



Pergamon

Child Abuse & Neglect xxx (2004) xxx–xxx

Child Abuse
& Neglect

Risk factors for infant maltreatment: a population-based study[☆]

Samuel S. Wu^a, Chang-Xing Ma^a, Randy L. Carter^b, Mario Ariet^c, Edward A. Feaver^d,
Michael B. Resnick^e, Jeffrey Roth^{e,*}

^a Department of Biostatistics, University of Florida, Gainesville, FL, USA

^b Department of Biostatistics, University at Buffalo, State University of New York, Buffalo, NY, USA

^c Department of Medicine, University of Florida, Gainesville, FL, USA

^d Chiles Center for Healthy Mothers and Babies, University of South Florida, USA

^e Department of Pediatrics, University of Florida, PO Box 100296, Gainesville, FL 32610-0296, USA

Received 6 August 2003; received in revised form 1 July 2004; accepted 24 July 2004

Abstract

Context: Of the approximately 900,000 children who were determined to be victims of abuse or neglect by US child protective services in 2002, the birth-to-3 age group had the highest rate of victimization (1.6%) and children younger than 1 accounted for the largest percentage of victims (9.6%).

Objective: To identify perinatal and sociodemographic risk factors associated with maltreatment of infants up to 1 year of age.

Design and Setting: Observational cohort study.

Participants: 189,055 children born in 1996 in Florida.

Main Outcome Measure: Infant maltreatment, defined as a verified report of abuse, neglect, or threatened harm that occurred between day 3 of life and 1 year.

Results: 1,602 children (.85%) of the 1996 birth cohort had verified instances of maltreatment by age 1. Of 15 perinatal and sociodemographic variables studied, 11 were found to be significantly related to infant maltreatment. Five factors had adjusted relative risks (RR) of two or greater: *Mother smoked during pregnancy* (RR 2.8); *more than two siblings* (RR 2.7); *Medicaid beneficiary* (RR 2.1); *unmarried marital status* (RR 2.0); *low birth weight infant* (RR 2.0). Infants who had four of these five risk factors had a maltreatment rate seven times higher than the population average.

[☆] This research was supported by grants from the Florida Agency for Health Care Administration; the Florida Department of Children and Families; Children's Medical Services, Florida Department of Health; University of Florida Maternal Child Health and Education Research and Data Center; and the Chiles Center, University of South Florida.

* Corresponding author.

26 **Conclusions:** Data on nearly all risk factors found to be significantly associated with infant maltreatment are
27 available on the birth certificate. Such information can be incorporated into a population-based risk-assessment
28 tool that could identify subpopulations at highest risk for infant maltreatment. Because resources are limited, these
29 groups should be given priority for enrollment in child abuse prevention programs.

30 © 2004 Published by Elsevier Ltd.

31 *Keywords:* Child abuse; Infant; Pregnancy; Risk factors

33 Introduction

34 Since the early 1960s, public concern about child abuse and neglect has grown dramatically. The
35 federal government enacted the Child Abuse Prevention and Treatment Act and established a National
36 Center on Child Abuse and Neglect in 1974. In 1990, the US Advisory Board on Child Abuse and Neglect
37 called it a national epidemic (US Advisory Board on Child Abuse and Neglect, 1990). The total number
38 of maltreated children reported to authorities has nearly doubled since 1986, with an estimated 896,000
39 abused or neglected children in the United States in 2002 (Schwartz-Kenney, McCauley, & Epstein, 2000;
40 Sedlak & Broadhurst, 1996; Wolfe, 1999; US Department of Health and Human Services, 2004). Prevent
41 Child Abuse America (2001) estimates the costs associated with child abuse in the US at \$94 billion per
42 year.

43 In the last 10 years, investigators and clinicians have begun to focus on primary prevention of child
44 abuse (Bethea, 1999; MacMillan, 2000). Efforts have centered on identifying the youngest children
45 who are at high risk for maltreatment, so that suitable interventions can be undertaken at the earliest
46 time to reduce prevalence (Kotch et al., 1995, 1997; Kotch, Browne, Dufort, Winsor, & Catellier, 1999;
47 McGuigan & Pratt, 2001; Zelenko, Lock, Kraemer, & Steiner, 2000). Of the nearly 900,000 children who
48 were determined to be victims of abuse or neglect by US child protective services in 2002, the birth-to-3
49 age group had the highest rate of victimization (1.6%) and children younger than 1 accounted for the
50 largest percentage of victims (9.6%) (US Department of Health and Human Services, 2004).

51 A number of factors have been found to be associated with an increased risk of child abuse. These
52 include: maternal poverty, young maternal age, low maternal educational achievement, and infant prema-
53 turity (Famularo, Fenton, & Kinscherff, 1992; Hay & Jones, 1994; Sidebotham, Golding, & The ALSPAC
54 Study Team, 2001; Stier, Leventhal, Berg, Johnson, & Mezger, 1993). Children experiencing maltreat-
55 ment are more likely to exhibit delays in achieving developmental milestones; aggression, violence and
56 criminal activity; risky health behaviors such as substance abuse; abuse of family members; school failure;
57 and suicidal tendencies (Grilo, Sanislow, Fehon, Martino, & McGlashan, 2001).

58 In fiscal year 2001–2002, the Florida Abuse Hotline Information System received 207,322 calls report-
59 ing that children under the age of 18 had been abused or neglected. Upon investigation, it was determined
60 that 48,532 of these initial reports (36.8%) had a finding of “verified” or “some indication” (Florida
61 Department of Children and Families, 2002).

62 The purpose of the present study was to identify perinatal and sociodemographic risk factors in mothers
63 and infants that were associated with maltreatment during the first year of life. There is a paucity of research
64 on predictors of infant maltreatment. We could locate only one recent study investigating the relationship
65 between maternal characteristics and infant maltreatment (Bugental & Happaney, 2004). The dependent
66 variable of that study was not a verified case finding of maltreatment but “harsh parenting and safety

neglect” as measured by responses on a questionnaire (p. 237). The chief independent variable of interest was maternal depression. The single-center sample was small ($N = 71$) and homogenous (98% Hispanic). Our study of risk factors for infant maltreatment was population-based. Using a large, statewide child abuse registry, we were able to analyze a wide spectrum of sociodemographic, health, and behavioral risk factors for an entire birth cohort. We believe that the methodology we employed with Florida data, linking birth vital statistics, Medicaid eligibility files, and Child Protective Services records, represents a model that agencies and researchers in other states can use to initiate early identification of maternal-infant dyads most at risk for maltreatment.

Methods

Design, setting, and participants

This is an observational cohort study of infants born in the state of Florida in 1996. It is an exploratory epidemiological evaluation of a secondary database merging birth vital statistics (BVS), Florida’s Child Protective Services (CPS) data and several other pregnancy-related data sources.

For a period of 1 year after birth, 6,394 different infants born in 1996 had reported instances of maltreatment in the CPS data set. Based on a deterministic merge by social security number (SSN), name and date of birth of infants and their parents, 5,952 (93.1%) of the maltreated infants were found in the 189,055 birth records in 1996 Florida vital statistics. Among the 442 (6.9%) infants not merged, 392 had the mother’s SSN in the child abuse data set but not in the birth vital statistics dataset, and we treated these children as not born in Florida. In addition, we excluded from the merged cases 1,456 infants who were reported to have been maltreated only before the second day of life because these were probably prenatal maltreatments and their risk factors and intervention strategies might differ from postnatal cases. Consequently our study sample consists of 189,055 infants, 4,496 of whom had records of being maltreated between 3 days and 1 year.

Ascertainment of outcomes

Infant maltreatment was defined as a verified report of abuse, neglect, or threatened harm up to age 1 according to criteria set by Florida’s CPS. CPS designates three different types of maltreatment: abuse, neglect, and threatened harm. Abuse is any willful act that results in any physical, mental or sexual injury that causes or is likely to cause the child’s physical, mental, or emotional health to be significantly impaired. Neglect is any failure or omission by a caretaker to provide the care, supervision, services or protection necessary to maintain the child’s physical and mental health. Threatened harm is a willful act that is intrinsically harmful or dangerous which could clearly and immediately result in injury or harm.

CPS records also indicate whether incidents reported to the agency constituted legally defined child maltreatment. There are three levels of findings: “verified,” “some indication,” and “no indication.” When an investigation determines that a preponderance of the credible evidence results in a determination that a specific injury, harm or threatened harm was the result of abuse or neglect, a case is coded as “verified.” When the credible evidence does not meet the standard of being preponderant, the case is classified as having “some indication” of abuse or neglect. Reported incidents for which the investigation uncovers no credible evidence of abuse are classified in the “no indication” category.

105 The main outcome measure used for our statistical modeling was verified infant maltreatment (Yes/No),
106 defined as any verified report of abuse, neglect, or threatened harm between 3 days and 1 year after birth.
107 Age of child was based on date of initial report. We looked beyond the first year of life to determine
108 whether the report was subsequently verified. We did not count episodes of maltreatment but the number
109 of children maltreated; therefore, we did not distinguish multiple verified reports on a child within the
110 first year of life from a single verified report of maltreatment.

111 *Independent variables*

112 We studied the association of 15 perinatal and sociodemographic risk factors with infant maltreatment.
113 These explanatory variables were compiled from four data sources: (1) BVS for 1996 supplied by the
114 Florida Department of Health; (2) Medicaid eligibility and enrollment data files supplied by Florida's
115 Agency of Health Care Administration; (3) Women, Infants and Children (WIC) Nutritional Supplement
116 Program certification files supplied by the Florida WIC office; and (4) the Florida Healthy Start prenatal
117 risk screen score data file supplied by Florida Department of Health.

118 The following 12 variables were obtained from BVS: mother's race (Black, White, other); maternal
119 education (<HS, if mother's education is less than or equal to 11 years; HS, if equal to 12 years; >HS,
120 if greater than 12 years); maternal age during pregnancy (<20 years, 20–34 years, >34 years); mother's
121 marital status during pregnancy (married, unmarried); number of siblings (>2, 1–2, and 0 based on previous
122 pregnancy that resulted in live births who were still living); previous adverse pregnancy experience (yes,
123 if one or more previous pregnancies terminated in either a spontaneous or induced abortion or if one or
124 more previous pregnancies resulted in a live born infant who later died; no, otherwise); pregnancy interval
125 in months (first pregnancy or ≥ 15 , <15 months between the previous child's birth date and the start of
126 the index pregnancy); prenatal care (inadequate, received less than 50% of expected visits, adjusted for
127 gestational age; adequate, received 50% or more of expected visits); mother smoked during pregnancy
128 (yes, no); infant's sex (male, female); infant born low birth weight (yes, if <2,500 g; no, otherwise);
129 plurality (1 if singleton, >1 if multiple birth). The other three predictors were from the other three data
130 sources: Medicaid beneficiary (yes, if mother participated in Medicaid during pregnancy; no, otherwise);
131 WIC participation (if mother participated in WIC program during pregnancy; no, otherwise); Florida's
132 Healthy Start prenatal risk screen score (high, if score ≥ 4 ; low, if score < 4; none, if not screened).

133 The Healthy Start prenatal risk screening instrument is offered to all pregnant women in Florida. About
134 40% of all pregnant women consent to be screened (65% among Medicaid beneficiaries and 25% among
135 Non-Medicaid beneficiaries). The survey questionnaire consists of 16 medical and environmental items
136 (e.g., illness requiring ongoing care, moving more than 3 times in past 12 months, feeling unsafe, high
137 stress level, hunger, problem keeping appointments). If four or more items are scored as present, then the
138 pregnant woman is eligible for referral to community prenatal intervention services such as psychosocial
139 or nutritional counseling, parenting or child birth education classes.

140 *Statistical analysis*

141 Generalized linear models (McCullagh & Nelder, 1989), with number of maltreated children as the
142 response variable and log link function, assuming Poisson error distribution and using the log of total
143 number of infants in each cell as an offset, were fitted using the GENMOD Procedure of SAS (SAS
144 Institute Inc., 2000). This method modeled the log of the probability of maltreatment as a linear function

of perinatal and sociodemographic variables. Stepwise model building with backward selection was employed, starting with a model including all main effects of explanatory factors. The significance level for deletion from the model was set at .05. Based on the fitted models, we estimated the adjusted relative risk of each factor, which reflects its association with maltreatment after controlling for the effects of all other explanatory variables.

Results

Table 1 presents a description of the study sample by the 15 perinatal and sociodemographic risk factors. Percentages of maltreated infants are given separately by abuse, neglect, and threatened harm and by two types of findings, “verified” and “some indication.” More than 90% of maltreatments were neglect or threatened harm. Among 189,055 children born in 1996 in Florida, 2,894 (1.53%) were found to have “some indication” of maltreatment in CPS records and 1,602 (.85%) were determined to be “verified” cases. Since an infant might have more than one type of maltreatment, the sum of percentages for abuse, neglect, or threatened harm shown in Table 1 may be larger than the total number of maltreated infants.

We first conducted stratified analyses by maltreatment type and finding (six different models). Our results indicated that the significant risk factors and their corresponding relative risks were similar across abuse, neglect and threatened harm, as well as for “verified” and “some indication” cases.

Table 2 shows the adjusted relative risks and 95% confidence intervals for the 15 risk factors, using “verified” cases only as the outcome variable. We found that 11 of the 15 predictors were significantly associated with elevated risk of infant maltreatment, while four others (race, WIC participation, infant’s sex, and plurality) were not significant at the .05 level.

Five factors had adjusted relative risks (RR) of two or greater: *Mother smoked during pregnancy* (RR 2.8); *more than two siblings* (RR 2.7); *Medicaid beneficiary* (RR 2.1); *unmarried marital status* (RR 2.0); and *infant born low birth weight* (RR 2.0).

An example of an epidemiologic risk-assessment tool for infant maltreatment

To illustrate the practical importance of identifying risk factors associated with infant maltreatment, we constructed an epidemiologic risk-assessment tool using the top five factors in the 1996 Florida birth cohort that had relative risks greater than two (Mother smoked during pregnancy, more than two siblings, Medicaid beneficiary, unmarried marital status, and infant born low birth weight). We called the group of infants that had 4 or more of these factors *extremely high risk*, the group with 3 of these factors *high risk*, the group with 2 of these factors *average risk*, and the group with 1 or 0 of these factors *low risk*.

The *extremely high-risk* group, consisting of 3,947 infants, had a verified maltreatment rate of 6.3%, which is 7.4 times the population average (.85%). The *high-risk* group, comprised of 20,697 infants, had a maltreatment rate of 2.7%, which 3.2 times the population average. The average group, comprised of 48,004 infants, had a maltreatment rate 1.3 times the population average. The *low-risk* group, containing 116,407 infants, had a maltreatment rate (.24%) about one-fourth the population average.

Figure 1 illustrates the size of these four risk groups and the distribution of maltreatment cases across the four groups. The extremely high-risk group (comprising 2.1% of all infants) accounted for 15.5% of

Table 1

Percentage of infants born in 1996 who were maltreated between 3 days and 1 year after birth, by maltreatment type and finding^a

Factor	Level ^b	Number of births	Abuse		Neglect		Threatened harm	
			Verified	Some indication	Verified	Some indication	Verified	Some indication
Mother smoked during pregnancy	Yes	30799	.45	.44	1.47	2.40	.99	2.38
	No	158256	.10	.14	.31	.64	.22	.56
Number of siblings	>2	17591	.29	.28	1.53	2.04	.81	1.80
	1–2	91656	.14	.18	.43	.89	.33	.80
	0	79808	.15	.18	.34	.72	.25	.71
Medicaid beneficiary	Yes	87473	.27	.33	.90	1.69	.61	1.53
	No	101582	.06	.06	.16	.26	.11	.28
Marital status	No	66875	.31	.35	1.03	1.79	.69	1.60
	Yes	122105	.07	.10	.20	.45	.15	.45
Infant born low birth weight	Yes	14858	.38	.36	1.31	1.85	.80	1.55
	No	174197	.14	.17	.43	.85	.30	.80
Maternal education	<HS	40961	.32	.38	1.21	2.31	.77	1.99
	HS	66309	.17	.19	.45	.83	.35	.82
	>HS	81114	.06	.09	.17	.29	.13	.31
Prenatal care	Inadequate	19818	.39	.36	1.40	2.15	.83	1.76
	Adequate	169237	.13	.17	.39	.78	.29	.75
Florida's Healthy Start prenatal risk screen scores	High	30698	.40	.43	1.38	2.46	.86	2.25
	None	112277	.10	.13	.32	.56	.23	.52
	Low	46080	.13	.17	.34	.78	.28	.75
Maternal age	<20	25112	.38	.45	.97	2.16	.66	1.81
	>34	24234	.07	.14	.36	.43	.27	.54
	20–34	139678	.13	.15	.44	.79	.30	.74
Pregnancy interval in months	≤15	37587	.23	.26	.76	1.47	.47	1.15
	First pregnancy	80246	.16	.18	.42	.81	.28	.80
	>15	71222	.12	.16	.44	.77	.36	.77
Previous adverse pregnancy experience	Yes	53800	.17	.21	.60	1.00	.45	.96
	No	135255	.15	.18	.46	.89	.30	.81
Race	Black	42169	.22	.26	.83	1.50	.49	1.22
	Other	4698	.11	.09	.21	.45	.23	.43
	White	142188	.14	.17	.41	.77	.30	.76
WIC participation	No	138405	.13	.15	.40	.73	.27	.66
	Yes	50650	.23	.28	.76	1.46	.54	1.41
Infant's sex	Male	97025	.16	.20	.50	.93	.32	.83
	Female	92018	.16	.18	.50	.92	.37	.88

Table 1 (Continued)

Factor	Level ^b	Number of births	Abuse		Neglect		Threatened harm	
			Verified	Some indication	Verified	Some indication	Verified	Some indication
Plurality	>1	4935	.28	.20	.89	.79	.26	1.01
	1	184120	.15	.19	.49	.93	.35	.85
Total population		189055	.16	.19	.50	.92	.34	.86

^a Table includes infants who may have had more than one type of maltreatment report (e.g., abuse and also neglect).

^b Level of each factor chosen a priori to be of lowest risk is placed last.

184 all maltreatment cases. By combining the two high-risk groups, 50.3% of all infant maltreatment cases
185 could be identified in 13.0% of the population.

186 Discussion

187 Eleven of 15 perinatal and sociodemographic factors were found to be significantly associated with
188 infant maltreatment. The finding that the two highest risk factors were smoking during pregnancy and
189 more than two siblings has potential practice implications: greater emphasis during prenatal care on
190 addressing the underlying stressful conditions for which tobacco use is a marker and more education
191 about family planning options. By stratifying an entire statewide birth cohort into four risk category
192 groups, we were able to show that pregnant women who had three or more risk factors accounted for
193 half of all infant maltreatment cases. In practice, a model fitting all 11 factors would generate even more
194 precise estimates of maltreatment risk than the five-factor groups delineated by our example assessment
195 tool. More narrowly cross-classified subpopulations at extremely high risk for infant maltreatment could
196 be identified and targeted for intervention, after the validity of the predictive model is tested using split
197 sample or bootstrapping techniques. Since data on nearly all these risk factors are available on the birth
198 certificate, such information could be incorporated into an epidemiologic risk-assessment tool to identify
199 families with the highest priority for enrollment into child abuse prevention programs.

200 Several of the risk factors examined in this study have previously been found to be associated with
201 child abuse. For example, large family size, poverty, young maternal age, and low maternal education
202 have been cited as reliable predictors of a maltreatment report (Kotch et al., 1995; Sidebotham et al.,
203 2001; Stier et al., 1993; Zuravin, 1991). However, few studies have focused on maltreatment within the
204 first year of life, usually because the resulting sample size would have been too small to conduct statistical
205 tests. Access to a statewide registry allowed us to concentrate on the earliest instances of abuse, neglect
206 or threatened harm.

207 Risk-assessment approaches can be used to target scarce services to families most in need (Britton,
208 1998; English, 1998; Fraser, Armstrong, Morris, & Dadds, 2000). Reduction in incidence of child mal-
209 treatment and other outcomes could lead to substantial government savings (MacMillan, 2000). Strategies
210 have been developed both on the societal level and the familial level (Hay & Jones, 1994). For example,
211 home visitation has been widely promoted in recent years as a means of preventing maltreatment in at-risk
212 families (CDC, 2003). An early randomized controlled trial of a prenatal and infancy home visitation

Table 2

Adjusted relative risks and 95% confidence interval of perinatal and sociodemographic factors associated with verified infant maltreatment^a

Factor	Level	Number of births	Maltreatment percentage	Adjusted relative risk	95% confidence interval
Mother smoked during pregnancy	Yes	30799	2.44	2.8	(2.5, 3.1)
	No	158256	.54	1	
Number of siblings	>2	17591	2.15	2.7	(2.3, 3.3)
	1–2	91656	.79	1.5	(1.3, 1.8)
	0	79808	.63	1	
Medicaid beneficiary	Yes	87473	1.50	2.1	(1.8, 2.4)
	No	101582	.26	1	
Marital status	No	66875	1.72	2.0	(1.8, 2.3)
	Yes	122105	.37	1	
Infant born low birth weight	Yes	14858	2.11	2.0	(1.8, 2.3)
	No	174197	.74	1	
Maternal education	<HS	40961	1.94	1.7	(1.4, 2.0)
	HS	66309	.82	1.3	(1.1, 1.5)
	>HS	81114	.31	1	
Prenatal care	Inadequate	19818	2.17	1.5	(1.4, 1.7)
	Adequate	169237	.69	1	
Florida's Healthy Start prenatal risk screen score	High	30698	2.19	1.4	(1.2, 1.6)
	None	112277	.56	1.2	(1.0, 1.4)
	Low	46080	.66	1	
Maternal age	<20	25112	1.68	1.4	(1.3, 1.7)
	>34	24234	.63	1.0	(.8, 1.2)
	20–34	139678	.74	1	
Pregnancy interval in months	≤15	37587	1.24	1.2	(1.1, 1.4)
	First pregnancy	80246	.72	1.1	(.9, 1.2)
	>15	71222	.78	1	
Previous adverse pregnancy experience	Yes	53800	1.02	1.1	(1.0, 1.3)
	No	135255	.78	1	
Race	Black	42169	1.38		
	Other	4698	.47		
	White	142188	.70		
WIC participation	No	138405	.69		
	Yes	50650	1.29		
Infant's sex	Male	97025	.83		
	Female	92018	.86		

Table 2(Continued)

Factor	Level	Number of births	Maltreatment percentage	Adjusted relative risk	95% confidence interval
Plurality	>1	4935	1.26		
	1	184120	.84		
Total population		189055	.85		

^a Factors with empty cells in the adjusted relative risk and 95% confidence interval columns were not significant in the final model.

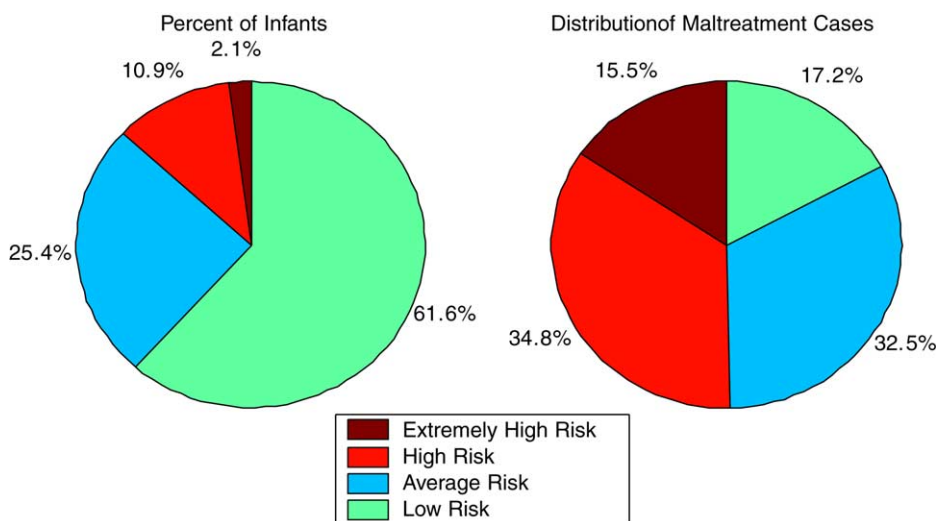


Figure 1. Percent of infants across the four risk category groups and the distribution of maltreatment cases across the four groups: 1996 Florida birth cohort. Application of an epidemiological risk-assessment tool. Based on the distribution of the top five risk factors in the 1996 Florida birth cohort, the study population was divided into four risk category groups: extremely high risk, high risk, average risk, and low risk.

213 program by nurses showed fewer instances of verified abuse and neglect during the child’s first 2 years
 214 among low-income, single, adolescent mothers (Olds, Henderson, Chamberlin, & Tatelbaum, 1986). A
 215 recent randomized controlled trial using community child health nurses in the immediate postnatal pe-
 216 riod to assess depression levels, stress, and coping skills of all new parents showed promise of preventing
 217 some cases of child abuse and neglect. (Fraser et al., 2000). However, a more recent evaluation of a
 218 community-based, paraprofessional home visiting program, Healthy Start/Healthy Families in Hawaii,
 219 also using an experimental design, did not find evidence that the program prevented child abuse (Duggan
 220 et al., 2004).

221 Currently, child abuse prevention efforts in Florida include Healthy Families Florida which is a
 222 community-based, voluntary home visiting program using trained family support workers to promote
 223 positive parent-child interaction among families in stressful life situations (Healthy Families Florida,
 224 2004). The state also maintains a confidential telephone crisis hotline that provides support and resources
 225 to parents, community-based child advocacy centers, and child protection teams, a multidisciplinary

program of physicians, nurse practitioners, and case coordinators who investigate and make referrals in known or suspected case of abuse and neglect (Florida Department of Children and Families, 2004; Florida Department of Health, 2004; Florida Network of Children's Advocacy Centers, 2004).

Looking at infant maltreatment from a statewide perspective has advantages but this study also has limitations. The outcome measure considered in this paper includes only cases documented in the Florida CPS registry. Olds and Kitzman have suggested that CPS data typically underestimate the frequency with which child maltreatment occurs (Olds & Kitzman, 1993). The study missed children born in Florida who moved and experienced maltreatment elsewhere. Conversely, children not born in Florida who moved there during the first year of life and were maltreated would also not be included in the study sample. Because this study is based on secondary data, it provides an incomplete picture of the sociodemographic environment relevant to the etiology of infant maltreatment. There may be differences in reporting maltreatment among different cultural groups. Maternal smoking during pregnancy as documented in Birth Vital Statistics is known to be an underestimate. The aggregation of abuse, neglect, and threatened harm into a single maltreatment outcome conflates different phenomena, for example, physical injury and substance misuse, or medical neglect and failure to supervise (Hildyard & Wolfe, 2002). Lastly, many of the significant predictors of infant maltreatment identified in this study may simply be markers of low socioeconomic status, a known risk factor for child maltreatment. Under no circumstances should the risk factors analyzed in this study be interpreted as causal factors for infant maltreatment. Their primary value is as a tool for identifying families who may benefit from preventive services such as home visitation programs, domestic violence counseling, and referral to family support agencies.

The perinatal and sociodemographic factors identified in this paper provide useful information to programs aiming to intervene as early as possible to prevent infant maltreatment. Health authorities in other states could use a similar methodology to construct a maltreatment risk-screening instrument that could identify subpopulations in their regions most at risk for infant maltreatment. Policy makers could use this tool to determine which groups are most in need of prevention services, and whether infant maltreatment subsequently declines in programs that participate in rigorously controlled outcome evaluations (Chaffin, 2004).

Acknowledgements

We thank Karen Freeman, Carol Graham, Meade Grigg, Michael Haney, Rhonda White, Florida Department of Health; Peter Gorski, Charles Mahan, Chiles Center, University of South Florida; Jason Campbell, Nancy Ross, Carolyn Turner, Debby Walters, Agency of Health Care Administration; Susan Chase, Department of Children and Families; and Li Yan, University of Florida Maternal Child Health and Education Research and Data Center for their assistance, cooperation, and advice.

References

- Bethea, L. (1999). Primary prevention of child abuse. *American Family Physician*, 59(6), 1577–1585.
- Britton, H. L. (1998). Perinatal screening for child abuse and neglect. *Clinical Perinatology*, 25(2), 453–460.
- Bugental, D. B., & Happaney, K. (2004). Predicting infant maltreatment in low-income families: The interactive effect of maternal attributions and child status at birth. *Developmental Psychology*, 40(2), 234–243.

- Centers for Disease Control and Prevention (CDC). (2003). First reports evaluating the effectiveness of strategies for preventing violence: Early childhood home visitation: Findings from the task force on community preventive services. *Morbidity and Mortality Weekly Report*, 52(RR-14), 1–9.
- Chaffin, M. (2004). Is it time to rethink Healthy Start/Healthy Families? *Child Abuse & Neglect*, 28(6), 589–595.
- Duggan, A., McFarlane, E., Fuddy, L., Burrell, L., Higman, S. M., Windham, A., & Sia, C. (2004). Randomized trial of a statewide home visiting program: Impact in preventing child abuse and neglect. *Child Abuse & Neglect*, 28(6), 597–622.
- English, D. J. (1998). The extent and consequences of child maltreatment. *Future of Children*, 8(1), 39–53.
- Famularo, R., Fenton, T., & Kinscherff, R. (1992). Medical and developmental histories of maltreated children. *Clinical Pediatrics*, 31(9), 536–541.
- Florida Department of Children and Families. (2002). *Child protective services. Annual statistical data tables. Fiscal year 2001–2002*. Tallahassee, FL: Author.
- Florida Department of Children and Families. (2004). *Florida abuse hotline*. Retrieved August 16, 2004, from <http://www.dcf.state.fl.us/abuse>.
- Florida Department of Health. (2004). *Children's Medical Services' Child Protection Team program*. Retrieved August 16, 2004, from <http://www.doh.state.fl.us/cms/cptindex.html>.
- Florida Network of Children's Advocacy Centers. (2004). *What are children's advocacy centers?* Retrieved August 16, 2004, from <http://www.fncac.org/default.htm>.
- Fraser, J. A., Armstrong, K. L., Morris, J. P., & Dadds, M. R. (2000). Home visiting intervention for vulnerable families with newborns: Follow-up results of a randomized controlled trial. *Child Abuse & Neglect*, 24(11), 1399–1429.
- Grilo, C. M., Sanislow, C., Fehon, D. C., Martino, S., & McGlashan, T. H. (2001). Psychological and behavioral functioning in adolescent psychiatric inpatients who report histories of childhood abuse. *American Journal of Psychiatry*, 156(4), 538–543.
- Hay, R., & Jones, L. (1994). Societal interventions to prevent child abuse and neglect. *Child Welfare*, 73(5), 405–430.
- Healthy Families Florida. (2004). *About Healthy Families Florida*. Retrieved August 16, 2004, from <http://www.healthyfamiliesfla.org/aboutus.html>.
- Hildyard, K. L., & Wolfe, D. A. (2002). Child neglect: Developmental issues and outcomes. *Child Abuse & Neglect*, 26(6/7), 679–695.
- Kotch, J. B., Browne, D. C., Dufort, V., Winsor, J., & Catellier, D. (1999). Predicting child maltreatment in the first 4 years of life from characteristics assessed in the neonatal period. *Child Abuse & Neglect*, 23(4), 305–319.
- Kotch, J. B., Browne, D. C., Ringwalt, C. L., Dufort, V., Ruina, E., Stewart, P. W., & Jung, J. W. (1997). Stress, social support, and substantiated maltreatment in the second and third years of life. *Child Abuse & Neglect*, 21(11), 1025–1037.
- Kotch, J. B., Browne, D. C., Ringwalt, C. L., Stewart, P. W., Ruina, E., Holt, K., Lowman, B., & Jung, J. W. (1995). Risk of child abuse or neglect in a cohort of low-income children. *Child Abuse & Neglect*, 19(9), 1115–1130.
- MacMillan, H. L. (2000). Preventive health care, 2000 update: Prevention of child maltreatment. *Canadian Medical Association Journal*, 163(11), 1451–1458.
- McCullagh, P., & Nelder, J. A. (1989). *Generalized linear models* (2nd ed.). New York: Chapman and Hall.
- McGuigan, W. M., & Pratt, C. C. (2001). The predictive impact of domestic violence on three types of child maltreatment. *Child Abuse & Neglect*, 25(7), 869–883.
- Olds, D. L., Henderson, C. R., Jr., Chamberlin, R., & Tatelbaum, R. (1986). Preventing child abuse and neglect: A randomized trial of nurse home visitation. *Pediatrics*, 78(1), 65–78.
- Olds, D. L., & Kitzman, H. (1993). Review of research on home visiting for pregnant women and parents of young children. *The Future of Children*, 3(3), 53–92.
- Prevent Child Abuse America. (2001). *Total estimated cost of child abuse and neglect in the United States: Statistical evidence*. Retrieved August 13, 2004, from http://www.preventchildabuse.org/learn_more/research_docs/cost_analysis.pdf.
- SAS Institute Inc. (2000). *SAS online documentations, version 8*. Cary, NC: SAS Institute.
- Schwartz-Kenney, B. M., McCauley, M., & Epstein, M. A. (Eds.). (2000). *Child abuse: A global view*. Westport, CT: Greenwood Press.
- Sedlak, A. J., & Broadhurst, D. D. (1996). *Third National Incidence Study of Child Abuse and Neglect: Final report*. Washington, DC: US Department of Health and Human Services, Administration for Children and Families, National Center on Child Abuse and Neglect.
- Sidebotham, P., Golding, J., & The ALSPAC Study Team. (2001). Child maltreatment in the “Children of the Nineties”: A longitudinal study of parental risk factors. *Child Abuse & Neglect*, 25(9), 1177–1200.

- 315 Stier, D. M., Leventhal, J. M., Berg, A. T., Johnson, L., & Mezger, J. (1993). Are children born to young mothers at increased
316 risk of maltreatment? *Pediatrics*, *91*(3), 642–648.
- 317 US Advisory Board on Child Abuse and Neglect. (1990). *Child abuse and neglect: Critical first steps in response to a national*
318 *emergency*. Washington, DC: Government Printing Office.
- 319 US Department of Health and Human Services. (2004). *Child maltreatment 2002: Thirteenth annual publication of the National*
320 *Child Abuse and Neglect Data System*. Washington, DC: Author.
- 321 Wolfe, D. A. (1999). *Child abuse* (2nd ed.). London: Sage Publications.
- 322 Zelenko, M., Lock, J., Kraemer, H. C., & Steiner, H. (2000). Perinatal complications and child abuse in a poverty sample. *Child*
323 *Abuse & Neglect*, *24*(7), 939–950.
- 324 Zuravin, S. J. (1991). Unplanned childbearing and family size: Their relationship to child neglect and abuse. *Family Planning*
325 *Perspectives*, *23*(4), 155–161.

326 **Résumé**

327 French- and Spanish-language abstracts not available at time of publication.

328 **Resumen**

329 French- and Spanish-language abstracts not available at time of publication.