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ASSOCIATION OF ALLEGATION-SPECIFIC RISK FACTORS WITH MORTALITY FROM INJURIES AMONG CHILDREN MONITORED BY THE GEORGIA DIVISION OF FAMILY AND CHILDREN SERVICES, 1999 – 2000

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2013

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2015

ABSTRACT

ASSOCIATION OF ALLEGATION-SPECIFIC RISK FACTORS WITH MORTALITY FROM INJURIES AMONG CHILDREN MONITORED BY THE GEORGIA DIVISION OF FAMILY AND CHILDREN SERVICES, 1999 - 2000
By Kinda Zureick

PURPOSE: In 2012, approximately 1,640 children died from abuse or neglect nationwide. Maltreatment of any type may occur as a single event or may become a chronic part of a child's life. It is important to identify the risk factors that place a child at higher risk of death after initial report to Child Protective Services so that a fatal event can be prevented. This study examines the association between allegation history and mortality from injuries among children.

METHODS: This project is a secondary analysis using data collected in a previously conducted case-control study of children served by the Georgia Division of Family and Children Services (DFCS). Cases were children who died and were living in a family with an open DFCS case record, while controls were children who did not die and were living in a family with an open case file. For the present analysis, we specifically examined the cases and controls under the age of five years. Children who died of medical causes were excluded, resulting in a total of 54 cases and 114 controls. Multivariate logistic regression models, examining the effect of the allegation-specific risk factors on death, were constructed.

RESULTS: The risk of death was 3.61 (95% CI: 0.83, 15.77) times higher among children with an allegation of physical abuse in the most recent report compared to those without an allegation of physical abuse in the most recent report, controlling for allegations of physical abuse in the first report, race, age category, and county type. The risk of death was 3.52 (95% CI: 0.75, 16.58) times higher for children with multiple allegations in total and with physical abuse at the most recent report, compared to those with other patterns, controlling for time since the most recent report, race, age category, and county type.

CONCLUSION: The findings from this study suggest that a recent history of physical abuse and time since the most recent report can be used to identify children who are at higher risk of death after initial report to a CPS agency. Future studies are needed to confirm the observed associations.

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Acknowledgements

I am incredibly thankful for the endless support and love of my family and friends throughout this process. I would also like to express my sincerest gratitude to my advisor, Dr. Carolyn Drews-Botsch, for her guidance and support which made this thesis possible.

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INTRODUCTION

More than 3.8 million children nationwide were the subjects of at least one report to Child Protective Services (CPS) agencies in 2012 (1). During the same year, approximately 1,640 children died from abuse and neglect, an average of 4 deaths each day (2). Children under 4 years of age comprise the largest proportion (34%) of child fatalities (1). In Georgia alone, CPS, located within the Division of Family and Children Services (DFCS), investigated 33,221 reports of child maltreatment in 2014 (3). When a report of suspected maltreatment is made, the DFCS is required to notify police enforcement and respond to the allegation in-person within 24 hours to five days. Response time depends on the nature and severity of the allegation, the child's age, and the history of the family with CPS (4).

CPS categorizes child maltreatment into three categories – physical abuse, neglect, and sexual abuse. Injury to a child under the age of 18 that results in bruising, welts, fractures, burns, cuts, or internal injuries is considered physical abuse. Neglect involves a parent or a caretaker's failure to ensure that a child is adequately supervised, fed, clothed, or housed. Sexual abuse arises when a parent or other adult uses a child under 18 for sexual gratification (4).

Factors Related to Child Maltreatment

Literature suggests that factors influencing a child's risk of maltreatment and/or maltreatment fatality are present on several levels including the individual (both child and caregiver) and family level. Child's age proves to be a consistent risk factor of maltreatment, with young children at a higher risk of any type of maltreatment (5-7).

Male children have been shown to have slightly higher reported rates of maltreatment than female children (1, 8).

In most child maltreatment occurrences, the perpetrator is one or both of the child's parents (1). Young parental age, specifically young maternal age, has been shown to place a child at higher risk of maltreatment (9). Low socio-economic status has been consistently associated with increased risk for initial reports of child maltreatment and for an increased risk of recurrent reports of child maltreatment (10, 11). Other familial contributors include single parent status, parental substance abuse, and maternal education (10, 12, 13).

Maltreatment recurrence

Maltreatment of any type may be a single occurrence or a chronic pattern in a child's life. Currently, there is not a standard definition of recurrence, as different studies have established their own definitions (14). Recurrence, however, is defined federally as an incident that occurs within 6 months of the previous incident (1). One study found that although the risk of recurrence is highest within the first four months of initial report, 26% of children reported for maltreatment experienced a subsequent report within 2 years of the initial report (14). Another study found that 43% of children reported as maltreated as infants were re-referred within 10 years. With each subsequent maltreatment event, the likelihood of recurrence increases suggesting that after several recurrences, maltreatment becomes chronic (15). A single type of maltreatment has yet to be identified as a predictor of recurrence of maltreatment in general. However, of the three types of maltreatment discussed previously (i.e. sexual abuse, physical abuse, and neglect),

children who were originally neglected are the most likely to experience recurring neglect (15).

Fatal Maltreatment

Death from maltreatment can be the result of intentional or unintentional injury. Children who are maltreated have an elevated risk of death before the age of 18 when compared to children who are not maltreated, regardless of sex (7, 16). Young children, especially those under the age of five years, have an increased risk of death as a result of maltreatment compared to maltreated children over the age of five years. However this could be explained by the children's vulnerability and dependence on others given their age (7). A child is four times more likely to die of intentional injury when previously reported for physical abuse compared to those previously reported for neglect (17). On the other hand, children previously reported for neglect are more likely to die of unintentional injury compared to children previously reported for physical abuse (17). Studies estimate that approximately 20% - 50% of fatal maltreatment cases are known to CPS agencies prior to death (6, 7, 17, 18).

It is apparent in the current literature that certain characteristics have been identified as risk factors for maltreatment among children. However, a relationship between child mortality and child survival, specifically, among those already monitored by CPS agencies has not yet been established. This aim of this study is to identify the risk factors that can act as flags indicating that a child within the CPS system is at higher risk of death compared to the other children. To accomplish this, we will examine the association between allegation history and mortality from injuries among children served

by the Georgia Division of Family and Children Services. With this information, CPS agencies will be better able to prioritize their cases and prevent fatal events from occurring.

METHODS

Study Population

The data analysis presented in this study is a secondary analysis that complements an earlier population based case-control study of 206 cases and 206 controls served by the Georgia Division of Family and Children Services (DFCS) in 1999 and 2000 (19). In the primary study, the study population was selected based on a list of all children, aged 0 to 17 years, living in a household in which either a DFCS case file was open on January 1, 1998 or an initial investigation was made in 1998 or 1999. Case files closed prior to January 1, 1998 were excluded from the database and were not analyzed. Cases were children who died and were living in a family with an open DFCS case record on or after January 1st of the year prior to the child's death (i.e., a child who died in 1999 had to live in a family with an open case file on January 1, 1998 or later). Controls were randomly selected children who did not die and were living in a family with an open case file during the 2-year study interval. Cases and controls were matched based on the child's age and county type (i.e., suburban, urban, growing rural, and declining rural). Social workers systematically abstracted extensive data, such as the family's allegation history, child's physical characteristics, placement history, and family structure and housing arrangement, from CPS case records and entered the information into a secure and confidential computer database.

For the present study, we analyzed the allegation-specific data from 1999 and 2000 of all cases and controls under the age of five years. Cases who died as a result of medical causes were excluded; however, controls who were matched to an excluded case were retained to maximize statistical power. The final study population used in the data

analysis consisted of 54 cases and 114 controls. Approval from the Emory University Institutional Review Board (IRB) and the state of Georgia IRB were obtained prior to data collection. Approval from the Emory University IRB was obtained prior to analysis.

Statistical Analysis

Age of the child was divided into four categories: 0 to 6 months, 6 to 12 month, 12 to 24 months, and greater than 24 months. County type was categorized as urban, suburban, growing rural, and declining rural (19). Sex was categorized into male, female, and unknown. Race was considered as white, non-Hipanic and other. We created six dichotomous (yes/no) variables based on the timing and type of allegation made against the family: physical abuse alleged in the first report, physical abuse alleged in the most recent report, ever alleged physical abuse, neglect alleged in the first report, neglect alleged in the most recent report, and ever alleged neglect. The total number of allegations in the first report and the total number of allegations in the most recent report were dichotomized into 1 allegation and 2 or more allegations. The total number of allegations overall was categorized as 1 allegation, 2 allegations, 3 to 4 allegations, and 5 or more allegations. It is important to note that allegations are made against the family and do not specify that the child was the alleged victim. In addition, having an allegation in general does not imply that the allegation was substantiated. The total number of substantiated allegations was categorized as 0 allegations, 1 allegation, and 2 or more allegations. Time since the first report against the family was categorized into five categories: 0 to 3 months, 3 to 6 months, 6 to 12 months, 12 to 36 months, and 36 months or more. The time since the most recent report against the family was categorized into

four categories: 0 to 3 months, 3 to 6 months, 6 to 12 months, and greater than or equal to 12 months.

All statistical analyses were performed using version 9.4 of SAS® software. Characteristics, by case-control status, were summarized using frequencies. Due to sparse data among categories of sexual abuse, emotional abuse, and other abuse, these types of allegations were not considered in further analysis. Mantel-Haenszel exposure odds ratios (OR) were calculated for each covariate, stratified by age category and county type to control for variation due to matching.

To examine the effect of the allegation-specific risk factors on death, multivariate logistic regression models were constructed. All models were stratified by age category and county type to account for matching. Variables related to allegation history were considered as exposure variables, while sex and race variables were considered as potential confounders. Interaction assessment was conducted using maximum likelihood estimate chi-square values. Confounding assessment was examined by using the 10% change in estimate rule in order to determine the best model.

RESULTS

We observed slight differences in the distribution of the matching variables between cases and controls because of differences in the distribution of these variables between children who died from medical causes and those who died from injury. The largest proportion of cases and controls were were under 6 months of age (42.6% of cases, 37% of controls) and residing in a growing rural county (37.0% of cases, 52.6% of controls) (Table 1).

Sex was divided equally among cases, with males and females each comprising 48.2% of the total cases (3.7% were unknown). Approximately 90% of cases were found to be either non-Hispanic White (42.6%) or non-Hispanic Black (48.2%). More cases died of unintentional injury (48.2%) compared to deaths from homicide (27.8%) or from undetermined causes (24.0%). The majority of controls were female (52.6%) and predominantly non-Hispanic White (44.7%) or non-Hispanic Black (39.5%).

The majority of case and control families had at least one allegation of neglect documented in their case files (85.2% of cases, 79.8% of controls). A higher proportion of case families than control families had alleged neglect in the first report of abuse (79.6% of cases, 70.2% of controls), while a higher proportion of control families had alleged neglect in the most recent report of abuse (66.7% of cases, 71.9% of controls). Case and control families primarily had a single allegation in their first report (85.2% of cases, 83.3% of controls) and a single allegation in their most recent report (77.8% of cases, 79.0% of controls). Although 74.6% of case families and 74.0% of control families had more than one allegation in total, the majority of case and control families did not have any substantiated allegations (74.1% of cases, 71.1% of controls).

The median time since first report was 554 days [Interquartile Range (IQR): 121, 1288] for case families and 385.5 [IQR: 128, 1214] for control families, with the largest proportion both case and control families having been known to DFCS for 12 to 36 months (31.5% of cases, 27.2% of controls). The median time since the most recent report was 122 days [IQR: 38, 345] for case families and 156 days [IQR: 620, 327] for control families, with the largest proportion of case and control families having a time of less than 3 months (37.0% of cases, 28.1% of controls).

Crude Models

The stratified Mantel-Haenszel analysis resulted in statistically non-significant associations. The odds of having physical abuse alleged in the most recent report was 1.67 times higher among cases than controls (95% Confidence Interval (CI): 0.75, 3.72). The odds of having any allegations of neglect against the family were approximately 40% higher among cases than controls (Odds Ratio (OR): 1.42, 95% CI: 0.60, 3.39). Similarly, the odds of having neglect in the first report against the family was higher among cases than among controls (OR: 1.69, 95% CI: 0.79, 3.60). The association between the total number of allegations against the family and death was u-shaped, with those in the third category at highest odds compared to the lowest category (OR: 2.15, 95% CI: 0.41, 3.96). There was a u-shaped, inverse association between all categories of time since first report against the family (reference = 0 to 3 months) and death, with the strongest association among families known to DFCS for 6 to 12 month category (OR: 0.11, 95% CI: 0.01, 0.98). An inverse association between the middle two categories of time since most

recent report against the family (reference = 0 to 3 month) and death was found, with an overall u-shape when considering all categories of time since most recent report.

Logistic Models

There were no statistically significant interactions in any model. Race was found to be a confounder in the model based on the 10% change in estimate rule. Therefore, race was included in all models in addition to age category and county type. After examining several models that included different groups of exposure variables, two models were selected based on the magnitude and precision of the effect estimates. Model 1 included physical abuse alleged in the first report against the family and physical abuse alleged in the most recent report against the family. Model 2 included physical abuse alleged in the most recent report against the family among those with multiple allegations in total and time since the most recent report against the family. Model 3 included physical abuse alleged in the most recent report and time since the most recent report against the family (Table 3).

Model 1: History of Physical Abuse

An allegation of physical abuse in the first report was associated with a decreased likelihood of death (OR: 0.54, 95% CI: 0.11, 2.78) compared to those without an allegation of physical abuse in the first report, after controlling for allegations of physical abuse in the most recent report, race, age category, and county type. An allegation of physical abuse in the most recent report had an odds ratio of 3.61 (95% CI: 0.83, 15.77) compared to those without an allegation of physical abuse in the most recent report, after

controlling for allegations of physical abuse in the first report, race, age category, and county type.

Model 2: Multiple Allegations, Recent Physical Abuse, and Time

Those with multiple allegations in total and with physical abuse at the most recent report have an odds ratio of 3.52 (95% CI: 0.75, 16.58) compared to all other patterns, after controlling for time since the most recent report, race, age category, and county type. The odds ratio for those whose time since most recent report was 3 to 6 months had an odds ratio of 0.54 (95% CI: 0.11, 2.73) compared to those whose time since most recent report was less than 3 months, after controlling for multiple allegations in total and physical abuse at the most recent report, race, age category, and county type. The odds ratio for those whose time since most recent report was between 6 months and 12 months was 0.66 (95% CI: 0.12, 3.52) compared to those whose time since most recent report was less than 3 months, after controlling for multiple allegations in total and physical abuse at the most recent report, race, age category, and county type. The odds ratio for those whose time since most recent report was twelve months or greater was 0.70 (95% CI: 0.15, 3.15) compared to those whose time since most recent report was less than three months, after controlling for multiple allegations in total and physical abuse at the most recent report, race, age category, and county type.

Model 3: Recent Physical Abuse and Time

An allegation of physical abuse in the most recent report was associated with an increased odds of death (OR: 2.71, 95% CI: 0.78, 9.44), compared to those without=an

allegation of physical abuse in the most recent report, after controlling for time since most recent report, race, age category, and county type. The odds ratio for those whose time since most recent report was less than three months was elevated (OR: 1.53, 95% CI: 0.44, 5.44), compared to all other categories of time, after controlling for physical abuse in the most recent report, race, age category, and county type.

DISCUSSION

The primary role of CPS agencies is to ensure that children are safe. The ultimate failure of this is having a child die, particularly when CPS is already working with a family. Theoretically, about 20% - 50% of maltreatment fatalities can and should be prevented, as these cases are known to CPS agencies (6, 7, 17, 18). Results from the present analysis indicate that a history of physical abuse, specifically as a part of the most recent report, may be an indicator of an increased risk of death from intentional or unintentional injury among children monitored by the Georgia DFCS. Furthermore, the results suggest that children who live in a family with a recent allegation of physical abuse are particularly at higher risk within the first several months following the report. These characteristics can serve as indicators for CPS agencies in identifying and prioritizing their cases.

Aside from a history of physical abuse, the results indicate that it is difficult to distinguish children who are at higher risk of death among all children within the DFCS system. This conclusion is plausible, given that the entire study population could already be considered "high-risk" because the families involved have already been alleged to have put their children at risk (19).

These findings elaborate on Putnam-Hornstein's conclusion that a prior allegation to CPS agencies is the strongest risk factor for injury-related mortality among children before the age of 5 years. To date, Putnam-Hornstein's cohort study is the largest study examining mortality of children after report to CPS agencies (10). Furthermore, in Sabotta and Davis's study, another large-scale cohort study, it was also found that a report of physical abuse increases the risk of death in children (16). Many studies have

established that any childhood maltreatment increases the risk of mortality when compared to children who are not maltreated (7, 10, 17), however our study goes one step further by specifically examining and comparing children within a CPS agency.

Study Limitations

The small sample size of this study serves as a notable limitation, reducing the statistical power and the precision of the analysis. A history of physical abuse and time since most recent report were the only risk factors found to be predictive of an increased risk of death from injury in this study, and these were neither statistically significant nor precise. This is not say that there are no other indicators, but rather to note that true effects of other factors may not have been observed as a result of low power. Furthermore, the magnitude of effects found may have been overestimated (20).

The methodological limitations of the original study have been previously described (19). Briefly, the results depend on the quality and accuracy of the information contained and abstracted from the DFCS files. Missing data can be attributed to either abstraction errors by the caseworkers or to an absence of documentation within the case files. Given the above limitations, it is not suggested that these results be generalized to other states or other populations within Georgia.

Future Directions

It is important for public health professionals to further study risk factors for mortality, separate from those for abuse, among children being served by CPS agencies with the intention of improving interventions to prevent death among this vulnerable

population. Future studies should examine associations on a larger scale and using data from multiple states. This could not only validate the results of this study, but also identify other risk factors that may flag children or families who may be at higher risk. As a result, CPS agencies can better utilize their resources and improve the outcomes of the children and families that they serve.

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Table 1. Selected characteristics of children served by the Division of Family and Children Services (DFCS) in a case control study of allegation-specific risk factors for mortality, Georgia 1999 - 2000

	Cases[1] (n = 54)		Controls (n = 114)	
	No.	**%**	**No.**	**%**
Matched Variables				
Age				
0 - < 6 months	23	42.6	60	52.6
6 - < 12 months	7	13.0	13	11.4
12 - < 24 months	9	16.7	19	16.7
24+ months	15	27.8	22	19.3
County Type				
Urban	7	13.0	26	22.8
Suburban	18	33.3	29	25.4
Growing Rural	20	37.0	44	38.6
Declining Rural	9	16.7	15	13.2
Covariates				
Cause of Death				
Homicide	15	27.8	-	-
Unintentional	26	48.2	-	-
Undetermined	13	24.0	-	-
Sex				
Male	26	48.2	60	52.6
Female	26	48.2	42	36.8
Not Specified	2	3.7	12	10.5
Child's Race/Ethnicity				
White, Non-Hispanic	23	42.6	51	44.7
Other	29	53.7	52	45.6
Not Specified	2	3.7	11	9.7
Emotional Abuse Alleged				
Ever	4	7.4	8	7.0
1st allegation	2	3.7	4	3.5
Most recent	1	1.9	3	2.6
Physical Abuse Alleged				
Ever	16	29.6	37	32.5
1st allegation	6	11.1	21	18.4
Most recent	14	25.9	18	15.8
Neglect Alleged				
Ever	46	85.2	91	79.8
1st Allegation	43	79.6	80	70.2
Most Recent	36	66.7	82	71.9
Sexual Abuse Alleged				
Ever	4	7.4	13	11.4
1st Allegation	1	1.9	7	6.1
Most Recent	1	1.9	7	6.1

	Cases[1] (n = 54)		Controls (n = 114)	
	No.	**%**	**No.**	**%**
Total Allegations in First Report [2]				
1 Allegation	46	85.2	95	83.3
2+ Allegations	8	14.8	19	16.7
Total Allegations in Most Recent Report[2]				
1 Allegation	42	77.8	90	79.0
2+ Allegations	12	22.2	24	21.0
Total Allegations[3]				
1 Allegation	19	35.2	41	36.0
2 Allegations	10	18.5	33	29.0
3 - 4 Allegations	16	29.6	20	17.5
5+ Allegations	9	16.7	20	17.5
Total Substantiated Allegations[2]				
0 Allegations	40	74.1	81	71.1
1 Allegation	11	20.4	30	26.3
2+ Allegations	3	5.6	3	2.6
Time Since First Report				
0 - < 3 months	10	18.5	17	14.9
3 - < 6 months	5	9.3	19	16.7
6 - < 12 months	5	9.3	16	14.0
12 - < 36 months	17	31.5	31	27.2
36+ months	14	25.9	29	25.4
Missing	3	5.6	2	1.8
Time Since Most Recent Report				
0 - <3 months	20	37.0	32	28.1
3 - <6 months	11	20.4	31	27.2
6 - <12 months	11	20.4	26	22.8
12+ months	12	22.2	22	19.3
Missing	0	0.0	3	2.6

[1] Deaths from unintentional injuries, homicides, and undetermined causes

[2] Of any type

Table 2. Mantel Haenszel odds ratios, stratified on matching variables, of allegation history and mortality among children ≤ 5 years served by the Division of Family and Children Services, Georgia 1999-2000

	OR[1]	95% CI[2]	
Sex			
Male	1.00	Ref.	Ref.
Female	1.34	0.65	2.75
Child's Race/Ethnicity			
White, non-Hispanic	1.39	0.27	7.15
Other	1.00	Ref.	Ref.
Physical Abuse Alleged			
Ever [3]	0.86	0.42	1.78
1st allegation [4]	0.49	0.02	1.32
Most recent [5]	1.67	0.75	3.72
Neglect Alleged			
Ever [3]	1.42	0.60	3.39
1st allegation [4]	1.69	0.79	3.60
Most recent [5]	0.76	0.37	1.55
Total Allegations in First Report [6]			
1 Allegation	1.00	Ref.	Ref.
2+ Allegations	0.90	0.36	2.29
Total Allegations in Most Recent Report [6]			
1 Allegation	1.00	Ref.	Ref.
2+ Allegations	1.16	0.52	2.61
Total Allegations [6]			
1 Allegation	1.00	Ref.	Ref.
2 Allegations	0.59	0.01	1.51
3 - 4 Allegations	2.15	0.80	5.76
5+ Allegations	1.27	0.41	3.96
Total Substantiated Allegations [6]			
0 Allegations	1.00	Ref.	Ref.
1 Allegation	0.86	0.38	1.94
2+ Allegations	1.41	0.27	7.49
Time Since First Report			
0 - < 3 months	1.00	Ref.	Ref.
3 - < 6 months	0.42	0.10	1.81
6 - < 12 months	0.11	0.01	0.98
12 - < 36 months	0.81	0.29	2.24
36+ months	0.97	0.29	3.23
Time Since Most Recent Report			
0 - < 3 months	1.00	Ref.	Ref.
3 - < 6 months	0.69	0.25	1.86
6 - < 12 months	0.38	0.12	1.21
12+ months	1.22	0.46	3.28

[1] Mantel Haenszel Odds Ratio stratified on county type (urban, suburban, growing rural, or declining rural) and age (0 - 6 months, 6 - 12 months, 12 - 24 months, 24 + months)

[2] 95 % Confidence Interval

[3] Reference = Never having respective abuse alleged

[4] Reference = Abuse not alleged in first report

[5] Reference = Abuse not alleged in most recent report

[6] Of any type

Table 3. Adjusted odds ratios, stratified by matching variables, for selected models model in a case control study of the effect of allegation-specific risk factors on mortality among children ≤ 5 years of age who are served by the Division of Family and Children Services (DFCS), Georgia 1999 – 2000

Covariates	OR[1]	95% CI	
Model 1			
Physical Abuse in the First Report	0.54	0.11	2.78
Physical Abuse in the Most Recent Report	3.61	0.83	15.77
Model 2			
Physical Abuse in the Most Recent Report, Multiple Allegations in Total	3.52	0.75	16.58
Time Category: 3 - < 6 months[2]	0.54	0.11	2.73
Time Category: 6 - < 12 months[2]	0.66	0.12	3.52
Time Category: 12+ months[2]	0.70	0.15	3.15
Model 3			
Physical Abuse in the Most Recent Report	2.71	0.78	9.44
Time Category: 0 - < 3 months[3]	1.53	0.44	5.44

[1] Odds ratio estimates adjusted for county type (urban, suburban, growing rural, or declining rural), age (0 - 6 months, 6 - 12 months, 12 - 24 months, 24 + months), and race (white, non-Hispanic and other)

[2] Reference = 0 - < 3 months

[3] Reference = all other time categories

APPENDIX

Table 4. Crude 2x2 tables of physical abuse alleged at most recent report by case-control status, stratified by county type and age category among children ≤ 5 years served by the Division of Family and Children Services, Georgia 1999-2000

Physical Abuse Alleged at Most Recent Report
Stratum 1: Urban County and Age of 0 - 6 mos

	No	Yes	Total
Case	13	1	14
Control	1	1	2
Total	14	2	16
Chi-square = 2.94 (p = 0.09)			

Physical Abuse Alleged at Most Recent Report
Stratum 2: Urban County and Age of
6 mos - 12 mos

	No	Yes	Total
Case	1	1	2
Control	1	1	0
Total	2	1	3
Chi-square = 0.75 (p = 0.39)			

Physical Abuse Alleged at Most Recent Report
Stratum 3: Urban County and Age of
12 mos - 24 mos

	No	Yes	Total
Case	8	0	8
Control	2	1	3
Total	10	1	11
Chi-square = 2.93 (p = 0.09)			

Physical Abuse Alleged at Most Recent Report
Stratum 4: Urban County and Age of 24 + mos

	No	Yes	Total
Case	2	0	2
Control	0	1	1
Total	2	1	3
Chi-square = 3.00 (p = 0.08)			

Physical Abuse Alleged at Most Recent Report
Stratum 5: Suburban County and Age of
0 - 6 mos

	No	Yes	Total
Case	13	3	16
Control	5	1	6
Total	18	4	22
Chi-square = 0.01 (p = 0.91)			

Physical Abuse Alleged at Most Recent Report
Stratum 6: Suburban County and Age of
6 mos - 12 mos

	No	Yes	Total
Case	3	0	3
Control	3	0	3
Total	6	0	6
No statistics calculated for this table			

Physical Abuse Alleged at Most Recent Report
Stratum 7: Suburban County and Age of
12 mos - 24 mos

	No	Yes	Total
Case	4	1	5
Control	2	2	4
Total	6	3	9
Chi-square = 0.90 (p = 0.34)			

Physical Abuse Alleged at Most Recent Report
Stratum 8: Suburban County and Age of
24 + mos

	No	Yes	Total
Case	4	1	5
Control	3	2	5
Total	7	3	10
Chi-square = 0.48 (p = 0.49)			

Physical Abuse Alleged at Most Recent Report
Stratum 9: Growing Rural County and Age of
0 - 6 mos

	No	Yes	Total
Case	20	4	24
Control	8	1	9
Total	28	5	33
Chi-square = 0.16 (p = 0.69)			

Physical Abuse Alleged at Most Recent Report
Stratum 10: Growing Rural County and Age of
6 mos - 12 mos

	No	Yes	Total
Case	7	0	7
Control	2	0	2
Total	9	0	9
No statistics calculated for this table			

Physical Abuse Alleged at Most Recent Report Stratum 11: Growing Rural County and Age of 12 mos - 24 mos			
	No	Yes	Total
Case	4	0	4
Control	1	1	2
Total	5	1	6
Chi-square = 2.40 (p = 0.12)			

Physical Abuse Alleged at Most Recent Report Stratum 12: Growing Rural County and Age of 24 + mos			
	No	Yes	Total
Case	7	2	9
Control	4	3	7
Total	11	5	16
Chi-square = 0.78 (p = 0.37)			

Physical Abuse Alleged at Most Recent Report Stratum 13: Declining Rural County and Age of 0 - 6 mos			
	No	Yes	Total
Case	5	1	6
Control	5	1	6
Total	10	2	12
Chi-square = 0.00 (p = 1.00)			

Physical Abuse Alleged at Most Recent Report Stratum 14: Declining Rural County and Age of 6 mos - 12 mos			
	No	Yes	Total
Case	0	1	1
Control	1	0	1
Total	1	1	2
Chi-square = 2.00 (p = 0.16)			

Physical Abuse Alleged at Most Recent Report Stratum 15: Declining Rural County and Age of 12 mos - 24 mos			
	No	Yes	Total
Case	1	1	2
Control	0	0	0
Total	1	1	2
No statistics calculated for this table			

Physical Abuse Alleged at Most Recent Report Stratum 16: Declining Rural County and Age of 24 + mos			
	No	Yes	Total
Case	4	2	6
Control	2	0	2
Total	6	2	8
Chi-square = 0.89 (p = 0.35)			

Table 5. Crude 2x2 tables of time since most recent report by case-control status, stratified by county type and age category among children ≤ 5 years served by the Division of Family and Children Services, Georgia 1999-2000

Time categories 3 - < 6 mos vs. 0 - < 3 mos

Time Since Most Recent Report Stratum 1: Urban County and Age of 0 - 6 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	8	0	8
Control	1	1	2
Total	9	1	10
Chi-square = 4.44 (p = 0.04)			

Time Since Most Recent Report Stratum 2: Urban County and Age of 6 mos - 12 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	0	0	0
Control	0	0	0
Total	0	0	0
No statistics calculated for this table			

Time Since Most Recent Report Stratum 3: Urban County and Age of 12 mos - 24 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	2	0	2
Control	1	1	2
Total	3	1	4
Chi-square = 1.33 (p = 0.25)			

Time Since Most Recent Report Stratum 4: Urban County and Age of 24 + mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	0	2	2
Control	0	0	0
Total	0	2	2
No statistics calculated for this table			

Time Since Most Recent Report Stratum 5: Suburban County and Age of 0 - 6 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	5	8	13
Control	1	2	3
Total	6	10	16
Chi-square = 0.03 (p = 0.87)			

Time Since Most Recent Report Stratum 6: Suburban County and Age of 6 mos - 12 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	0	3	3
Control	2	0	2
Total	2	3	5
Chi-square = 5.00 (p = 0.03)			

Time Since Most Recent Report Stratum 7: Suburban County and Age of 12 mos - 24 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	1	1	2
Control	2	1	3
Total	3	2	5
Chi-square = 0.14 (p = 0.71)			

Time Since Most Recent Report Stratum 8: Suburban County and Age of 24 + mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	3	0	3
Control	1	0	1
Total	4	0	4
No statistics calculated for this table			

Time Since Most Recent Report Stratum 9: Growing Rural County and Age of 0 - 6 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	7	2	9
Control	6	1	7
Total	13	3	16
Chi-square = 0.16 (p = 0.69)			

Time Since Most Recent Report Stratum 10: Growing Rural County and Age of 6 mos - 12 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	2	3	5
Control	0	1	1
Total	2	4	6
Chi-square = 0.60 (p = 0.44)			

Stratum 11: Growing Rural County and Age of 12 mos - 24 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	1	2	3
Control	2	0	2
Total	3	2	5
Chi-square = 2.22 (p = 0.14)			

Stratum 12: Growing Rural County and Age of 24 + mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	1	5	6
Control	1	3	4
Total	2	8	10
Chi-square = 0.10 (p = 0.75)			

Time Since Most Recent Report Stratum 13: Declining Rural County and Age of 0 - 6 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	2	1	3
Control	3	0	3
Total	5	1	6
Chi-square = 1.20 (p = 0.27)			

Time Since Most Recent Report Stratum 14: Declining Rural County and Age of 6 mos - 12 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	0	1	1
Control	0	0	0
Total	0	1	1
No statistics calculated for this table			

Time Since Most Recent Report Stratum 15: Declining Rural County and Age of 12 mos - 24 mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	0	1	1
Control	0	0	0
Total	0	1	1
No statistics calculated for this table			

Time Since Most Recent Report Stratum 16: Declining Rural County and Age of 24 + mos			
	0 - < 3 mos	3 - < 6 mos	Total
Case	0	2	2
Control	0	1	1
Total	0	3	3
No statistics calculated for this table			

Time categories 6 - < 12 mos vs. 0 - < 3 mos

Time Since Most Recent Report Stratum 1: Urban County and Age of 0 - 6 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	8	1	9
Control	1	0	1
Total	9	1	10
Chi-square = 0.12 (p = 0.73)			

Time Since Most Recent Report Stratum 2: Urban County and Age of 6 mos - 12 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	0	1	1
Control	0	1	1
Total	0	2	2
No statistics calculated for this table			

Time Since Most Recent Report Stratum 3: Urban County and Age of 12 mos - 24 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	2	3	5
Control	1	1	2
Total	3	4	7
Chi-square = 0.06 (p = 0.81)			

Time Since Most Recent Report Stratum 4: Urban County and Age of 24 + mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	0	0	0
Control	0	1	1
Total	0	1	1
No statistics calculated for this table			

Time Since Most Recent Report Stratum 5: Suburban County and Age of 0 - 6 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	5	2	7
Control	1	0	1
Total	6	2	8
Chi-square = 0.38 (p = 0.54)			

Time Since Most Recent Report Stratum 6: Suburban County and Age of 6 mos - 12 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	0	0	0
Control	2	1	3
Total	2	1	3
No statistics calculated for this table			

Time Since Most Recent Report Stratum 7: Suburban County and Age of 12 mos - 24 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	1	3	4
Control	2	1	3
Total	3	4	7
Chi-square = 1.22 (p = 0.27)			

Time Since Most Recent Report Stratum 8: Suburban County and Age of 24 + mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	3	1	4
Control	1	1	2
Total	4	2	6
Chi-square = 0.38 (p = 0.54)			

Time Since Most Recent Report Stratum 9: Growing Rural County and Age of 0 - 6 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	7	8	15
Control	6	1	7
Total	13	9	22
Chi-square = 3.01 (p = 0.08)			

Time Since Most Recent Report Stratum 10: Growing Rural County and Age of 6 mos - 12 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	2	1	3
Control	0	0	0
Total	2	1	3
No statistics calculated for this table			

Time Since Most Recent Report Stratum 11: Growing Rural County and Age of 12 mos - 24 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	1	0	1
Control	2	0	2
Total	3	0	3
No statistics calculated for this table			

Time Since Most Recent Report Stratum 12: Growing Rural County and Age of 24 + mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	1	3	4
Control	1	2	3
Total	2	5	7
Chi-square = 0.06 (p = 0.81)			

Time Since Most Recent Report Stratum 13: Declining Rural County and Age of 0 - 6 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	2	1	3
Control	3	1	4
Total	5	2	7
Chi-square = 0.06 (p = 0.81)			

Time Since Most Recent Report Stratum 14: Declining Rural County and Age of 6 mos - 12 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	0	0	0
Control	0	1	1
Total	0	1	1
No statistics calculated for this table			

Time Since Most Recent Report Stratum 15: Declining Rural County and Age of 12 mos - 24 mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	0	1	1
Control	0	0	0
Total	0	1	1
No statistics calculated for this table			

Time Since Most Recent Report Stratum 16: Declining Rural County and Age of 24 + mos			
	0 - < 3 mos	6 - < 12 mos	Total
Case	0	1	1
Control	0	0	0
Total	0	1	1
No statistics calculated for this table			

Time categories 6 - < 12 mos vs. 0 - < 3 mos

Time Since Most Recent Report Stratum 1: Urban County and Age of 0 - 6 mos			
	0 - < 3 mos	12+ mos	Total
Case	8	5	13
Control	1	0	1
Total	9	5	14
Chi-square = 0.60 (p = 0.44)			

Time Since Most Recent Report Stratum 2: Urban County and Age of 6 mos - 12 mos			
	0 - < 3 mos	12+ mos	Total
Case	0	1	1
Control	0	0	0
Total	0	0	0
No statistics calculated for this table			

Time Since Most Recent Report Stratum 3: Urban County and Age of 12 mos - 24 mos			
	0 - < 3 mos	12+ mos	Total
Case	2	3	5
Control	1	0	1
Total	3	3	6
Chi-square = 1.20 (p = 0.27)			

Time Since Most Recent Report Stratum 4: Urban County and Age of 24 + mos			
	0 - < 3 mos	12+ mos	Total
Case	0	0	0
Control	0	0	0
Total	0	0	0
No statistics calculated for this table			

Time Since Most Recent Report Stratum 5: Suburban County and Age of 0 - 6 mos			
	0 - < 3 mos	12+ mos	Total
Case	5	1	6
Control	1	3	4
Total	6	4	10
Chi-square = 3.40 (p = 0.07)			

Time Since Most Recent Report Stratum 6: Suburban County and Age of 6 mos - 12 mos			
	0 - < 3 mos	12+ mos	Total
Case	0	0	0
Control	2	0	2
Total	2	0	2
No statistics calculated for this table			

Time Since Most Recent Report Stratum 7: Suburban County and Age of 12 mos - 24 mos			
	0 - < 3 mos	12+ mos	Total
Case	1	0	1
Control	2	0	2
Total	3	0	3
No statistics calculated for this table			

Time Since Most Recent Report Stratum 8: Suburban County and Age of 24 + mos			
	0 - < 3 mos	12+ mos	Total
Case	3	1	4
Control	1	3	4
Total	4	4	8
Chi-square = 2.00 (p = 0.16)			

Time Since Most Recent Report Stratum 9: Growing Rural County and Age of 0 - 6 mos			
	0 - < 3 mos	12+ mos	Total
Case	7	5	12
Control	6	1	7
Total	13	6	19
Chi-square = 1.53 (p = 0.22)			

Time Since Most Recent Report Stratum 10: Growing Rural County and Age of 6 mos - 12 mos			
	0 - < 3 mos	12+ mos	Total
Case	2	1	3
Control	0	1	1
Total	2	2	4
Chi-square = 1.33 (p = 0.25)			

Time Since Most Recent Report Stratum 11: Growing Rural County and Age of 12 mos - 24 mos			
	0 - < 3 mos	12+ mos	Total
Case	1	1	2
Control	2	0	2
Total	3	1	4
Chi-square = 1.33 (p = 0.25)			

Time Since Most Recent Report Stratum 12: Growing Rural County and Age of 24 + mos			
	0 - < 3 mos	12+ mos	Total
Case	1	0	1
Control	1	1	2
Total	2	1	3
Chi-square = 0.75 (p = 0.39)			

Time Since Most Recent Report Stratum 13: Declining Rural County and Age of 0 - 6 mos			
	0 - < 3 mos	12+ mos	Total
Case	2	1	3
Control	3	2	5
Total	5	3	8
Chi-square = 0.04 (p = 0.85)			

Time Since Most Recent Report Stratum 14: Declining Rural County and Age of 6 mos - 12 mos			
	0 - < 3 mos	12+ mos	Total
Case	0	0	0
Control	0	0	0
Total	0	0	0
No statistics calculated for this table			

Time Since Most Recent Report Stratum 16: Declining Rural County and Age of 12 mos - 24 mos			
	0 - < 3 mos	12+ mos	Total
Case	0	0	0
Control	0	0	0
Total	0	0	0
No statistics calculated for this table			

Time Since Most Recent Report Stratum 17: Declining Rural County and Age of 24 + mos			
	0 - < 3 mos	12+ mos	Total
Case	0	3	3
Control	0	1	1
Total	0	4	4
No statistics calculated for this table			

Table 6. Confounding assessment of a multivariate logistic model in a case control study of the effect of allegation-specific risk factors on mortality among children ≤ 5 years of age who are served by the Division of Family and Children Services (DFCS), Georgia 1999 – 2000

Confounders in Model	OR #1[+]	95% CI		CI Width	CI Ratio	OR #2[++]	95% CI		CI Width	CI Ratio
ALL- sex and race	0.59	0.11	3.09	2.98	27.60	3.27	0.73	14.65	13.92	20.10
Sex only	0.25	0.08	0.85	0.77	11.28	3.03	1.11	8.26	7.14	7.41
Race only	0.54	0.11	2.78	2.68	26.49	3.61	0.83	15.77	14.94	19.06
None	0.25	0.08	0.85	0.77	10.63	3.10	1.14	8.42	7.28	7.39

[+] Odds ratio (OR) for physical abuse at first report, compared to no physical abuse at first report, controlling for physical abuse at most recent report and confounders listed in left column

[++] OR for physical abuse at most recent report, compared to no physical abuse at most recent report, controlling for physical abuse at first report and confounders listed in left column

Table 7. Confounding assessment of a multivariate logistic model in a case control study of allegation-specific risk factors for death among children ≤ 5 years of age who are served by the Division of Family and Children Services (DFCS), Georgia 1999 - 2000

Confounders in Model	OR #1[+]	95% CI		CI Width	CI Ratio	OR #2[++]	95% CI		CI Width	CI Ratio
ALL- sex and race	3.85	0.79	18.82	18.04	23.92	1.00	1.00	1.00	0.00	1.01
Sex only	2.69	1.06	6.83	5.77	6.46	1.00	1.00	1.00	0.00	1.00
Race only	3.62	0.81	16.24	15.43	20.14	1.00	1.00	1.00	0.00	1.00
None	2.50	0.98	6.39	5.41	6.52	1.00	1.00	1.00	0.00	1.00

[+] Odds ratio (OR) for physical abuse at most recent report and multiple allegations in total, compared to no physical abuse at most recent report and multiple allegations in total, controlling for time since most recent report and confounders listed in left column

[++] OR for time since most recent report, controlling for physical abuse at most recent report and multiple allegations in total and confounders listed in left column

Table 8. Potential multivariate logistic models, stratified by age category and county type, in a case control study of allegation-specific risk factors for death among children ≤ 5 years of age who are served by the Division of Family and Children Services (DFCS), Georgia 1999 - 2000

Covariates	Estimate	Pr > ChiSq	OR	95% CI	
Model 1					
Physical Last	2.0273	0.0254	7.594	1.283	44.939
Physical Ever	-1.7362	0.0344	0.176	0.035	0.88
Neglect Last	-0.9285	0.137	0.395	0.116	1.343
Neglect Ever	1.4113	0.0346	4.101	1.108	15.186
Model 2					
Physical Last	2.0273	0.0099	9.923	1.737	56.694
Physical Ever	-1.7362	0.0445	0.201	0.042	0.962
Neglect Ever	-0.9285	0.1278	2.199	0.798	6.065
Model 3					
Physical Last	1.9491	0.0232	7.022	1.304	37.802
Physical Ever	-1.5786	0.0489	0.206	0.043	0.992
Model 4					
Physical Last	1.9491	0.0232	7.022	1.304	37.802
Physical Ever	-1.5786	0.0489	0.206	0.043	0.992
Model 5					
Physical abuse alleged, single allegation in total	-0.5442	0.5218	0.58	0.11	3.068
Physical abuse alleged at first report, multiple allegations in total	-1.2252	0.0695	0.294	0.078	1.103
Physical abuse alleged at most recent report, multiple allegations in total	1.1817	0.0225	3.26	1.182	8.993
Model 6					
Time recent 1 vs 0	-0.4676	0.2448	0.385	0.111	1.328
Time recent 2 vs 0	-0.3116	0.4274	0.449	0.127	1.588
Time recent 3 vs 0	0.2911	0.4372	0.821	0.26	2.597
Time first 1 vs 0	-0.3458	0.5105	0.724	0.149	3.51
Time first 2 vs 0	-0.0281	0.9585	0.995	0.184	5.387
Time first 3 vs 0	0.2126	0.5404	1.266	0.362	4.433
Time first 4 vs 0	0.1846	0.5863	1.231	0.345	4.396
Model 7					
First and most recent report after birth of child (dummy variable)	0.2183	0.6347	1.244	0.506	3.061
First report before birth of child, most recent report after birth of child (dummy variable)	0.351	0.4778	1.42	0.539	3.744

Covariates	Estimate	Pr > ChiSq	OR	95% CI	
Model 8					
First and most recent report after birth of child (dummy variable)	0.3009	0.5299	1.351	0.528	3.454
First report before birth of child, most recent report after birth of child (dummy variable)	0.3485	0.5007	1.417	0.514	3.908
Physical abuse at first report	-0.9509	0.1724	0.386	0.099	1.514
Physical abuse at last report	0.8702	0.1593	2.387	0.711	8.021
Neglect at first report	0.8275	0.1889	2.288	0.666	7.86
Neglect at last report	-0.553	0.3612	0.575	0.176	1.885
Model 9					
First and most recent report after birth of child (dummy variable)	0.2952	0.5342	1.343	0.53	3.408
First report before birth of child, most recent report after birth of child (dummy variable)	0.3684	0.4748	1.445	0.526	3.97
Physical abuse at first report	-1.4053	0.0236	0.245	0.073	0.828
Physical abuse at last report	1.1182	0.0293	3.059	1.119	8.362