

Maltreatment of Children Under Age 2 With Specific Birth Defects: A Population-Based Study

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abstract

BACKGROUND AND OBJECTIVES: Children with disabilities are at an increased risk for maltreatment. However, the risk of maltreatment is unknown for children with specific types of birth defects. This study was conducted to determine whether the risk and predictors of maltreatment differ between children with and without 3 birth defects: Down syndrome, cleft lip with/without cleft palate, and spina bifida.

METHODS: This population-based study of substantiated childhood maltreatment was conducted in Texas from 2002 to 2011. Linked data were used to describe the risk and types of maltreatment that occurred before age 2 years in children with and without specific birth defects. Poisson regression was used to identify predictors of maltreatment and assess differences in those predictors between children with and without these specific birth defects.

RESULTS: The risk of maltreatment (any type) in children with cleft lip with/without cleft palate and spina bifida was increased by 40% and 58%, respectively, compared with children with no birth defects. The risk of any maltreatment was similar between children with Down syndrome and unaffected children. Across birth defect groups, the risk of medical neglect was 3 to 6 times higher than in the unaffected group. Child-, family-, and neighborhood-level factors predicted maltreatment in children with and without birth defects.

CONCLUSIONS: The overall risk of substantiated maltreatment was significantly higher for some but not all birth defect groups. The factors associated with increased risk were similar across groups. Enhancement of existing maltreatment prevention and early intervention programs may be effective mechanisms to provide at-risk families additional support.



WHAT'S KNOWN ON THIS SUBJECT: Children with disabilities are at an increased risk for maltreatment. As a group, birth defects have been shown to increase the risk of maltreatment.

WHAT THIS STUDY ADDS: Few studies have examined maltreatment in children with specific birth defects. This study found many factors predictive of maltreatment in young children, including type of birth defect as well as child-, family-, and neighborhood-level factors.

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Dr Van Horne designed the study, analyzed the data, and prepared the manuscript; Ms Moffitt prepared, cleaned, and linked the data; Drs Canfield and Case conceptualized the study, assisted in acquiring the data from multiple agencies, and reviewed the manuscript; Dr Greeley assisted with the design and interpretation of results and reviewed drafts of the manuscript; Dr Morgan assisted with the design and data analysis and reviewed drafts of the manuscript; Dr Mitchell assisted in the design of the study and interpretation of results and reviewed multiple drafts of the manuscript; and all authors approved the final version of the manuscript as submitted.

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Identifying and preventing child maltreatment is an established public health priority.¹ Maltreatment of children with disabilities is of particular concern because this vulnerable group is overrepresented in the maltreated population.² Although 9% to 18% of children aged <18 years in the United States have a disability, up to 54% of the children served by Child Protective Services reportedly have some form of disability.³⁻⁵ Furthermore, in population-based studies, the prevalence of maltreatment in children with disabilities is higher than in children without a known disability, and the relative proportions of maltreatment types (eg, physical abuse) vary across disability category (eg, language delay, physical disability).⁶⁻¹¹

Birth defects, which occur in ~1 in 33 births in the United States, include a range of abnormalities in function, structure, and metabolism¹² and are a leading cause of disability.^{13,14} Compared with children without birth defects, children with birth defects are at increased risk for maltreatment and out-of-home placement.^{15,16} However, given the heterogeneous nature of birth defects, the medical needs and disabilities of affected children vary. Consequently, the risk and type of maltreatment may differ across birth defect categories.

The present study was undertaken to determine whether the overall risk, type, and predictors of maltreatment in children aged <2 years with specific birth defects differ from unaffected children. We evaluated 3 common birth defects that are characterized by different types of disabilities: Down syndrome (intellectual impairment), cleft lip with or without cleft palate (CL ± P; facial malformation and speech impairment), and spina bifida (physical disability).

METHODS

This population-based cohort study included ~3 million children born in

Texas between 2002 and 2009. We examined substantiated child maltreatment, as defined by the State of Texas Family Law Code 261, and predictors of substantiated maltreatment among children 4 days to 2 years of age. State administrative and US census data were linked to identify the study population and covariates of interest. This study was approved by the institutional review boards at the Texas Department of State Health Services and the University of Texas Health Science Center at Houston.

Population and Sources

Data from birth and death records, obtained from the Texas Department of State Health Services Vital Statistics Unit, were used to identify the cohort. All live-born children delivered January 1, 2002, through December 31, 2009, to women who were Texas residents at the time of delivery were eligible to be included in the study ($N = 3\,130\,324$). Children who died on or before the third day of life ($n = 6206$) were excluded.

Children with birth defects were identified by using surveillance data from the Texas Birth Defects Registry (TBDR). TBDR is a population-based registry that collects data on birth defects throughout Texas by using an active surveillance approach.¹⁷ TBDR codes diagnoses by using the Centers for Disease Control and Prevention's modification of the British Pediatric Association Classification of Diseases (BPA codes).

The birth defects included in the present study were: Down syndrome (BPA codes 758.000-758.090), CL ± P (BPA codes 749.100-749.220), and spina bifida (BPA codes 741.000-741.990). Potential cases with BPA codes for both spina bifida and anencephaly (BPA codes 740.000-740.100) were excluded. Children with multiple defects were included unless they had ≥2 of the

conditions under study (eg, children with both CL ± P and spina bifida were excluded). Children unaffected by any type of birth defect, as determined by TBDR, comprised the "unaffected" comparison group.

Maltreatment information was obtained from the Child Protective Service records from the Texas Department of Family and Protective Services (TDFPS). Texas defines 8 types of child maltreatment: neglectful supervision, physical abuse, physical neglect, medical neglect, sexual abuse, abandonment, emotional abuse, and refusal to assume parental responsibility (definitions can be found in the Supplemental Appendix).¹⁸ The main outcome variable for these analyses was any type of substantiated maltreatment reported between days 4 and 730 of life (first 2 years of life). Substantiated maltreatment is defined as an overall case disposition of "reason to believe," meaning that after a complete investigation by TDFPS, a court ruled that there was a preponderance of evidence indicating that maltreatment had occurred. Child-level data on all substantiated child maltreatment cases over a 10-year period (January 1, 2002-December 31, 2011) for children born between January 1, 2002, and December 31, 2009, were obtained from TDFPS. For children with >1 maltreatment case before their second birthday, only the information for the first substantiated case was used. Date of the reported allegation(s), maltreatment type(s), perpetrator type(s) (eg, parent), and allegation disposition(s) (eg, reason to believe) were provided for each substantiated case. Information on unsubstantiated cases and any caregiver changes that may have occurred between birth and the time of maltreatment were not provided by TDFPS. Children identified by TDFPS who did not have a substantiated type of maltreatment ($n = 552$) or whose date of report was >1 week after their date of death

($n = 56$) were excluded because the circumstances surrounding the maltreatment case were unclear.

Covariates

All covariates were selected a priori based on the maltreatment literature. Covariate data for children with and without birth defects were ascertained from birth certificates and included information about the child (gestational age at birth, birth weight, gender, and plurality), mother (race/ethnicity, age, education, parity, marital status, type of payment at birth, and census tract of residence at the time of birth), and father (race/ethnicity, age at birth, and education). Because paternal information was missing for $>10\%$ of children, a dichotomous variable indicating whether information on the father was present or absent was created.

For the birth defect groups, children were categorized as having an isolated birth defect (1 major birth defect) or multiple major birth defects. Major defects are defined as conditions causing structural changes to the body that have a significant impact on health, development, or ability.¹⁹ This variable was included in all analyses that were restricted to include data only from children with a specific birth defect (ie, no unaffected children) because the presence of additional major birth defects may be associated with the risk of maltreatment.

Neighborhood-level data, based on the mother's residence at the time of birth, were obtained from the 5-year 2005 to 2009 American Community Survey and included percentage of poverty, vacant housing, unemployment, and single-headed households with children aged <5 years according to census tract. These variables were standardized against the distribution for the state of Texas and were used to create a composite measure for neighborhood economic impoverishment as described by Korbin et al.²⁰ A neighborhood was

considered to have high economic impoverishment if it was >1 SD above the mean level of impoverishment for the state.

Data Linkage

Data from TBDR and TDFPS were separately linked to vital statistics records by using probabilistic data strategies that included 12 matching algorithms using unique combinations of parent and child names, dates of birth, and Social Security numbers. The linked TBDR and TDFPS were then merged by using the birth certificate number as the unique identifier. Neighborhood-level data, calculated from the American Community Survey, were merged by using census tract numbers. Data linkage and de-identification was performed by TBDR data analysts using SAS version 9.1 (SAS Institute, Inc, Cary, NC).

Statistical Analysis

Counts and frequencies were used to describe the 4 study groups (unaffected, Down syndrome, $CL \pm P$, and spina bifida). A χ^2 test was used to compare characteristics of each birth defect group with the unaffected group. P values $<.05$ were considered statistically significant.

Poisson regression was used to estimate the unadjusted risk ratio and 95% confidence interval (CI) for the association between each birth defect group and substantiated maltreatment. In addition, among children who had a substantiated maltreatment report, unadjusted relative risks comparing maltreatment case characteristics (eg, maltreatment type) of each birth defect group versus the unaffected group were estimated.

Modified Poisson regression with a robust SE adjustment was used to identify predictors of overall maltreatment. Adjusted rate ratios (aRRs) were estimated, and 95% CIs that did not include 1.00 were considered statistically significant.

Analyses were initially conducted separately for each birth defect group. Specifically, data from unaffected children and children with a specific birth defect (eg, $CL \pm P$) were fitted to a model that included all of the covariates that were selected a priori. To determine whether the association of each covariate with maltreatment differed according to birth defect status (eg, the association between plurality and maltreatment depending on the presence or absence of $CL \pm P$), interaction terms involving a birth defect indicator variable and each covariate were individually added to the models, and likelihood ratio tests were used to compare the fit of the models with and without interaction terms. Interaction terms were considered statistically significant if P values were $<.05$. Because the tests for interaction were all nonsignificant (data not presented), the data from all groups (Down syndrome, $CL \pm P$, spina bifida, and unaffected) were combined and fitted to the final model including all covariates. Statistical analyses were performed by using Stata version 12.1 (StataCorp, College Station, TX).²¹

RESULTS

The percentage of successful matches between TBDR and vital statistics records was $>98\%$ for all years. Overall, 85.8% of children with a substantiated TDFPS investigation during the study period could be matched to vital statistics records. The rate of matching increased over the study period from 81.7% in 2002 to 90.6% in 2009 (Table 1).

Population

A total of 2 977 758 children were included in these analyses (95% of live births in Texas, 2002–2009), including 2 970 101 unaffected children, 3743 with Down syndrome, 2943 with $CL \pm P$, and 971 with

TABLE 1 Results of Data Linkage Between Birth, Substantiated Child Maltreatment, and Birth Defect Record, Texas, 2002 to 2009

Birth Year	Texas Birth Records	Substantiated Maltreatment Records for Children Born In Given Year	Matched With Birth Records	% Matched ^a	All Birth Defects Identified Within Given Year ^b	Matched With Birth Records	% Matched
2002	372 369	35 072	28 638	81.7	14 036	13 773	98.1
2003	377 374	34 002	28 203	82.9	14 614	14 399	98.5
2004	381 441	33 734	28 166	83.5	16 066	15 814	98.4
2005	385 537	32 051	27 528	85.9	16 887	16 693	98.9
2006	399 309	30 897	27 109	87.7	17 626	17 410	98.8
2007	407 453	27 420	24 334	88.7	18 373	18 119	98.6
2008	405 242	23 298	20 911	89.8	19 207	18 964	98.7
2009	401 599	19 036	17 245	90.6	19 998	19 697	98.5

^a Maltreatment records for children who moved to Texas after birth (no Texas birth certificate) could not be matched.

^b Includes fetal deaths for which there are no birth certificates.

spina bifida. The birth defect groups differed from the unaffected group on a range of demographic factors (Table 2). In general, these differences were consistent with known epidemiologic characteristics of the birth defect group. For example, mothers of children with Down syndrome tended to be older than mothers of unaffected children, which is consistent with the known association between Down syndrome and maternal age.²²

Overall Maltreatment

Of the 2 970 101 unaffected children included in the study, 67 049 (23 per 1000 children) had a substantiated case of maltreatment before their second birthday (Table 3). In the Down syndrome group, the prevalence of maltreatment (20 per 1000) was not significantly different from the prevalence in the unaffected group (aRR: 1.08 [95% CI: 0.85–1.37]). In contrast, the prevalence and relative risk of maltreatment in the CL ± P group (prevalence: 36 per 1000; aRR: 1.40 [95% CI: 1.14–1.71]) and the spina bifida group (prevalence: 38 per 1000; aRR: 1.58 [95% CI: 1.12–2.24]) were significantly higher compared with the unaffected group.

Characteristics of Maltreatment

Among children with substantiated maltreatment, age at the time of the first substantiated maltreatment report was divided into 5

categories: <1 month, 1 to 6 months, 7 to 12 months, 13 to 18 months, and 19 to 23 months (Table 4). Among maltreated children, those with a birth defect were ~2 to 3 times more likely than unaffected children to have an episode of maltreatment reported before 1 month of age; this difference was statistically significant only for the CL + P and spina bifida groups.

Neglectful supervision was the most common form of maltreatment in all 4 groups (Table 4). Compared with unaffected maltreated children, the risk of neglectful supervision was similar (Down syndrome) or significantly lower in children with birth defects (CL ± P and spina bifida). In contrast, the risk of medical neglect was 3.6 to 6.2 times higher in the 3 birth defects groups compared with the unaffected group. The risk of multiple types of maltreatment was not significantly different in any of the 3 birth defects groups compared with their unaffected counterparts.

Parents were the most frequent perpetrators of substantiated maltreatment in each group (93%–100%). No significant differences in perpetrator type were found between the birth defects groups and the unaffected group (data not shown).

Predictors of Maltreatment

Analyses of covariates to identify predictors of maltreatment were initially conducted separately by

using data from unaffected children and children with a specific birth defect (eg, CL ± P). The covariate indicating whether the child had an isolated birth defect or multiple major birth defects was included in group-specific regression models. This covariate was not significant in crude or adjusted models for any birth defect group (data not presented). A comparison of the fully adjusted models revealed that the predictors of maltreatment (ie, the association between maltreatment and each covariate) were similar across models, and interaction terms were not statistically significant. The adjusted model for the entire population (all groups combined) is presented in Table 5 and is described in the following sections.

Child-level Predictors

After adjusting for all other factors, children with a substantiated report of maltreatment were more likely than children without a substantiated report to have been premature (aRR: 1.18 [95% CI: 1.15–1.21]) or very premature (aRR: 1.28 [95% CI: 1.21–1.35]); have a low birth weight (aRR: 1.39 [95% CI: 1.34–1.43]); and be male (aRR: 1.05 [95% CI: 1.04–1.07]). Twins and other multiples were less likely to have a substantiated maltreatment case than were singletons (aRR: 0.55 [95% CI: 0.52–0.58]).

Family-level Predictors

All of the family characteristics that were examined varied significantly

TABLE 2 Demographic Characteristics According to Study Group in Children Aged 4 Days to 2 Years, Texas, 2002 to 2011

Characteristic	Unaffected (N = 2 970 101)		Down Syndrome (N = 3743)			CL ± P (N = 2943)			Spina Bifida (N = 971)		
	N	%	N	%	χ ² P	N	%	χ ² P	N	%	χ ² P
Child characteristics											
Gestational age, wk											
≤32 (very premature)	51 315	1.7	163	4.4	<.001	119	4.0	<.001	42	4.3	<.001
33–36 (premature)	248 956	8.4	854	22.8		383	13.0		175	18.0	
≥37 (term)	2 669 830	89.9	2726	72.8		2441	82.9		754	77.7	
Birth weight, g											
≤2499 (low birth weight)	218 598	7.4	855	22.8	<.001	485	16.5	<.001	158	16.3	<.001
>2499 (normal)	2 750 888	92.6	2887	77.1		2457	83.5		811	83.5	
Gender											
Male	1 507 179	50.7	2002	53.5	.001	1820	61.8	<.001	485	49.9	.62
Female	1 462 922	49.3	1741	46.5		1123	38.2		486	50.1	
Plurality											
Single	2 885 014	97.1	3617	96.6	.07	2850	96.8	.34	948	97.6	.35
Multiple	85 087	2.9	126	3.4		93	3.2		23	2.4	
No. of birth defects											
Isolated defect	NA		750	20.0	NA	2124	72.2	NA	212	21.8	NA
Multiple major defects	NA		2993	80.0		819	27.8		759	78.2	
Family characteristics											
Maternal race/ethnicity											
White non-Hispanic	1 042 069	35.1	1223	32.7	<.001	1085	36.9	<.001	307	31.6	<.001
Black non-Hispanic	328 552	11.1	297	7.9		201	6.8		67	6.9	
Hispanic	1 474 612	49.6	2091	55.9		1528	51.9		582	59.9	
Other non-Hispanic	121 575	4.1	126	3.4		125	4.2		14	1.4	
Parity											
No prior births	1 131 316	38.1	999	26.7	<.001	1082	36.8	.07	328	33.8	.005
1 prior birth	917 666	30.9	1051	28.1		883	30.0		296	30.5	
2 prior births	533 502	18.0	824	22.0		574	19.5		189	19.5	
≥3 prior births	347 354	11.7	809	21.6		364	12.4		141	14.5	
Maternal age at birth, y											
20 (teenager)	406 291	13.7	301	8.0	<.001	440	15.0	.08	125	12.9	.58
20–34	2 232 512	75.2	1843	49.2		2162	73.5		744	76.6	
≥35	331 073	11.1	1599	42.7		341	11.6		102	10.5	
Marital status											
Married	1 840 478	62.0	2619	70.0	<.001	1836	62.4	.64	608	62.6	0.68
Not married	1 128 931	38.0	1124	30.0		1106	37.6		363	37.4	
Maternal education											
Less than high school	891 364	30.0	1190	31.8	<.001	960	32.6	<.001	355	36.6	<.001
High school	843 232	28.4	921	24.6		886	30.1		277	28.5	
Greater than high school	1 218 237	41.0	1601	42.8		1074	36.5		326	33.6	
Type of payment at birth											
Other (not Medicaid)	1 802 701	60.7	2504	66.9	<.001	1696	57.6	<.001	632	65.1	.005
Medicaid	1 167 400	39.3	1239	33.1		1247	42.4		339	34.9	
Paternal information missing from birth record											
Information present	2 546 341	85.7	3296	88.1	<.001	2509	85.3	.46	832	85.7	.97
Information missing	423 760	14.3	447	11.9		434	14.7		139	14.3	
Neighborhood characteristics											
Neighborhood economic impoverishment											
Low	2 572 870	86.6	3280	87.6	.07	2506	85.2	.16	836	86.1	.27
High	179 214	6.0	200	5.3		194	6.6		67	6.9	

NA, not applicable.

between children with and without a substantiated maltreatment report. Compared with mothers of children without a substantiated maltreatment report, mothers of maltreated children were more likely to have had previous live

births (aRRs ranging from 1.6–3.2 comparing mothers with 1 to ≥3 previous births vs primiparous mothers), a high school education or less (aRR_{<HS vs >HS}: 2.43 [95% CI: 2.36–2.49]; aRR_{HS vs >HS}: 1.79 [95% CI: 1.75–1.84]), and had the delivery

costs covered by Medicaid (aRR_{Medicaid vs other}: 2.71 [95% CI: 2.66–2.76]). The risk of maltreatment was also elevated for children whose mothers were young, unmarried, and who did not include paternity information on the

TABLE 3 Overall Prevalence (per 1000 Children) and Risk of Maltreatment According to Study Group in Children Aged 4 Days to 2 Years, Texas, 2002 to 2011

Study Group	N	Substantiated Maltreatment, n (%)	Prevalence per 1000 Children	Crude RR	95% CI	aRR ^a	95% CI
Unaffected	2 970 101	67 049 (2.3)	22.57	Ref	—	Ref.	—
Down syndrome	3743	74 (2.0)	19.77	0.88	0.70–1.10	1.08	0.85–1.37
CL ± P	2943	107 (3.6)	36.36	1.61	1.33–1.95	1.40	1.14–1.71
Spina bifida	971	37 (3.8)	38.11	1.69	1.22–2.33	1.58	1.12–2.24

RR, relative risk.

^a Adjusted for gestational age, birth weight, gender, plurality, maternal race/ethnicity, parity, maternal age at birth, maternal marital status, maternal education, type of payment at birth, paternal information missing from birth certificate, and neighborhood economic impoverishment.

birth certificate compared with children whose mothers were older, married, and who did include paternity information on the birth certificate (aRR: 1.5–1.8). Children of white non-Hispanic mothers were at significantly greater risk of maltreatment compared with children with mothers in all other race/ethnic groups (aRR: 1.6–2.4).

Neighborhood-level Predictors

Neighborhood-level economic impoverishment was also associated with an increased risk of maltreatment. Children living in a neighborhood with a high degree of economic impoverishment were 1.12 times (95% CI: 1.09–1.15) more likely to have a substantiated maltreatment report than those in less impoverished neighborhoods.

DISCUSSION

The risk of overall maltreatment before 2 years of age was significantly higher for children with CL ± P and spina bifida compared with unaffected children, even after adjusting for child-, family-, and neighborhood-level factors. In contrast, children with Down syndrome were not at increased risk of maltreatment before 2 years of age compared with unaffected children. These findings suggest that, in addition to the presence of a birth defect, the specific condition (ie, CL ± P and spina bifida) may be an important predictor of the risk of maltreatment before age 2 years.

The results of these analyses also indicate that children with birth defects are at risk for different types

of maltreatment compared with their unaffected contemporaries. Among children with substantiated maltreatment, the risk of medical neglect was significantly higher among all 3 birth defect groups than in the unaffected group. Their medical complexity may account for the increased risk for medical neglect in these groups versus other forms of neglect. In addition, children with birth defects were significantly more likely than unaffected children to be maltreated during the first month of life, although this association was statistically significant for the CL ± P and spina bifida groups only. For both CL ± P and spina bifida, the medical care typically required during the first few months of life is complex, and it is recommended that these conditions be treated by specialized teams of providers.^{23–25}

All of the family-level risk factors exhibited were associated with substantiated maltreatment (relative risk ≥1.5). Poverty-related factors, such as low maternal education, Medicaid use, and multiple previous births, were associated with 2- to 3-fold increases in risk for maltreatment in this study and have been consistently associated with

TABLE 4 Characteristics of Maltreatment: Crude RR According to Age and Specific Maltreatment Type in Children Aged 4 Days to 2 Years, Texas, 2002 to 2011

Characteristic	Unaffected (N = 67 049)		Down Syndrome (N = 74)				CL ± P (N = 107)				Spina Bifida (N = 37)			
	Freq.	%	Freq.	%	RR	95% CI	Freq.	%	RR	95% CI	Freq.	%	RR	95% CI
Child age at report, mo														
<1	3878	5.8	8	10.8	1.87	0.97–3.59	13	12.1	2.10	1.26–3.50	6	16.2	2.80	1.35–5.84
1–6	18 987	28.3	19	25.7	0.91	0.62–1.34	30	28.0	0.99	0.73–1.34	10	27.0	0.95	0.56–1.62
7–12	16 512	24.6	17	23.0	0.93	0.61–1.42	25	23.4	0.95	0.67–1.34	10	27.0	1.10	0.65–1.86
13–18	15 433	23.0	17	23.0	1.00	0.66–1.52	24	22.4	0.97	0.68–1.39	2	5.4	0.23	0.06–0.90
19–23	12 239	18.3	13	17.6	0.96	0.59–1.58	15	14.0	0.77	0.48–1.23	9	24.3	1.33	0.75–2.35
Type of maltreatment substantiated														
Neglectful supervision	53 920	80.4	57	77.0	0.96	0.85–1.08	74	69.2	0.86	0.76–0.98	19	51.4	0.64	0.47–0.87
Physical abuse	13 422	20.0	9	12.2	0.61	0.33–1.12	19	17.8	0.89	0.59–1.33	4	10.8	0.54	0.21–1.36
Physical neglect	9250	13.8	9	12.2	0.88	0.48–1.63	17	15.9	1.15	0.74–1.78	6	16.2	1.18	0.56–2.45
Medical neglect	3531	5.3	14	18.9	3.59	2.24–5.76	27	25.2	4.79	3.45–6.65	12	32.4	6.16	3.86–9.82
Sexual abuse	293	0.4	1	1.4	3.09	0.43–21.74	0	0	—	—	0	0	—	—
Abandonment	253	0.4	0	0	—	—	0	0	—	—	2	5.4	14.33	3.70–55.45
Emotional abuse	94	0.1	0	0	—	—	0	0	—	—	0	0	—	—
Refusal to assume parental responsibility	166	0.2	0	0	—	—	0	0	—	—	0	0	—	—
Multiple types of maltreatment														
Multiple types substantiated	12 463	18.6	15	20.3	1.09	0.69–1.71	24	22.4	1.21	0.85–1.72	5	13.5	0.73	0.32–1.64

RR, relative risk.

TABLE 5 aRRs for Maltreatment in Children Aged 4 Days to 2 Years

Characteristic	All Groups	
	aRR ^a	95% CI
Child characteristics		
Birth defect group		
Unaffected (no birth defect)	Ref.	—
Down syndrome	1.08	0.85–1.37
CL ± P	1.40	1.14–1.71
Spina bifida	1.58	1.12–2.24
Gestational age		
≥37 wk (term)	Ref.	—
33–36 wk (premature)	1.18	1.15–1.21
≤32 wk (very premature)	1.28	1.21–1.35
Birth weight, g		
>2499 (normal)	Ref.	—
≤2499 g (low birth weight)	1.39	1.34–1.43
Gender		
Female	Ref.	—
Male	1.05	1.04–1.07
Plurality		
Single	Ref.	—
Multiple	0.55	0.52–0.58
Family characteristics		
Maternal race/ethnicity		
White Non-Hispanic	Ref.	—
Black Non-Hispanic	0.62	0.61–0.64
Hispanic	0.43	0.42–0.43
Other Non-Hispanic	0.42	0.39–0.46
Parity		
No prior births	Ref.	—
1 prior birth	1.55	1.52–1.59
2 prior births	2.11	2.06–2.16
≥3 prior births	3.17	3.09–3.25
Maternal age at birth, y		
20–34	Ref.	—
<20 (teenager)	1.64	1.61–1.68
≥35	0.54	0.52–0.56
Maternal marital status		
Married	Ref.	—
Not married	1.83	1.79–1.87
Maternal education		
Greater than high school	Ref.	—
High school	1.79	1.75–1.84
Less than high school	2.43	(2.36–2.49)
Type of payment at birth		
Not Medicaid	Ref.	—
Medicaid	2.71	2.66–2.76
Paternal information		
missing	Ref.	—
Information present	Ref.	—
Information missing	1.52	1.49–1.55
Neighborhood characteristics		
Low NEI	Ref.	—
High NEI	1.12	1.09–1.15

NEI, neighborhood economic impoverishment.

^a Adjusted for gestational age, birth weight, gender, plurality, maternal race/ethnicity, parity, maternal age at birth, maternal marital status, maternal education, type of payment at birth, paternal information missing from birth certificate, and neighborhood economic impoverishment.

maltreatment in earlier studies.^{15,26–28} In contrast, our finding that children whose mothers were white non-Hispanic were nearly twice as likely to be maltreated as any other race ethnic group, after adjusting for all factors, has not been consistently found by other investigators. However, similar trends were reported in a large linkage study from California, a state demographically comparable to Texas.¹⁵

It is possible that some substantiated cases of maltreatment included in these analyses were based on a family's previous involvement with TDFPS and not maltreatment of the study child. To decrease this possibility, we excluded substantiated cases reported before day 4 of life. In addition, because children with birth defects are likely to interact with mandatory reporters more often than unaffected children, surveillance bias is a concern.

Family mobility (out of Texas) was not taken into account. Consequently, children with substantiated maltreatment reports in other states were not classified as maltreated in these analyses. Therefore, the prevalence of maltreatment in all groups is likely an underestimate.

CONCLUSIONS

Findings from this study suggest that the specific type of birth defect may be an important factor to consider when identifying children aged <2 years who are at increased risk for maltreatment. Further analysis should be conducted to determine whether the increased risk of maltreatment in children with specific birth defects persists throughout childhood. In addition, children with other birth defects should be examined to determine whether they are also at increased risk of maltreatment compared with unaffected children.

The results of this study, in combination with findings from other population-based studies of maltreatment in children with

disabilities,^{6,7,15,28} may inform policies and services aimed at improving the well-being of families. For example, the Maternal, Infant, and Early Childhood Home Visiting Program of the Patient Protection and Affordable Care Act has provided all states with funding to support home visitation programs aimed at improving the outcomes of at-risk families with young children. Our findings could be used to enhance the targeting of populations with the highest risk for maltreatment. In addition, young children with developmental delays, including children with the birth defects examined in the present study, qualify for early childhood intervention services (Part C) provided by the Individuals with Disabilities Education Improvement Act. These services are provided in the home and are intended to support both the family and the child. Despite these services being free or low-cost, many qualifying children do not receive them.²⁹ Increasing enrollment in existing services, as well as enhancing these services to include child maltreatment prevention strategies,^{30–34} may prove to be an efficient and cost-effective way of preventing maltreatment in children with birth defects.

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ABBREVIATIONS

aRR: adjusted rate ratio
 BPA: British Pediatric Association
 CI: confidence interval
 CL ± P: cleft lip with or without cleft palate
 TBDR: Texas Birth Defects Registry
 TDFPS: Texas Department of Family and Protective Services

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