the child or parent identifies the child as a member;
Child's Hispanic Ethnicity (CHISP): A Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish ancestry, regardless of race (Y/N);
Prior Victimization Status (CHPRIOR): Existence of previous substantiated or indicated incident of maltreatment (Y/N).

Two additional fields are included in the 'J' files:

Notifications (NOTIFS): Mandated or courtesy contacting of other agencies concerning report of child maltreatment;
Substantiated or Indicated Maltreatment (FLVICTIM): A computed variable flag of substantiated or indicated maltreatment of child in this report (Y/N).

The fifty additional fields in the 'K' files contain a variety of variables with information about the child, caretaker and services provided after a substantiated or indicated report:

Post Investigation Services Provided (POSTSERV): CPS or child welfare services provided as a result of needs identified during the investigation (Y/N);
Date of Post Investigative Services (SERVDATE): Date post investigation services were provided, generally the date of the report disposition;
Family Support Services Provided (FAMSUP): Family support services were open or panned for the family (Y/N);
Family Preservation Services Provided (FAMPRES): Family preservation services were open or planned for the family (Y/N);

Foster Care Services Provided (FOSTERCR): Services or activities associated with 24 hour substitute care for all children placed away from their parents (Y/N);

Removal Date (RMVDATE): The month, day and year the child was removed from the care and supervision of his or her parents;

Juvenile Court Petition (JUVPET): Legal document filed with the court requesting that the court take action regarding the child's status (Y/N);

Court Petition Date (PETDATE): The month, day and year the juvenile court petition was filed;

Maltreatment Count (C_MAL_CN): Computed variable representing number of substantiated or indicated maltreatments;

Child Victim of Physical Abuse (FL_CVPHY): Computed flag indicating whether child was substantiated or indicated victim of physical abuse (Y/N);

Physical Abuse Disposition (C_PHYDIS): Computed variable representing the disposition of maltreatment associated with report of physical abuse;

Child Victim of Neglect (FL_CVNEG): Computed flag indicating whether child was substantiated or indicated victim of neglect (Y/N);

Neglect Disposition (C_NEGDIS): Computed variable representing the disposition of maltreatment associated with report of neglect;

Child Victim of Medical Neglect (FL_CVMED): Computed flag indicating whether child was substantiated or indicated victim of medical neglect (Y/N);

Medical Neglect Disposition (C_MEDDIS): Computed variable representing the disposition of maltreatment associated with report of medical neglect;

Child Victim of Sexual Abuse (FL_CVSEX): Computed flag indicating whether child was substantiated or indicated victim of sexual abuse (Y/N);

Sexual Abuse Disposition (C_SEXDIS): Computed variable representing the disposition of maltreatment associated with report of sexual abuse;

Child Victim of Psychological Abuse (FL_CVPSY): Computed flag indicating whether child was substantiated or indicated victim of psychological abuse (Y/N);

Psychological Abuse Disposition (C_PSYDIS): Computed variable representing the disposition of maltreatment associated with report of psychological abuse;

Child Victim of Other Abuse (FL_CVOTH): Computed flag indicating whether child was substantiated or indicated victim of other abuse (Y/N);

Other Abuse Disposition (C_OTHDIS): Computed variable representing the disposition of maltreatment associated with report of other abuse;

Child Victim of Unknown Maltreatment (FL_CVUNK): Computed flag indicating whether child was substantiated or indicated victim of an unknown type of maltreatment (Y/N);

Unknown Maltreatment Disposition (C_PHYUNK): Computed variable representing the disposition of maltreatment associated with report of an unknown type of maltreatment;

Child Problem Recorded (CDPROBFL): A computed variable flag that the child was reported to have a special problem such as drug abuse or a physical handicap (Y/N);

Child Problem, Drugs or Alcohol (CDALCDRU): A computed variable flag that the child was reported to have a problem with either drugs or alcohol (Y/N);

Child Problem, Mental or Physical (CDPHYSME): A computed variable flag that the child was reported to have a physical or mental problem (Y/N);

Child Problem with Alcohol (CDALC): The child was reported to compulsively use or need alcohol (Y/N). For young children this generally indicates neonatal alcohol exposure;

Child Problem with Drugs (CDDRUG): The child was reported to compulsively use or need narcotics (Y/N). For young children this generally indicates neonatal drug exposure;

Child Mentally Retarded (CDRTRD): The child was clinically diagnosed to be significantly sub average in general cognitive ability (Y/N);

Child Emotionally Disturbed (CDEMOTNL): The child was clinically diagnosed to be emotionally disturbed (Y/N);

Child Visual or Hearing Impaired (CDVISUAL): The child was clinically diagnosed to be visually, hearing or speech impaired (Y/N);

Child Learning Disability (CDLEARN): The child was reported to have a learning disability (Y/N). For young children this generally indicates developmental disability;

Child Physically Disabled (CDPHYS): The child was reported to be physically disabled (Y/N);

Child Behavior Problem (CDBEHAV): The child was reported to have a behavior problem in school or in the community (Y/N);

Child Other Medical Problem (CDMEDICL): The child was reported to have another medical problem not previously identified (Y/N);

Caretaker Problem Recorded (FCPROBFL): A variable flag for the caretaker was reported to have a special problem such as drug abuse or a physical handicap (Y/N);

Caretaker Problem, Drugs or Alcohol (FCALCDRU): A variable flag for caretaker was reported to have a problem with drugs or alcohol (Y/N);

Caretaker Mental or Physical Problem (FCPHYSME): A variable flag for caretaker was reported to have a physical or mental problem (Y/N);

Caretaker Problem with Alcohol (FCALC): Caretaker was reported to compulsively use or need alcohol (Y/N);

Caretaker Problem with Drugs (FCDRUG): Caretaker was reported to compulsively use or need narcotics (Y/N);

Caretaker Mentally Retarded (FCRTRD): Caretaker was clinically diagnosed to be significantly sub average in general cognitive ability (Y/N);

Caretaker Emotionally Disturbed (FCEMOTNL): Caretaker was clinically diagnosed to be emotionally disturbed (Y/N);

Caretaker Visual or Hearing Problem (FCVISUAL): Caretaker was clinically diagnosed to be visually, hearing or speech impaired (Y/N);

Caretaker Learning Disability (FCLEARN): Caretaker was reported to have a learning disability (Y/N);

Caretaker Physically Disabled (FCPHYS): Caretaker was reported to be physically disabled (Y/N);

Caretaker Other Medical Problem (FCMEDICL): Caretaker was reported to have another medical problem not previously identified (Y/N);

Violence Between Caretakers (FCVIOL): Domestic violence between caretakers reported (Y/N);

Inadequate Housing (FCHOUSE): Family reported to have inadequate housing (Y/N);

Family Financial Problems (FCMONEY): Family finances do not meet minimal needs (Y/N);

Family Receives Public Assistance (FCPUBLIC): Family receives public assistance from AFDC, general Assistance, Medicaid, SSI, Food Stamps, etc. (Y/N).

Appendix 3
SAS Code

```
/*  NCANDS 1995-1999 Analyses  */

/*  creates library 'indata' and includes ncands formats*/
      libname indata 'C:\ncands\big kahuna files';
      %include "C:\ncands\ncands formats.sas";

/* combine J and K files and deletes substantiated reports from jkahuna
file to create summary file (bigkahun) with add'l fields for confirmed
rpts*/
data temp1;
      set indata.jkahuna;
      if flvictim = 1 then delete;
      run;
data temp;
      set indata.kkahuna;
      run;

/*appends modified jkahuna file to kkahuna file*/
proc APPEND BASE=temp data=temp1 force;
      run;

/*creates new child id 'stchid' which gets rid of rollups and
      the first 4 numbers in 'yschid' child id and creates a year field
*/
data indata.bigkahun;
      set temp;
      stchid = substr(yschid,5);
      year = substr(yschid,1,4);
      run;

/* Creates file (LTTHREE) for all reports for ages LT three, recreates
victim flag, sorts, removes rollups, creates and advances report counter
*/
data indata.LTTHREE;
      set indata.bigkahun;
      where chage LT 3;
      if ((fl_cvphy = 1) or  (fl_cvsex = 1) or  (fl_cvneg = 1) or
(fl_cvmed = 1) or
        (fl_cvpsy = 1) or  (fl_cvoth = 1) or  (fl_cvunk = 1)) then
flvictim = 1;
        else flvictim = 0;
      run;

/*sorts by child-report unique pairs*/
proc sort data=indata.LTTHREE;
      by stchid rptdt;
      run;

/*gets rid of rollup (duplicate unsub reports in one day)*/
data indata.LTTHREE;
      set indata.LTTHREE;
      if ((stchid = lag(stchid)) and (rptdt = lag(rptdt)) and (flvictim
= 0)) then delete;
```

```
run;

/*sorts by child-report unique pairs, descending*/
proc sort data=indata.LTTHREE;
      by stchid descending rptdt;
      run;

/*gets rid of rollup (duplicate reports in one day)*/
data indata.LTTHREE;
      set indata.LTTHREE;
      if ((stchid = lag(stchid)) and (rptdt = lag(rptdt))) then delete;
      run;

/*re-sorts by child-report unique pairs*/
proc sort data=indata.LTTHREE;
      by stchid rptdt;
      run;
data indata.LTTHREE;
      set indata.LTTHREE;
      by stchid rptdt;
      retain numsub numunsub rptposit;
      if (first.stchid and flvictim = 1) then numsub =1;
      if (first.stchid and flvictim = 0) then numsub =0;
      if ((not first.stchid) and (flvictim = 1)) then numsub = numsub +
1;
      if first.stchid then rptposit = 1;
            else rptposit = rptposit + 1;
      numunsub = rptposit - numsub;
      if last.stchid then lastrpt = 1;
      run;

/*identifies individual child id's and counts substantiated reports by
type of abuse */
data indata.LTTHREE;
      set indata.LTTHREE;
      by stchid rptdt;
      retain numpa numsex numneg nummed numpsy numoth numunk;
      if (first.stchid and fl_cvphy = 1) then numpa =1;
      if (first.stchid and fl_cvsex = 1) then numsex =1;
      if (first.stchid and fl_cvneg = 1) then numneg =1;
      if (first.stchid and fl_cvmed = 1) then nummed =1;
      if (first.stchid and fl_cvpsy = 1) then numpsy =1;
      if (first.stchid and fl_cvoth = 1) then numoth =1;
      if (first.stchid and fl_cvunk = 1) then numunk =1;
      if (first.stchid and fl_cvphy = 0) then numpa =0;
      if (first.stchid and fl_cvsex = 0) then numsex =0;
      if (first.stchid and fl_cvneg = 0) then numneg =0;
      if (first.stchid and fl_cvmed = 0) then nummed =0;
      if (first.stchid and fl_cvpsy = 0) then numpsy =0;
      if (first.stchid and fl_cvoth = 0) then numoth =0;
      if (first.stchid and fl_cvunk = 0) then numunk =0;
      if (not first.stchid and fl_cvphy = 1) then numpa = numpa + 1;
      if (not first.stchid and fl_cvsex = 1) then numsex = numsex + 1;
      if (not first.stchid and fl_cvneg = 1) then numneg = numneg + 1;
      if (not first.stchid and fl_cvmed = 1) then nummed = nummed + 1;
      if (not first.stchid and fl_cvpsy = 1) then numpsy = numpsy + 1;
      if (not first.stchid and fl_cvoth = 1) then numoth = numoth + 1;
```

```
      if (not first.stchid and fl_cvunk = 1) then numunk = numunk + 1;
      run;

/* Adds percent urban as 'pcturban', labels quartiles 'qrturban' top=4,
bottom=1 */
data indata.ltthree;
      set indata.ltthree;
      if staterr = 'AR' then pcturban = 53.5;
      if staterr = 'AR' then qrturban = 1;
      if staterr = 'CO' then pcturban = 82.4;
      if staterr = 'CO' then qrturban = 3;
      if staterr = 'DE' then pcturban = 73;
      if staterr = 'DE' then qrturban = 3;
      if staterr = 'FL' then pcturban = 84.8;
      if staterr = 'FL' then qrturban = 4;
      if staterr = 'KY' then pcturban = 51.8;
      if staterr = 'KY' then qrturban = 1;
      if staterr = 'LA' then pcturban = 68.1;
      if staterr = 'LA' then qrturban = 2;
      if staterr = 'MA' then pcturban = 84.3;
      if staterr = 'MA' then qrturban = 4;
      if staterr = 'MO' then pcturban = 68.7;
      if staterr = 'MO' then qrturban = 2;
      if staterr = 'NC' then pcturban = 50.4;
      if staterr = 'NC' then qrturban = 1;
      if staterr = 'OK' then pcturban = 67.7;
      if staterr = 'OK' then qrturban = 2;
      if staterr = 'RI' then pcturban = 86;
      if staterr = 'RI' then qrturban = 4;
      if staterr = 'TX' then pcturban = 80.3;
      if staterr = 'TX' then qrturban = 3;
      if staterr = 'UT' then pcturban = 87;
      if staterr = 'UT' then qrturban = 4;
      if staterr = 'VT' then pcturban = 32.3;
      if staterr = 'VT' then qrturban = 1;
      if staterr = 'WA' then pcturban = 76.4;
      if staterr = 'WA' then qrturban = 3;
      if staterr = 'WY' then pcturban = 65;
      if staterr = 'WY' then qrturban = 2;
      run;

/*creates dummy label variables0 (0 or 1) for all fields by setting
all known values >zero to 0 and then resetting variable0 = 1 for
value of choice */
data indata.LTTHREE;
      set indata.LTTHREE;
      if (rptsrc GT 0 and rptsrc LT 99) then rptsrc0 = 0; if rptsrc = 2
then rptsrc0 = 1;
      if (chsex GT 0 and chsex LT 9) then chsex0 = 0; if chsex = 1 then
chsex0 = 1;
      if chage = 0 then chage0 = 0; if chage > 0 then chage0 = 1;
      if (chrace GT 0 and chrace LT 99) then chrace0 = 0; if chrace = 1
then chrace0 = 1;
      if (chisp GT 0 and chisp LT 9) then chisp0 = 0; if chisp = 1 then
chisp0 = 1;
      if (postserv GT 0 and postserv LT 9) then postserv0 = 0; if
postserv = 1 then postserv0 = 1;
```

```
      if (famsup GT 0 and famsup LT 9) then famsup0 = 0; if famsup = 1
then famsup0 = 1;
      if (fampres GT 0 and fampres LT 9) then fampres0 = 0; if fampres =
1 then fampres0 = 1;
      if (fostercr GT 0 and fostercr LT 9) then fostercr0 = 0; if
fostercr = 1 then fostercr0 = 1;
      if (juvpet GT 0 and juvpet LT 9) then juvpet0 = 0; if juvpet = 1
then juvpet0 = 1;
      if (cdalc GT 0 and cdalc LT 9) then cdalc0 = 0; if cdalc = 1 then
cdalc0 = 1;
      if (cddrug GT 0 and cddrug LT 9) then cddrug0 = 0; if cddrug = 1
then cddrug0 = 1;
      if (cdrtrd GT 0 and cdrtrd LT 9) then cdrtrd0 = 0; if cdrtrd = 1
then cdrtrd = 1;
      if (cdemotnl GT 0 and cdemotnl LT 9) then cdemotnl0 = 0; if
cdemotnl = 1 then cdemotnl0 = 1;
      if (cdvisual GT 0 and cdvisual LT 9) then cdvisual0 = 0; if
cdvisual = 1 then cdvisual0 = 1;
      if (cdlearn GT 0 and cdlearn LT 9) then cdlearn0 = 0; if cdlearn =
1 then cdlearn0 = 1;
      if (cdphys GT 0 and cdphys LT 9) then cdphys0 = 0; if cdphys = 1
then cdphys0 = 1;
      if (cdbehav GT 0 and cdbehav LT 9) then cdbehav0 = 0; if cdbehav =
1 then cdbehav0 = 1;
      if (cdmedicl GT 0 and cdmedicl LT 9) then cdmedicl0 = 0; if
cdmedicl = 1 then cdmedicl0 = 1;
      if (fcalc GT 0 and fcalc LT 9) then fcalc0 = 0; if fcalc = 1 then
fcalc0 = 1;
      if (fcdrug GT 0 and fcdrug LT 9) then fcdrug0 = 0; if fcdrug = 1
then fcdrug0 = 1;
      if (fcrtrd GT 0 and fcrtrd LT 9) then fcrtrd0 = 0; if fcrtrd = 1
then fcrtrd0 = 1;
      if (fcemotnl GT 0 and fcemotnl LT 9) then fcemotnl0 = 0; if
fcemotnl= 1 then fcemotnl0 = 1;
      if (fcvisual GT 0 and fcvisual LT 9) then fcvisual0 = 0; if
fcvisual = 1 then fcvisual0 = 1;
      if (fclearn GT 0 and fclearn LT 9) then fclearn0 = 0; if fclearn =
1 then fclearn0 = 1;
      if (fcphys GT 0 and fcphys LT 9) then fcphys0 = 0; if fcphys = 1
then fcphys0 = 1;
      if (fcmedicl GT 0 and fcmedicl LT 9) then fcmedicl0 = 0; if
fcmedicl = 1 then fcmedicl0 = 1;
      if (fcviol GT 0 and fcviol LT 9) then fcviol0 = 0; if fcviol = 1
then fcviol0 = 1;
      if (fchouse GT 0 and fchouse LT 9) then fchouse0 = 0; if fchouse =
1 then fchouse0 = 1;
      if (fcmoney GT 0 and fcmoney LT 9) then fcmoney0 = 0; if fcmoney =
1 then fcmoney0 = 1;
      if (fcpublic GT 0 and fcpublic LT 9) then fcpublic0 = 0; if
fcpublic = 1 then fcpublic0 = 1;
      if qrturban = 1 then qrturban0 = 0;
      if qrturban = 4 then qrturban0 = 1;
      run;

/* DESCRIPTIVE EPI of children less than 3 years */

proc contents varnum data=indata.LTTHREE;
```

```
      run;
proc freq data=indata.LTTHREE;
      title1 'Table 1: Crosstabs of state by year, children < 3y, all
reports';
      TABLES staterr * year;
      run;
proc freq data=indata.LTTHREE;
      title1 'State quartiles for percentage urban population, 1990
Census data';
      tables staterr * qrturban;
      run;
proc freq data=indata.LTTHREE;
      title1 'Table 2: Crosstabs of report dispositions, by year, by
type of abuse';
      TABLES (C_phydis C_negdis C_meddis C_sexdis C_psydis C_othdis
C_unkdis) * year;
      run;
proc freq data=indata.LTTHREE;
      title1 'Table 3a: Demographic characteristics, individual children
age < 3y';
      where lastrpt = 1;
      tables chage chsex chrace chisp qrturban numsub numunsub rptposit;
      run;
proc means data=indata.ltthree;
      title1 'Table 3b: Mean total number reports by type, individual
children, age < 3y';
      where lastrpt = 1;
      var numpa numsex numneg nummed numpsy numoth numunk numsub
numunsub rptposit ;
      run;
proc univariate data=indata.LTTHREE;
      where lastrpt EQ 1;
      title1 'Table 3c: Quartiles for percent urban location, individual
children, age < 3y' ;
      var pcturban;
      run;
proc freq data=indata.LTTHREE;
      title1 'Table 4: Crosstabs of variables, PA and total, all
confirmed records';
      where flvictim = 1;
      tables (year rptsrc rptsrc0 chage chage0 chsex chsex0 chrace
chrace0 chisp chisp0
                  qrturban qrturban0
                  cdalc0 cddrug0 cdrtrd0 cdemotnl0 cdvisual0 cdlearn0
cdphys0 cdbehav0 cdmedicl0
                  fcalc0 fcdrug0 fcrtrd0 fcemotnl0 fcvisual0 fclearn0
fcphys0 fcmedicl0 fcviol0
                  fchouse0 fcmoney0 fcpublic0
                  postserv0 famsup0 fampres0 fostercr0 juvpet0 numsub
numunsub rptposit)
                  * fl_cvphy;
      run;
proc freq data=indata.LTTHREE;
      title1 'Table 5a: First confirmed PA reports, by state and year,
by age';
      where (numsub = 1 and fl_cvphy = 1);
      tables year* staterr * chage ;
```

```
      run;
proc freq data=indata.LTTHREE;
      title1 'Table 5b: First confirmed PA reports, by state and age';
      where (numsub = 1 and fl_cvphy = 1);
      tables staterr * chage;
      run;

/* COHORT STUDY of recurrence
Cohort definition:      children less than 3y
with first confirmed PA before age 1y,
in states and years with 2 or more consecutive years of followup

Cohort Analysis:
CONTROL:    No additional confirmed PA: sub2pa=1
CASE:       2nd PA in child: sub2pa=1;

Labels cases and controls in COHORT study and creates new file
(PAcohort)  */
data indata.PAcohort;
      set indata.LTTHREE;
      if ((numpa=1 and fl_cvphy=1 and chage=0)and
            ((staterr = 'CO' and year = 1995) or
            (staterr = 'CO' and year = 1996) or
            (staterr = 'FL' and year = 1995) or
            (staterr = 'FL' and year = 1996) or
            (staterr = 'FL' and year = 1997) or
            (staterr = 'KY' and year = 1997) or
            (staterr = 'MA' and year = 1995) or
            (staterr = 'OK' and year = 1996) or
            (staterr = 'OK' and year = 1997) or
            (staterr = 'RI' and year = 1997) or
            (staterr = 'UT' and year = 1995) or
            (staterr = 'UT' and year = 1996) or
            (staterr = 'UT' and year = 1997) or
            (staterr = 'VT' and year = 1995) or
            (staterr = 'VT' and year = 1996) or
            (staterr = 'VT' and year = 1997) or
            (staterr = 'WY' and year = 1997)))  then sub2pa=0;
      if (numpa=2 and fl_cvphy=1) then sub2pa=1;
      run;


/*Removes records not pertaining for first or second confirmed PA
reports */
data indata.PAcohort;
      set indata.PAcohort;
      where (sub2pa=0 or sub2pa=1);
      run;
proc freq data=indata.PAcohort;
      title1 'Table 6a: Cohort status by state and year (sub2pa=0 =>
first PA)';
      where (sub2pa=0);
      tables staterr * year;
      run;

/*sorts by child-report date unique pairs*/
proc sort data=indata.PAcohort;
```

```
      by stchid rptdt;
      run;

/*deletes additional records with no first PA before 1 year*/
data indata.PAcohort;
      set indata.PAcohort;
      if ((stchid NE lag(stchid)) and (sub2pa =1)) then delete;
      run;
proc freq data=indata.PAcohort;
      title1 'Table 6b: Cohort status by state and year (second PA)';
      where (sub2pa=1);
      tables staterr * year;
      run;

/*dataset descriptives for COHORT study */
proc contents varnum data=indata.PAcohort;
      title1 'COHORT dataset descriptives';
      run;
proc freq data=indata.PAcohort;
      title1 'Table 8: Age of child by recurrence status (sub2pa=1 ->
repeat PA)';
      tables chage*sub2pa;
      run;

/*sorts by child-report date unique pairs*/
proc sort data=indata.PAcohort;
      by stchid rptdt;
      run;

/* copies fields from first report to second record 'f' variables*/
data indata.PAcohort;
      set indata.PAcohort;
      fpostserv0 = lag(postserv0);
      ffamsup0   = lag(famsup0);
      ffampres0  = lag(fampres0);
      ffostercr0 = lag(fostercr0);
      fjuvpet0   = lag(juvpet0);
      frptdt     = lag(rptdt);
      fservdate  = lag(servdate);
      frmvdate   = lag(rmvdate);
      fpetdate   = lag(petdate);
      fchage     = lag(chage);
      fyear      = lag(year);
      run;

/* calculates time intervals in weeks between first and second reports
for report, service, removals and court petition dates */
data indata.PAcohort;
      set indata.PAcohort;
      time2     = (rptdt - frptdt);
      timeserv  = (rptdt - fservdate);
      timermv   = (rptdt - frmvdate);
      timepet   = (rptdt - fpetdate);
      run;
data indata.PAcohort;
      set indata.PAcohort;
      if timeserv  < 0 then timeserv = 0;
```

```
      if timermv  < 0 then timermv = 0;
      if timepet  < 0 then timepet = 0;
      run;
proc freq data=indata.PAcohort;
      title1 'Crosstab of first year of PA (fyear) by year of recurrence
of PA';
      where sub2pa =1;
      tables fyear*year;
      run;

/*Transfers info from second report to first in children with multiple
reports */

/*sorts by child-ID and position, descending*/
proc sort data=indata.PAcohort out=indata.PAcohort;
      by stchid descending rptdt descending sub2pa ;
      run;

/* copies fields from second report to first record 's' variables*/
data indata.PAcohort;
      set indata.PAcohort;
      spostserv0 = lag(postserv0);
      sfamsup0   = lag(famsup0);
      sfampres0  = lag(fampres0);
      sfostercr0 = lag(fostercr0);
      sjuvpet0   = lag(juvpet0);
      srptdt     = lag(rptdt);
      sservdate  = lag(servdate);
      srmvdate   = lag(rmvdate);
      spetdate   = lag(petdate);
      schage     = lag(chage);
      syear      = lag(year);
      stime2     = lag(time2);
      stimeserv  = lag(timeserv);
      stimermv   = lag(timermv);
      stimepet   = lag(timepet);
      run;

/* creates variable labeling PA recurrence cases (PArecur=1) vs cases
with no recurrence (PArecur=0) and back-labels first record */
data indata.PAcohort;
      set indata.PAcohort;
      retain PArecur;
      if sub2pa=1 then PArecur=1; else PArecur = 0;
      if ((stchid = lag(stchid)) and (lag(PArecur)=1)) then PArecur=1;
      run;

/* Creates new dataset (PArecur) which selects first records only */
data indata.PArecur;
      set indata.PAcohort;
      where sub2pa=0;
      run;

/*dataset descriptives for recurrence records */
proc contents varnum data=indata.PArecur;
      title1 'PArecur dataset descriptives';
      run;
```

```
proc freq data=indata.PArecur;
      title1 'Age of child by recurrence status (PArecur=1 : repeat
PA)';
      tables chage*PArecur;
      run;

/* Comparison of recurrence vs non-PA recurrence cases */
proc freq data=indata.PArecur;
      title1 'Table 7: Crosstabs of variables by PA recurrence
(PArecur=1) in COHORT';
      tables (qrturban year rptdisp rptsrc chage chsex chrace chisp
chprior
                  cdalc cddrug cdrtrd cdemotnl cdvisual cdlearn cdphys
cdbehav cdmedicl
                  fcalc fcdrug fcrtrd fcemotnl fcvisual fclearn fcphys
fcmedicl fcviol
                  fchouse fcmoney fcpublic
                  C_MAL_CN FL_CVPHY C_PHYDIS FL_CVNEG C_NEGDIS FL_CVMED
C_MEDDIS
                  FL_CVSEX C_SEXDIS FL_CVPSY C_PSYDIS FL_CVOTH C_OTHDIS
FL_CVUNK C_UNKDIS
                  CDPROBFL CDALCDRU CDPHYSME FCPROBFL FCALCDRU FCPHYSME
                  postserv famsup fampres fostercr juvpet numunsub)
                  * PArecur;
                  run;
proc freq data=indata.PArecur;
      title1 'Table 9a: 2x2 tables and stats, variables for recurrence
comparisons in COHORT';
      tables (rptsrc0 qrturban0 chage0 chsex0 chrace0 chisp0
                  cdalc0 cddrug0 cdrtrd0 cdemotnl0 cdvisual0 cdlearn0
                  cdphys0 cdbehav0 cdmedicl0
                  fcalc0 fcdrug0 fcrtrd0 fcemotnl0 fcvisual0 fclearn0
                  fcphys0 fcmedicl0 fcviol0
                  fchouse0 fcmoney0 fcpublic0
                  postserv0 famsup0 fampres0 fostercr0 juvpet0)
                  * PArecur /cmh;
                  run;

/* Analysis of time variables */
Proc ttest data=indata.PArecur;
      title1 'Table 9b: Comparison of variables by recurrence
(PArecur)';
      var numunsub stime2 stimeserv stimermv stimepet;
      class PArecur;
      run;
Proc means data=indata.PArecur;
      title1 'Table 9c: Comparison of variables by recurrence
(PArecur)';
      var numunsub stime2 stimeserv stimermv stimepet;
      class PArecur;
      run;
proc phreg data=indata.PArecur;
      title1 'Table 11a: Cox proportional hazards model of recurrence,
initial model';
      model stime2*PArecur(0)=
                  rptsrc0 pcturban chsex0 chrace0 cdvisual0 cdlearn0
                  cdbehav0 cdmedicl0
```

```
                fcalc0 fcviol0
                fchouse0 fcpublic0
                postserv0 fampres0 fostercr0
                numunsub
                stimeserv stimermv;
                run;
proc phreg data=indata.PArecur;
      title1 'Table 11b: Cox proportional hazards model of recurrence,
final adjusted model';
      model stime2*PArecur(0)=
                rptsrc0 chsex0 chrace0 cdmedicl0
                fostercr0
                stimeserv;
                run;
```

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