

# Preventable Injury Deaths: A Population-Based Proxy of Child Maltreatment Risk in California

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## ABSTRACT

**Objective.** This study used group variations in child injury fatality rates to assess racial bias in the population of children identified as victims of maltreatment.

**Methods.** Injury fatality and maltreatment data from California were compiled for the years 1998–2007. Death and maltreatment risk ratios (RRs) and 95% confidence intervals (CIs) were computed by race and age. Rates of excess child injury mortality by race were derived from three different baseline rates of death. Substantiations per excess injury death were calculated.

**Results.** Compared with white children, black children faced a risk of substantiated maltreatment that was more than twice as great (black RR: 2.39, 95% CI 2.37, 2.42) and were fatally injured at nearly twice the rate (black RR: 1.89, 95% CI 1.68, 2.12). Per excess death, however, black children had rates of substantiated maltreatment allegations that were equivalent to or lower than the rates for white children.

**Conclusions.** These data support claims that, at least in California, black-white racial disparities observed in maltreatment rates reflect real group differences in risk. These data provide no evidence of systematic racial bias in the child protective services' substantiation process.

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In the United States, data collected by child protective services (CPS) consistently indicate that black children are abused and neglected at roughly twice the rate of white children.<sup>1-3</sup> Yet, these data reflect only maltreatment victims known to CPS, with other sources suggesting the count of abused and neglected children may be far higher.<sup>4,5</sup> Unknown is whether the group of maltreated children identified by CPS is racially representative of the broader population of maltreated children.

In an effort to overcome the limitations of CPS data, the National Incidence Study of Child Abuse and Neglect (NIS) has been conducted on four separate occasions between 1980 and 2006.<sup>4,6-8</sup> The NIS attempts to estimate the actual number and characteristics of maltreated children based on cases reported to CPS, as well as knowledge of abused and neglected children ascertained from other professionals. Despite large black-white disparities observed in CPS-reported rates of maltreatment, the first three waves of the NIS failed to identify any statistically significant racial differences in the community incidence of abuse and neglect.<sup>6-8</sup> As such, it was widely concluded that there must be a racially biased identification of black children by CPS.<sup>9-11</sup> For the first time, however, the most recent wave of the NIS found that black children were maltreated at significantly higher rates than white children, reporting “strong and pervasive race differences in the incidence of maltreatment.”<sup>14</sup>

The purpose of this study was to examine racial disparities in child maltreatment using a new, population-based and public health-oriented approach. Given the incomplete nature of CPS data,<sup>5,12,13</sup> the contradictory claims and sampling controversies that surround the NIS,<sup>14-16</sup> and research arising from other sources suggesting possible reporting and CPS substantiation bias of black children,<sup>17-19</sup> it seemed an opportune time to consider other data that might inform an understanding of racial disparities. In this ecological study, data from two public surveillance systems were used to assess possible bias in one source (data collected by CPS) by using the more complete and objective information available in the other (vital statistics death data). Rates of excess injury mortality were based on different assumptions as to the fraction of injury deaths that were preventable. The ratios of substantiations per excess death were compared across races. It was hypothesized that racial variability in rates of excess injury death would be observed—arising from disproportionate burdens of poverty, substance use, and other risk factors—but that absent widespread bias on the part of CPS, there would be a fairly consistent count of substantiations for each excess death.

## METHODS

### Overview

This study used racial variations in the injury fatality rates of infants and young children as a proxy of population-level differences in maltreatment risk. Excess injury deaths were treated as a measure of child risk uncontaminated by the bias that may impact CPS-reported rates of maltreatment. The objective was to determine whether, per excess death, the corresponding number of children identified as maltreated was consistent across racial groups.

### Data sources

Injury mortality data from California’s Death Statistical Master Files were extracted and stratified by injury mechanism and manner, age, year of death, and race/ethnicity. Child maltreatment data were obtained from California’s Child Welfare Services/Case Management System (CWS/CMS) database. Annual counts of unique children with a substantiated allegation of maltreatment were compiled by age, year of maltreatment, and race/ethnicity. Statewide population estimates published by the National Center for Health Statistics were used to compute rates and associated 95% confidence intervals (CIs).<sup>20-22</sup>

### Study variables

**Age.** This study was limited to children younger than 5 years of age based on literature indicating that (1) many injury deaths suffered by infants and young children are preventable,<sup>23</sup> (2) these injuries tend to occur in the home environment,<sup>24</sup> and (3) a substantial proportion of these injury fatalities result from inadequate caregiving or supervision.<sup>25-27</sup> Restricting the study population to this youngest age group helped reduce environmental confounds present as children age and spend increasing amounts of time outside of the home and under the supervision of nonparental caregivers.

**Race/ethnicity.** Injury deaths, substantiated allegations of maltreatment, and corresponding population counts were classified into five mutually exclusive racial/ethnic categories using primary race and a Hispanic identifier: (1) non-Hispanic black, (2) non-Hispanic white, (3) non-Hispanic Native American, (4) non-Hispanic Asian/Pacific Islander (A/PI), and (5) Hispanic (all races).

**Mechanism and intent of injury death.** Injury deaths occurring in 1998 were classified using International Classification of Diseases, Ninth Revision (ICD-9) E-codes, as well as 995 codes identifying child abuse fatalities. ICD 10th Revision (ICD-10) E-codes (i.e., VXWY) were used

to identify all injury deaths occurring between 1999 and 2007.<sup>28,29</sup> California law requires that all suspicious or violent deaths and those deaths in which a physician did not see the decedent in the 20 days prior to the death be reported to the Department of the Coroner. The Coroner is then responsible for determining the manner and mechanism of these deaths.<sup>30</sup>

**Maltreatment.** Administrative child maltreatment data were extracted from the state's CWS/CMS system.<sup>31</sup> Maltreatment was defined as any substantiated allegation of abuse or neglect for a child younger than 5 years of age during the study period. The decision was made to focus on this particular decision point because it serves as the main gateway for child welfare interventions and because the racial disparities observed in substantiated allegations are consistent with those observed in the total pool of allegations.<sup>2,32</sup> Because a child may have had more than one substantiated allegation in a given year, substantiations were unduplicated. Children abused or neglected during more than one year were counted for each year in which they were maltreated.

**Years.** Data were compiled and collapsed across the years 1998–2007 for all data sources. Due to ICD coding changes in 1999, and California's implementation of a new system to collect child maltreatment data in 1998, analyses with the period restricted to 2000–2007 were also run. However, excluding the earlier years did not change the results.

### Analyses

**Rates and risk ratios.** Race- and age-stratified injury death rates (per 100,000 child-years) and maltreatment rates (per 1,000 child-years) were computed using death and maltreatment counts collapsed across the study window and annual population counts of age-eligible children summed across this same period. Relative risk ratios (RRs) and 95% CIs were used to compare age-specific rates of injury death and maltreatment for each racial/ethnic group with those of white children. Stata<sup>®</sup> version 11.1 was used for all analyses.<sup>33</sup>

**Excess mortality.** Rates of excess or preventable injury mortality were derived based on the difference between each racial group's rate of injury death and that of an achievable baseline (i.e., the lowest injury death rate observed for a group in the study). Because the achievable death rate likely included deaths that could have been prevented, it was treated as an upper-bound estimate of the true baseline above which deaths might be considered preventable. Therefore, two alternative baselines corresponding to roughly 50% and 75%

of this achievable rate were also specified to test the robustness of findings to different assumptions.

**Substantiations per excess death.** Using each of the three mortality baselines to estimate the number of excess injury deaths for each racial group, substantiated cases of maltreatment per excess death [(substantiation rate / (injury death rate – baseline death rate) × 100)] were computed. While there is no way of knowing how many substantiated allegations should be associated with each excess death in a community, it was posited that in the absence of widespread racial bias on the part of CPS, consistent numbers of substantiated cases for each excess death would be observed across racial groups. In contrast, differences in the number of substantiations per excess death would indicate that CPS had identified a racially biased sample of the full population of children at risk of maltreatment. Substantiations per excess death are not presented by age, as these stratifications did not vary from the broader pattern observed for all children in the study.

## RESULTS

### Study population

This study reflects California's population of children younger than 5 years of age during each year from 1998 to 2007. In total, 25,561,014 child-years were captured, during which 365,313 allegations of maltreatment were substantiated by CPS and 3,228 injury deaths occurred.

### Rates of substantiated maltreatment and injury death

The Table shows the rates of both maltreatment substantiations (per 1,000 child-years) and injury fatalities (per 100,000 child-years) by race/ethnicity and age. Figure 1 plots these rates. Although scaled differently, each racial group's rate of injury death closely tracks its rate of maltreatment. Rates of injury death and maltreatment were very similar for white and Hispanic children, while black children had notably higher rates and A/PI children had lower rates.

**Substantiated maltreatment.** During the study period, the substantiated rate of maltreatment was 14.8 per 1,000 child-years. For all racial/ethnic groups, the rate of substantiation was highest during the first year of life and declined with age. Black children were identified as substantiated victims of maltreatment at significantly higher rates than white children for each age group (RR for infants <1 year of age: 2.91, 95% CI 2.86, 2.96; RR for children aged 1–2 years: 2.24, 95% CI 2.20, 2.28; RR for children aged 3–4 years: 2.09, 95% CI 2.05, 2.13). The same heightened risk patterns were

**Table. Rates of substantiated child maltreatment and child injury death, by age group and race/ethnicity: California, 1998–2007**

Race/ethnicity	Substantiation rates per 1,000 child-years											
	Infants <1 year of age			Children 1–2 years of age			Children 3–4 years of age			All children 0–4 years of age		
	Rate	RR (95% CI)		Rate	RR (95% CI)		Rate	RR (95% CI)		Rate	RR (95% CI)	
White	21.6	Ref.		11.8	Ref.		11.4	Ref.		13.6	Ref.	
Black	62.8	2.91 (2.86, 2.96)		26.3	2.24 (2.20, 2.28)		23.9	2.09 (2.05, 2.13)		32.5	2.39 (2.37, 2.42)	
Hispanic	20.7	0.96 (0.94, 1.00)		12.3	1.04 (1.00, 1.06)		12.1	1.06 (1.05, 1.07)		14.0	1.03 (1.02, 1.04)	
Native American	63.3	2.93 (2.79, 3.08)		29.7	2.52 (2.39, 2.65)		24.8	2.17 (2.06, 2.29)		33.9	2.50 (2.43, 2.57)	
Asian/Pacific Islander	7.0	0.32 (0.31, 0.33)		4.2	0.36 (0.35, 0.37)		4.3	0.38 (0.37, 0.39)		4.8	0.35 (0.35, 0.36)	
Total <sup>a</sup>	23.4			12.8			12.5			14.8		

Race/ethnicity	Injury death rates per 100,000 child-years											
	Infants <1 year of age			Children 1–2 years of age			Children 3–4 years of age			All children 0–4 years of age		
	Rate	RR (95% CI)		Rate	RR (95% CI)		Rate	RR (95% CI)		Rate	RR (95% CI)	
White	18.8	Ref.		14.5	Ref.		6.7	Ref.		12.2	Ref.	
Black	45.5	2.43 (2.00, 2.94)		22.1	1.52 (1.26, 1.83)		13.2	1.96 (1.53, 2.50)		23.1	1.89 (1.68, 2.12)	
Hispanic	16.9	0.90 (0.77, 1.04)		13.7	0.95 (0.84, 1.06)		8.1	1.20 (1.00, 1.42)		12.2	1.00 (0.92, 1.08)	
Native American	NC <sup>b</sup>			NC <sup>b</sup>			NC <sup>b</sup>			26.6	2.18 (1.52, 3.04)	
Asian/Pacific Islander	12.3	0.65 (0.49, 0.85)		9.0	0.62 (0.49, 0.78)		5.2	0.77 (0.56, 1.03)		8.2	0.67 (0.58, 0.78)	
Total <sup>c</sup>	19.2			14.1			7.8			12.6		

<sup>a</sup>Includes 14,149 children with missing race/ethnicity

<sup>b</sup>Small cell sizes (<20) prevented a stable rate of injury death from being calculated.

<sup>c</sup>Includes six children with missing race/ethnicity

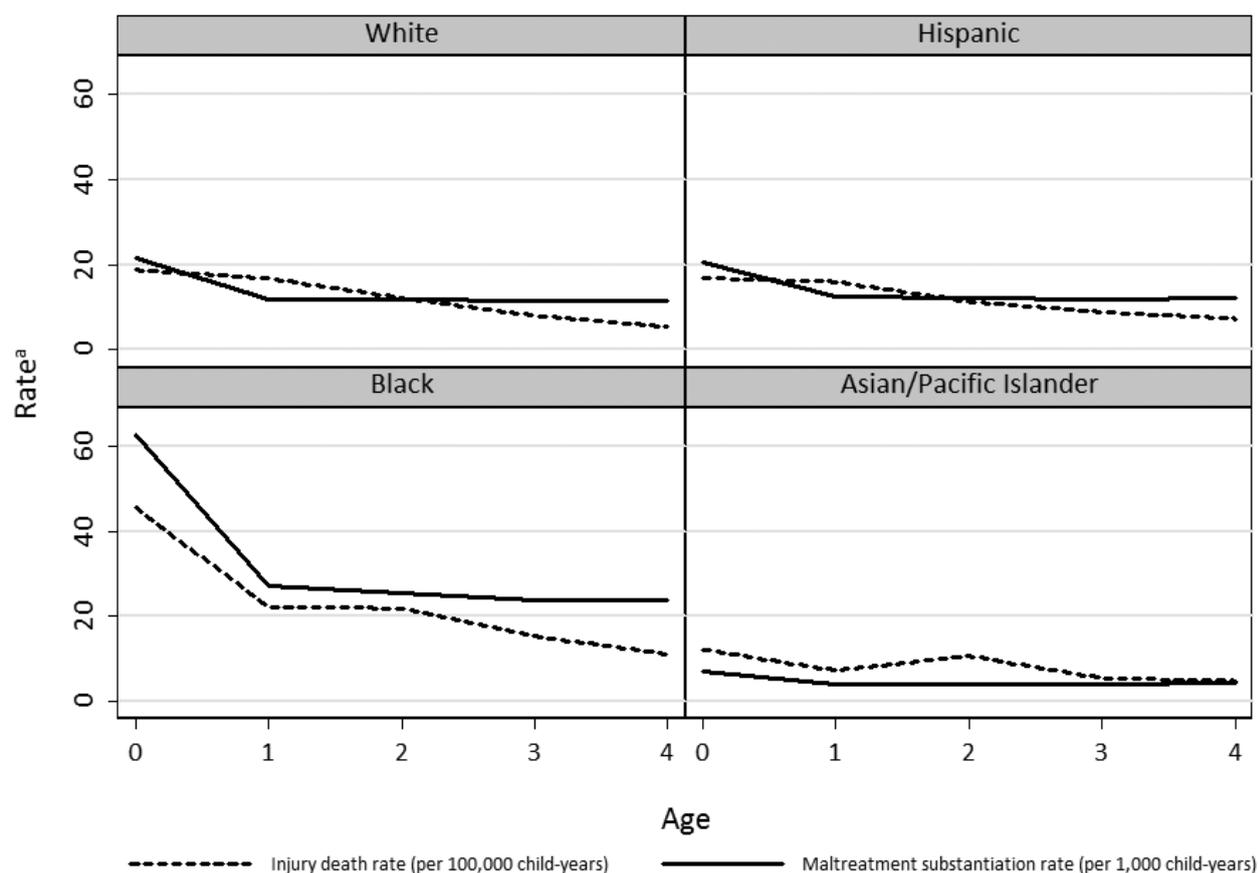
RR = risk ratio

CI = confidence interval

Ref. = reference group

NC = not calculated

**Figure 1. Rates<sup>a</sup> of substantiated child maltreatment and child injury death in California, by age and race/ethnicity: 1998–2007**



<sup>a</sup>Rates computed based on child-year denominators: white = 8,305,252; Hispanic = 12,642,086; black = 1,807,375; and Asian/Pacific Islander = 2,671,185. Rates for Native American children were excluded due to small cell sizes.

observed for Native American compared with white children across all age groups. Rates of substantiated maltreatment among Hispanic children were statistically equivalent to those of white children, except for children aged 3–4 years, who had a slightly higher substantiation risk (RR=1.06, 95% CI 1.05, 1.07). Among A/PI children, the rate of substantiation was consistently 60% to 70% lower than the rate for white children.

**Injury death.** The injury death rate for children younger than 5 years of age was 12.6 per 100,000 child-years. Consistent with substantiation data, the greatest vulnerability to an injury fatality occurred within the first year of life and varied significantly by race. Black infants died of injuries at 2.4 times the rate of their white counterparts (RR=2.43, 95% CI 2.00, 2.94), black children aged 1–2 years died of injuries at 1.5 times the rate of their white counterparts (RR=1.52, 95% CI 1.26, 1.83), and black children aged 3–4 years died of injuries at twice the rate of their white counterparts

(RR=1.96, 95% CI 1.53, 2.50). Although small cell sizes prevented age stratifications, Native American children aged 0–4 years had a risk of injury fatality that was 2.2 times that of white children (RR=2.18, 95% CI 1.52, 3.04). There were no significant differences in the rates of injury deaths between Hispanic and white children at any age. A/PI children had lower rates of injury deaths than white children for each age category, although this difference was not significant for children aged 3–4 years.

#### Excess injury mortality

Figure 2 presents the lowest rate of injury death achieved by one group in this study (8.2 per 100,000 child-years) and rates of excess injury mortality above this achievable baseline for each race. Using this 8.2 baseline specification, rates of excess deaths for white and Hispanic children were equivalent (4.0 per 100,000 child-years), while black and Native American children had much higher rates of excess deaths (14.9 and 18.5

per 100,000 child-years, respectively). Because A/PI children achieved the lowest rate of injury death in this study, they had no excess deaths using this baseline specification.

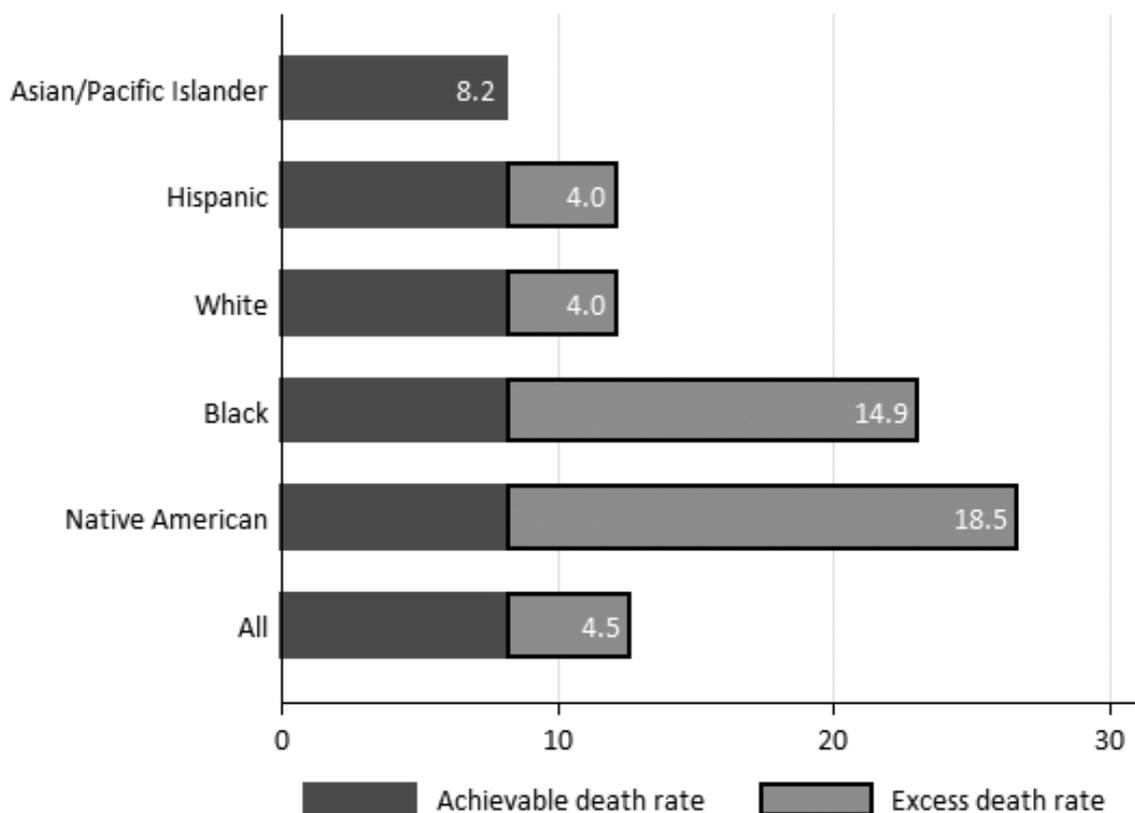
#### Substantiated allegations of maltreatment per excess death

Figure 3 plots the ratios of substantiated allegations per death in excess of the achievable rate of injury death (8.2 per 100,000 child-years). Also plotted are substantiated allegations per death in excess of baseline rates of four and six deaths per 100,000 child-years, or roughly 50% and 75% of the achievable baseline. When excess deaths were defined as anything above a rate of four injury deaths per 100,000 child-years, every excess injury death corresponded to 166 substantiated allegations of maltreatment for white children, 170 substantiations for black children, 171 substantiations for Hispanic children, 150 substantiations for Native American children, and 116 substantiations for A/PI children. The comparability in the number of substantiated allegations per excess death for black and white children was consistent with an unbiased substantiation process. Because a lower ratio of substantiations per excess death was observed for Native American chil-

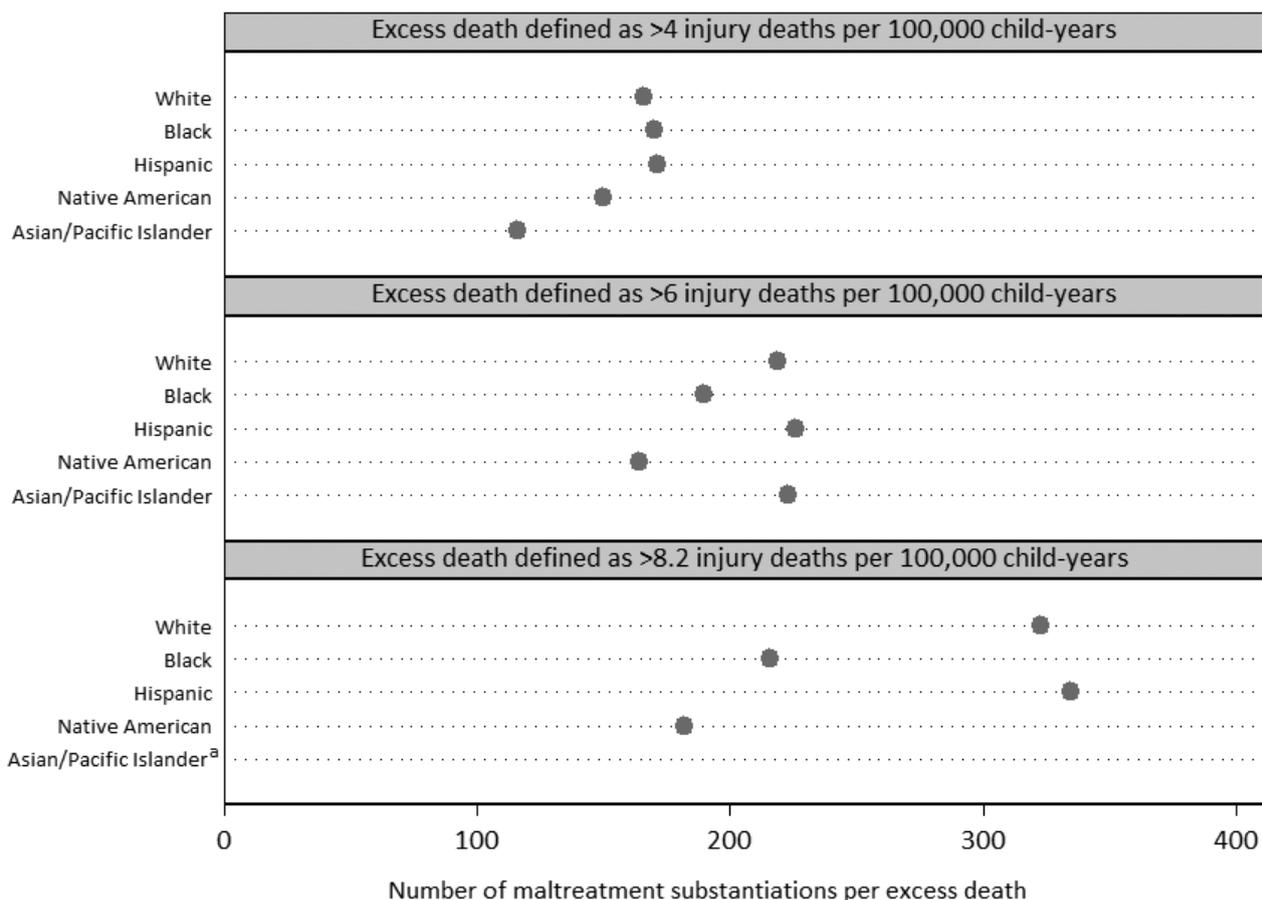
dren when compared with white children, these data do not support claims that Native American children were over-identified as maltreatment victims.

When excess injury deaths were defined as anything above a rate of six per 100,000 child-years, a slightly different picture emerged. Similar rates of substantiations per excess death were observed for white (219), Hispanic (226), and A/PI (223) children. Comparatively lower rates of substantiations per excess death emerged for black (190) and Native American (164) children. Lower ratios of substantiations per excess death observed for both black and Native American children can be interpreted as either arising from (1) an over-substantiation of white, Hispanic, and A/PI children; or (2) an under-substantiation of black and Native American children. Neither interpretation, however, suggests that the rates at which black or Native American children were substantiated arose from bias rather than real differences in risk. An assumption that the achievable injury death rate of 8.2 per 100,000 child-years represents the true rate of unpreventable injury mortality provides a more extreme version of this same pattern and lends itself to the same interpretation. For each white or Hispanic death in excess of the 8.2 baseline, there were 340 and 352 substantiated

**Figure 2. Rates of excess injury deaths for children aged 0–4 years in California, by race/ethnicity: 1998–2007**



**Figure 3. Substantiated allegations of maltreatment per excess injury death for children in California, by race/ethnicity: 1998–2007**



<sup>a</sup>Excess death rate is equal to 0.

cases of maltreatment in the broader community of white and Hispanic people, respectively. Meanwhile, every excess death of a black child corresponded to only 218 substantiations, while each excess death of a Native American child was associated with only 184 substantiations.

## DISCUSSION

This research used a novel approach to examine racial disparities, employing excess injury deaths as a population-based proxy of group differences in child maltreatment risk. This method of analysis provided no evidence that a systematically biased CPS identification and substantiation process led to falsely elevated rates of maltreatment for black and Native American children. Rather, findings suggest that racial disparities in rates of substantiated maltreatment arose from real group-level differences in risk.

Although there is no perfect method for determin-

ing how many injury deaths were preventable, the analysis relied upon prior research in which an achievable baseline fatality rate was established from the lowest rate of injury death observed for a group in the study, with all deaths above this rate deemed preventable and, therefore, considered excessive.<sup>34,35</sup> Using this method, an achievable baseline rate of injury death for children younger than 5 years of age in California was set at 8.2 per 100,000 child-years. This death rate was treated as an upper-bound estimate of all deaths that could not have been prevented, and alternative baselines were also set at 50% (4.0 per 100,000 child-years) and 75% (6.0 per 100,000 child-years) of this rate. The corresponding numbers of substantiated allegations of maltreatment associated with each excess death above these three baseline specifications were then examined across races.

A higher number of substantiations per excess death for black or Native American children compared with white children would have indicated possible racial bias

in the substantiation process, providing evidence that these two groups were substantiated at higher rates than white children, given similar levels of risk. Across all three baseline injury death rate specifications, however, equivalent or lower numbers of substantiated allegations were observed for black and Native American children compared with white children. These findings provide no evidence that a biased substantiation process explains higher rates of maltreatment victimization for black and Native American children. Rather, the conclusion drawn from this analysis is that black and Native American children are overrepresented among maltreated children identified by CPS because they are also overrepresented among maltreated children in the population.

#### Consistency with prior research

The most recent wave of the National Incidence Study of Child Abuse and Neglect (NIS-4) found that the racial composition of maltreated children known to CPS was generally consistent with the racial distribution of maltreated children in the population.<sup>3,4,16</sup> Using a very different methodology, the general conclusions that can be drawn from the present study align with these recent NIS findings. Both this analysis and the most recent NIS support claims that the higher rates at which black children are reported to and substantiated by CPS arise from real group differences in risk. The ecological nature of this study, however, means that the findings reported in this article cannot be used to refute claims that racial bias factors into decisions made at the individual case level; these aggregate data may mask subgroup variations in reporting and substantiation by race.

Prior research examining health-care providers' evaluation of child injuries has suggested that black children may be screened for physical injuries and subsequently reported to CPS at higher rates than white children.<sup>17,19</sup> At least one study indicated a biased assessment of black children,<sup>19</sup> while other studies have suggested a systematic under-ascertainment of maltreatment among injured white children.<sup>17,36</sup> Yet, young children reported for physical abuse by health-care providers comprised only a small fraction of the allegations concerning maltreatment received by CPS (approximately 12%) and an even smaller proportion of all substantiations (5%). The present analysis suggests that as much as bias may play a role in which children are reported to CPS and subsequently substantiated for maltreatment—by medical providers or other reporters—it is unlikely to operate on such a large scale as to account for the racial disparities observed in rates of maltreatment.

#### Strengths and limitations

This study provides a new approach to studying racial disparities in an effort to overcome the limitations of existing data sources. Employing injury death as a proxy of maltreatment risk is consistent with the view that “a mortality-based standard for evaluating parental behavior may be the closest we can get to ‘culture-free’ definitions of neglect and abuse.”<sup>37</sup> Although there exists a strong conceptual and empirical basis for the consideration of injury fatalities as a relevant population-based indicator of the risk of child maltreatment,<sup>23,27,35,38–40</sup> this research relied on three critical assumptions that must be considered.

First, this analysis was based on an assumption that rates of excess injury death can be quantified based on group differences in fatality rates. While the true rate of unpreventable injury death remains uncertain, this study did not rely on an arbitrary baseline to compute rates of excess deaths. Instead, it relied on a baseline rate of injury death that was actually achieved by one group in the study (i.e., 8.2 per 100,000 child-years). Thus, it is difficult to argue that deaths in excess of this achieved baseline were not at least theoretically preventable. To demonstrate that reported findings held across alternative assumptions of injury preventability, two additional baselines were used to estimate rates of excess deaths.

Second, an assumption was made that injury deaths provide a largely objective measure of child risk, not subject to the same sources of identification bias that may impact CPS maltreatment rates. This assumption should be considered reasonable given that all manners of injury deaths were considered, both unintentional and maltreatment-related. Prior research suggests that the manner of a child's injury death is commonly miscoded on death records,<sup>41–45</sup> with race-biased coding of intentional deaths uncovered in at least one study.<sup>46</sup> An examination of only those deaths coded as intentional could have provided a biased measure of racial differences in excess deaths. Yet, by utilizing all injury deaths and ignoring the death's coding as accidental or maltreatment-related, this research avoided the identification bias that may factor into elevated rates of intentional injury deaths for black children.<sup>40</sup> It should be noted that this analysis was unable to account for injury fatalities that may have been misclassified as deaths due to natural causes, which is a limitation, given difficulties in distinguishing sudden infant death syndrome from injury suffocation deaths.<sup>47–49</sup>

Finally, while research suggests that the physical well-being of nonambulatory infants and young children is largely defined by the adequacy of age-appropriate supervision and caregiving,<sup>25,50–52</sup> variability in children's exposure to neighborhood or environmental

hazards cannot be ignored. Among children residing in impoverished and dangerous neighborhoods, it may be that a smaller fraction of injury fatalities can be attributed to parental factors associated with the risk of maltreatment. Although there was no way to directly control for these nonparental risk factors, all analyses were also run with motor vehicle, pedestrian, and other transport-related injury deaths excluded, as these, by definition, would have occurred outside of the home. The exclusion of these deaths did not change the findings.

## CONCLUSIONS

These findings have potentially important implications as to how and where communities intervene to reduce racial disparities. To date, efforts to reduce racial disparities have been oriented around an understanding that the overrepresentation of black children among victims of maltreatment originated from CPS system or worker bias.<sup>1,10,11,53</sup> This assumption resulted in a proliferation of trainings to reduce racially biased decisions made by CPS workers,<sup>1,11</sup> institutional reviews to identify system-level bias,<sup>53,54</sup> and unqualified calls “to reduce and ultimately eliminate racial disparities.”<sup>55</sup> Yet, very different activities (i.e., targeted prevention efforts) are necessitated to reduce disparities that stem from actual group differences in maltreatment risk. Efforts to reduce racial disparities will continue to fall short if intervention strategies ignore the social and economic factors that place some children at far greater risk of abuse or neglect than others.

In summary, this study used a novel approach to examine the racial disparities in the rates of substantiated cases of maltreatment. The findings suggest that the overrepresentation of black and Native American children in the child welfare system may be a manifestation of historical and contemporary racial inequities that place these minority children at a disproportionate risk of maltreatment. If correct, a very different approach to reducing racial disparities than that which has currently been adopted in the U.S. should be used. These findings suggest that a renewed community focus on front-end, highly targeted services to families with children at high risk of maltreatment is necessary to reduce racial disparities in the actual incidence of maltreatment.

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