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ORIGINAL ARTICLE

Hyperthermia deaths among children in parked vehicles: an analysis of 231 fatalities in the United States, 1999–2007

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Abstract Motor vehicle-related child hyperthermia fatalities (MVRCHF) have risen slightly in the past decade, but little research has been done investigating the circumstances surrounding MVRCHF. In order to address gaps in our understanding, the current study describes MVRCHF circumstances among children <1–14 years of age in the United States from 1999 to 2007. Three sources were used to identify child hyperthermia death cases in the United States from 1999 to 2007: the Centers for Disease Control and Prevention's Compressed Mortality File (1999–2004), the Golden Gate Weather Service's public MVRCHF database (2003-Present), and an independent internet search. Data about the victim's characteristics and the circumstances surrounding the death were extracted. From 1999 to 2007, 231 MVRCHF were identified. Children were left unattended in >80% of cases, 25% of victims were playing at the time of death, and 60% were male. On average, the core body temperature was 107.2°F after being left inside the vehicle for an average of 4.6 h. The largest number of deaths occurred in the South, followed by the West, Midwest, and Northeast. Parents were found to be accountable for 2/3 of the hyperthermia deaths. The geographic distribution of incidence may be attributable to two major influences: (1) regional climate differences; and (2) population characteristics. The accountability of parents for MVRCHF is likely due to the exposure-risk concept, in which the situation/circumstances increase the injury probability.

Keywords Hyperthermia · Vehicle-related child hyperthermia · Child hyperthermia · Hyperthermia fatalities · Hyperthermia death · Child death

Introduction

Despite a 45% decline in the rate of injury-related deaths among children in the United States from 15.4 per 100,000 in 1987 to 8.5 per 100,000 in 2005, unintentional injuries remain the leading cause of death for those aged 1–14 years, with motor vehicle (MV)-related fatalities representing the majority [1, 2]. One specific, albeit rare, type of MV-related fatality among children that is of growing concern is hyperthermia. Although the true burden is elusive due to a lack of standard data sources, it is estimated that from 2003 to 2007 there was an increase in the average number of MV-related child hyperthermia fatalities (MVRCHF) (37.4 per year) when compared to 1998–2002 (33.6 per year) [3].

Children left in a MV for even short time periods in moderate ambient temperatures (e.g. ~21°C) are at risk for hyperthermia [4]. The internal temperature within a closed MV ascends rapidly in the first 15 min despite variations in the rate of increase due to vehicle type, color, and window

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tinting [4–7]. On average, temperatures increase 1.7–1.9°C per 5 min. Within 30 min 80% of the temperature increase is accounted for and within 60 min vehicles have reached identical peak temperatures, regardless of whether windows are closed or cracked open [4].

Two factors make children more prone to hyperthermia than adults—children have a greater surface area to body mass ratio than adults and a child's thermoregulation is less efficient than an adults [4]. In warm environments healthy infants have been shown to have temperatures +38.3°C [7]. In areas of high humidity the body's cooling method (perspiration/evaporation) is less effective. When considering infants usually remain clothed below window level in cushioned seats when being transported in a vehicle, one can observe their significant disadvantage in reduced total surface area available for the body's natural cooling method to be most effective [7]. Therefore, children are especially prone to develop hyperthermia when inside a closed, hot vehicle.

Currently only one peer-reviewed publication describes a large number of MVRCHF in the United States (US) [8]. Neither the responsible caretaker nor the family social/lifestyle patterns were examined in that study. Such knowledge may provide awareness groups considerable insight about the injury-specific complexities related to demographic, economic, and sociologic patterns, allowing directed communication with those individuals in most need of education concerning the danger to children in MVs.

Considering regional differences in MVRCHF is also important as climate plays a significant role. While northern latitudes experience sporadic heat waves, exposure of the southern latitudes to a greater number of hot and sunny days increases the opportunity for heat-related illnesses. In keeping with their distinctive climates, heat warnings/advisories differ between Northeastern and Southern cities in North America with the latter considering oppressive air masses, the forecasted maximum temperature, and time of year in the decision to issue heat warnings/advisories. Furthermore, heat-related hazards, including internal vehicle temperatures, are more commonly advertised in the South as part of public education [9].

To address gaps in our understanding of MV hyperthermia deaths, the current study sought to describe the geographic distribution, circumstances, and victim characteristics of MVRCHF among children <1–14 years of age in the US between 1999 and 2007.

Materials and methods

The Centers for Disease Control and Prevention WONDER Online Database, compiled from the Compressed Mortality File (CMF) 1999–2004, was utilized to identify hyperthermia deaths of children <1–14 years of age with an International Classification of Disease (ICD) code for exposure to excessive natural heat [10]. The CMF is a county level national mortality database that contains information on the number of deaths, age group, race (white, black, and other), gender, year of death, and underlying cause-of-death, based on the four-digit ICD code or group of codes. Because not all deaths due to excessive natural heat are MV-related, it was necessary to investigate each death to determine the circumstances surrounding the fatality. Based upon the information provided by the CMF, exhaustive electronic news article searches were conducted to determine the setting of the hyperthermia fatality. CMF cases not verified by an electronic news article were excluded.

A second source was used to identify MVRCHF dating from 2003-present. This data source has been cooperatively developed through a comprehensive network of MVRCHF awareness groups throughout the US, such as Harrison's Hope and Kids 'N Cars [3], with support from the Golden Gate Weather Service (GGWS) and the Department of Meteorology at San Francisco State University. This publicly available database is updated daily, and its creator, Dr. Jan Null, proclaims it to be the most complete child hyperthermia mortality database. Each case listed in this database is linked to an electronic news article. These cases are derived from a network of individuals studying hyperthermia fatalities or actively involved in child hyperthermia awareness groups throughout the nation. The GGWS database was the primary data source for 2003–2007.

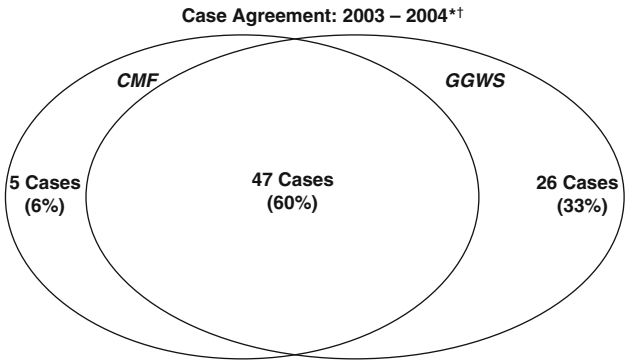
Since the CMF and GGWS database overlap from 2003 to 2004, the completeness of our dataset was confirmed by cross-checking all identified case information for these years.

Third, a separate internet search utilizing key words, including, but not limited to, "hyperthermia", "child", and "death", were employed in common search engines, such as Google and Yahoo, in an attempt to identify any fatalities not specified in the CMF or GGWS database.

Jointly, data from the CMF, GGWS database, and key word searches were compiled to form our dataset which contained information pertaining to the victim's name, age, and gender, whether the victim was playing, left unattended (intentionally, unintentionally, or intention unclear), the estimated body temperature, number of entrapment hours, location of the incident (county, state), and the responsible caretaker.

Results

Between 1999 and 2007, 231 MVRCHF occurred insofar as our sources revealed. From 178 cases identified between



*Note: All percentages are rounded to the nearest whole number resulting in a sum of less than 100%.
†Note: A large number of cases may be missing from the time period prior to the GGWS database.

Fig. 1 Agreement of cases from CMF and GGWS vehicle-related child hyperthermia fatality news article sources in overlapping years, 2003–2004

1999 and 2004 by the CMF, 78 were verified by completing an internet search. An additional 21 cases between the same years were identified by an internet search alone. From 2003 to 2007, the GGWS database supplied 133 cases. Figure 1 illustrates the agreement among CMF and GGWS cases identified in overlapping years, 2003–2004.

Of the 231 cases, 70 were <1 year old (yo) (30%), 147 were 1–4 yo (64%), 12 were 5–9 yo (5%), and 2 were 10–14 yo (1%) with 135 (58.4%) being male and 96 (41.6%) female. After investigations by law enforcement children were determined to have expired while playing in 58 (25.1%) cases reviewed. Children were playing inside the vehicle in 18 cases. In 17, the child was initially playing outside the vehicle, but at some point entered the vehicle where they died. In 23 cases it was unclear where the child was playing. Only one case stated the child took the vehicle's keys prior to the fatality. While it was unclear in seven cases (3.0%), the child was supervised while playing at the time of death in 32 cases (13.8%).

Of 192 (83.1%) children left unattended, 25 (13.0%) were intentionally left unattended, 145 (75.5%) were unintentionally left unattended, and in 22 (11.5%) cases the intentions were unclear. In 16 cases (7.0%) the children were attended to but the supervisor either forgot about the child (9) or fell asleep (4), or the child was playing hide-and-seek (2) or awoke from a nap without the supervisor's knowledge (1). The circumstances were unclear in 23 cases (10.0%). Table 1 illustrates the circumstance of the fatality by age group when the child was left unattended.

When evaluating the caretakers liability, there were 100 (43.2%) cases where the child was simply forgotten in the car or the caretaker forgot to drop the child off at daycare/with the babysitter. Additionally, the caretaker believed the child was playing (but not necessarily in/around a vehicle)

Table 1 Age distribution of vehicle-related hyperthermia fatalities for children ≤14 years of age left unattended in the United States, 1999–2007

Age (years)	Circumstances *n* (%)			Total *n* (%)
	Intentional	Unintentional	Unclear	
<1	8 (11.8)	52 (76.5)	8 (11.8)	68 (35.4)
1–4	15 (12.2)	87 (75.0)	14 (12.1)	116 (60.4)
5–9	2 (25)	6 (75.0)	0	8 (4.2)
10–14	0	0	0	0
Total	25 (13.0)	145 (75.5)	22 (11.5)	192 (100)

in 41 (17.7%) cases. Although this appears to be fewer children playing than indicated above, these circumstances were classified based on the accountability of the caretaker prior to the MVRCHF rather than the decedents whereabouts prior to the death. Table 2 describes the cases according to the circumstances surrounding the MVRCHF as related to the caretaker.

There were 160 counties in 41 states having ≥1 hyperthermia death. Texas ranks first with 28 (12.1%) cases followed by Florida with 24 (10.4%), California with 21 (9.1%), Arizona with 13 (5.6%), and Tennessee with 12 (5.2%). Over 25% of fatalities occurred in counties with >1 MVRCHF case, eight incidents of which contained ≥2 children dying together (e.g., siblings trapped). Table 3 summarizes the distribution of cases according to region using the CDC's definitions [11]. Figure 2 demonstrates the regions according to the CDC's definition with the number of MVRCHF for each state.

The amount of time when the decedent was last known alive and when the decedent was found dead or dying inside the vehicle averaged 4.6 h with a range of 0.25–16 h ($n = 178$). The mean core body temperature at the time of discovery was 41.8°C ($n = 20$, range 39.4–42.8°C). Overall, while the mother was responsible for the child at the time of death in 1/3 and the father in ¼ of MVRCHF cases, the parents were accountable for a combined 65%. Table 4 illustrates the identity of the caretaker at the time of death.

Discussion

This descriptive review of 231 MVRCHF, a sample much larger than the only previous study [8], identified the regional variation and accountable caretaker for MVRCHF across all US counties between 1999 and 2007.

Regionally, the number of MVRCHF varies. Primarily, the geographic distribution can be attributed to distinctive regional climates. The South and West "sun-belt" states have higher annual mean hours of sunshine and warmer

Table 2 Circumstances immediately prior to each motor vehicle-related child hyperthermia fatality

Circumstances related to the caretaker for each MVRCHF[a]	
Circumstance	*n* (%)
Child forgotten in vehicle	56 (24.2)
Child forgotten to be dropped off at daycare/babysitter	44 (19.0)
Child playing in vehicle	41 (17.7)
Unknown/unable to be determined from information provided	21 (9.1)
Daycare workers forgot child in vehicle	16 (6.9)
Miscommunication between caretakers	15 (6.5)
Caretaker left child in vehicle while running errands	14 (6.1)
Left child in vehicle while at work	10 (4.3)
Parent went to sleep & awoke to find child in vehicle	8 (3.5)
Child presumed to be asleep but found in vehicle	6 (2.6)
Total	231 (100)

[a] All percentages are rounded to the nearest tenth resulting in a sum of less than 100%

Table 3 Vehicle-related hyperthermia fatalities for children ≤14 years of age by region of the United States, 1999–2007

Hyperthermia fatalities ≤14 years of age by region of the US, 1999–2007	
Region[a]	% of fatalities (*n*)
South	55.8 (129)
West	23.4 (54)
Midwest	14.7 (34)
Northeast	6.1 (14)
Overall	100 (231)

[a] Regions were defined by the CDC criteria as illustrated in Fig. 2

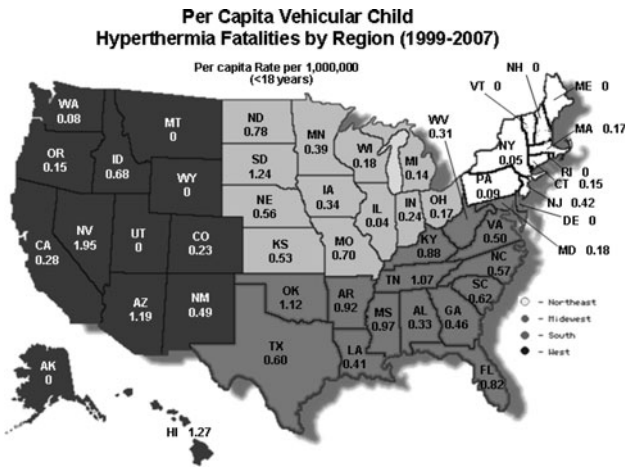


Fig. 2 Per Capita motor vehicle-related child (<18 years) hyperthermia fatalities (1999–2007) by state in the four United States regions defined by the CDC

annual daily average temperatures when compared to the Midwest and Northeast "frost-belt" states [12]. Although the "sun-belt" has increased exposure opportunity, the "frost-belt", where oppressive summer air masses are

Table 4 Caretaker responsible for the vehicle-related child hyperthermia fatality in the United States

Caretaker at time of hyperthermia fatality	
Person responsible	*n* (%)
Mother (alone)	77 (33.3)
Father (alone)	54 (23.4)
Related family	44 (19.1)
Mother and father together	20 (8.7)
Daycare workers	18 (7.8)
Unrelated person (ex: babysitter)	10 (4.3)
Unknown person	8 (3.5)
Total	231 (100)

periodic, has the greatest weather-mortality correlation [13]. In contrast, recurring oppressive air masses in the "sun-belt" may sanction behavioral and psychological acclimations in that region [13]. Heat warnings/advisories have demonstrated a reduction in heat-related mortalities, however, the notification criteria have several deficiencies: (1) they assume human responses to only temperature and relative humidity; (2) the negative impact of consecutive days of oppressive weather is not accounted for; (3) the greater health hazards of early summer heat waves compared to those late in the season are not influential; (4) the defined heat index parameters are not proven estimators of heat-related morbidity or mortality; (5) lack of criteria prevent the derivation of morbidity or mortality estimates from excessive heat warnings; and (6) each city issues warnings according to standard values without accounting for climate acclimation within populations (e.g., a heat index of 40.6°C will affect populations in Boston and Orlando differently) [13]. For maximum effectiveness, heat warning/advisory systems must consider additional factors and be customized according to local populations [13].

Table 5 The estimated elapsed time between when a child was last known alive to when the decedent was found dead or dying in a vehicle

Estimated elapsed time between when child was last known alive and when decedent was found	
Number of hours	*n* (%)
≤0.5	9 (3.9)
>0.5 to ≤1.0	19 (8.2)
>1.0 to ≤2.0	19 (8.2)
>2.0 to ≤3.0	42 (18.2)
>3.0 to ≤4.0	11 (4.8)
>4.0 to ≤5.0	11 (4.8)
>5.0 to ≤6.0	8 (3.5)
>6.0 to ≤7.0	16 (6.9)
>7.0 to ≤8.0	34 (14.7)
>8.0	9 (3.9)
Unknown/not reported	53 (22.9)
Total	231 (100)

Interestingly, our data indicate 19.8% more and 18.3% fewer MVRCHF in the South and Midwest compared to Guard and Gallagher [8]. These regional differences may be attributed to how cases were stratified into regions. For example, cases may be recorded based on where deaths occur (e.g., vacation) rather than county of residence. Alternatively, a shift in where MVRCHF's are occurring could be attributable to regional population changes.

The elapsed time between when a decedent was last known alive and when that decedent was found dead or dying inside a vehicle averaged 4.6 h, with a range of 0.25–16 h. Although the time between vehicular environmental exposure and death would be of more interest to pathologists, this can only be estimated from the reports that exist. Nevertheless, it is clear from the 15 min interval at the low end of the range that death from hyperthermia can occur quickly, depending on the vehicles internal temperature and the child's size. Table 5 describes the cases according to the estimated time between when a child was last known alive and when the decedent was found dead or dying in the vehicle.

The preponderance of unintentional injury deaths transpire while children are unsupervised [14]. A Wake Forest University publication found unintentional fatal childhood injuries occurred most frequently while the mother (33.8%) was supervising the child at the time of injury, followed by the father (21.7%), both parents (10.4%), related family (10.4%), and an unrelated individual (22.5%) [15]. The relationship between exposure and risk explains this finding. Proportionally, fathers account for 2/5 the involvement of mothers (43.5%) [16]. Therefore, mothers are inevitably involved in a greater proportion of the hyperthermia fatality events. For responsible parents, jointly coordinating early morning and late afternoon work with family schedules can become quite hectic and stressful [17].

The general consensus is that if parents are criminally charged, conviction is improbable [15]. Wake Forest University School of Law reported parents are prosecuted for only 54% of MVRCHF whereas individuals unrelated to the victim are prosecuted in nearly 90% of cases [15]. Conviction was found to be contingent upon socioeconomic status and job status, with individuals of lower SES being prosecuted more frequently, and "white-collar" workers convicted less frequently [15]. Also, those judged to have "suffered enough" were less likely to be sentenced harshly [15].

MVRCHF involve a wide range of circumstances including miscommunication between parents, children playing who do not realize the repercussions of their play, and cases in which parents intentionally leave the child in the car while at work or to not interrupt the child sleeping. Information concerning these circumstances is essential to medical examiners for determining the manner of death. If the caregiver is determined to be intentionally negligent then the manner of death may be classified as homicide.

Our study can be interpreted in light of several strengths and limitations. Although parked MVRCHF are a preventable cause of death, their frequency is largely underestimated, particularly ahead of the GGWS database, due to several contributing factors. First, not only is a national database/registry for MVRCHF nonexistent, as we have shown, but there is no way of determining the relative risk of an individual (e.g., mother) responsible for a child immediately prior to an event. Estimating the risk is complex because critical information, including the amount of time and number of children left unattended in parked MV's, is typically unavailable.

Second, neither the ICD-9 nor ICD-10 contains cataloging codes for vehicular heat-related deaths. For example, only 78 (44%) of the 178 CMF cases initially identified were MVRCHF. The remaining 100 (56%) hyperthermia cases were either unable to be verified by a news article or involved circumstances other than a vehicle heat-related fatality. This accentuates the problem of utilizing "administrative" data sources to identify cases and further underscores the notion that MVRCHF are diversely coded.

Third, death certificates often designate hyperthermia as a secondary, rather than a primary, cause of death [18], thus introducing case-identification complexities. For example, during a heat-wave in July 1995, the Cook County Medical Examiner found 696 excess deaths with 514 heat-related deaths [19]. Therefore, the heat-wave was associated with an additional 182 deaths that were not formally attributed to the heat-wave but which were certainly a result of the heat-

wave [19]. Between July 14 and July 20, calculations determined there were 485 heat-related deaths and 739 excess deaths making it appear the heat wave contributed 254 more deaths than suggested [19].

Fourth, although researchers have found that newspapers provide the most complete account of worldwide events while offering a plethora of information typically unavailable in traditional databases, the definitive precision and validity of the articles can never be known [20]. Additionally, selection biases (selective reporting based on space, editorial concerns, etc.) favor reporting events with the most "newsworthy" characteristics, such as unusual, large, violent, dramatic, or rare events, particularly crime related to children such as abuse or any incident associated with high or increasing disease mortality rates [20]. For example, only 20 of our incidents reported a mean core body temperature, perhaps a result of law enforcement/emergency medical personnel estimating the MVs internal temperature or the body temperature when it seemed exceptionally elevated. These factors affect all types of newspapers, including national, regional, local, urban, and rural [20]. Larger newspapers containing electronic assets, usually in urban environments, will potentially report hyperthermia deaths, but due to economic constraints, smaller rural communities may process only lithographs. However, these determinants, along with cultural factors, may prompt a dramatic MVRCHF to be reported because it "hits close to home" making an impact on surrounding communities, especially if there is more than one incident in a short time period. Hence, the likelihood of reporting a MVRCHF is not fully understood.

Despite potential reporting irregularities, utilizing the internet as a search engine provided the ability to search all media types simultaneously. However, the internet is in real time, therefore older news may not be electronically published as time elapses. Furthermore, the key words utilized may not have developed a "hit" for the data of interest. Lastly, neither the GGWS database nor our own internet search includes data from restricted access databases, such as Lexis-Nexis. Regardless of these latter concerns, we are confident in the accuracy of the cases we reviewed because the GGWS database and our own internet search generated duplicate chronicles.

Conclusion

MVRCHF continue to be a preventable type of death that occur primarily in the south and western regions of the US while being unsupervised by the victim's parents. Both epidemiological and clinical rare events research suffer from limited case availability. Notably, MV-related injuries top the National Pediatric Injury Prevention Priorities ranking [21]. Building a registry for MV-related pediatric injuries that includes MVRCHF seems sensible. A more adequate framework with a larger quantity of cases and more complete data can assist in developing prevention strategies by elucidating associated problems. Additionally, by increasing awareness through education, regulation, engineering, and legislation, as Guard and Gallagher have described [8], this exceptional and dramatic event can become even rarer.

Impact on industry

By initiating a tracking system for MV-related pediatric injuries and, as Guard and Gallagher have suggested, increasing awareness of MVRCHF through education, regulation, engineering, and legislation can have a profound impact on preventing this dramatic, albeit, rare event.

Key points

1. MV-related injuries top the National Pediatric Injury Prevention Priorities ranking.
2. MVRCHF continue to rise, primarily in the Southern and Western US regions, but little research has been done investigating the surrounding circumstances.
3. Both epidemiological and clinical rare events research suffer from limited case availability; however, a more adequate framework that facilitates a larger quantity of cases with more complete data can assist in developing prevention strategies by elucidating associated problems.
4. Preventing this dramatic, albeit, rare event will be accomplished with a surveillance system as well as increasing awareness of MVRCHF through education, regulation, engineering, and legislation.
5. The geographic distribution may be attributable to regional climate differences and population characteristics. The accountability of parents for MVRCHF is likely due to the exposure-risk concept, in which the situation/circumstances increase the injury probability.

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References

1. Accidental deaths of children in US decline. In: Reuters foundation AlertNet: alerting humanitarians to emergencies. 2008. http://www.alertnet.org/thenews/newsdesk/N28500260.htm. Accessed 6 May 2008.

2. WISQARS leading causes of death report, 1999–2005. In: National Center for Injury Prevention and Control. 2008. http://webappa.cdc.gov/sasweb/ncipc/leadcaus10.html. Accessed 6 May 2008.
3. Null J. Hyperthermia deaths of children in vehicles. San Francisco State University, Department of Geosciences and Golden Gate Weather Services. 2007. http://ggweather.com/heat/. Accessed 15 Dec 2007.
4. McLaren C, Null J, Quinn J. Heat stress from enclosed vehicles: moderate ambient temperatures cause significant temperature rise in enclosed vehicles. Pediatrics. 2005;116:109–12.
5. Surpure JS. The automobile and heat stress. Annu Emerg Med. 1982;11:263–5.
6. Roberts KB, Roberts EC. The automobile and heat stress. Pediatrics. 1976;58:101–4.
7. Gibbs LI, Lawrence DW, Kohn MA. Heat exposure in an enclosed automobile. J La State Med Soc. 1995;147:545–6.
8. Guard A, Gallagher SS. Heat related deaths to young children in parked cars: an analysis of 171 fatalities in the United States, 1995–2002. Inj Prev. 2005;11:33–7.
9. Sheridan SC. A survey of public perception and response to heat warnings across four North American cities: an evaluation of municipal effectiveness. Int J Biometeorol. 2007;52:3–15.
10. Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed mortality file 1999–2004. CDC WONDER On-line Database, compiled from Compressed Mortality File 1999–2004 Series 20 No. 2J. 2007. http://wonder.cdc.gov/cmf-icd10.html. Accessed 5 Nov 2007.
11. National Centers for Health Statistics definitions: geographic region and division. The Centers for Disease Control and Prevention. 2008. http://www.cdc.gov/nchs/datawh/nchsdefs/region.htm. Accessed 6 May 2008.
12. Climate atlas of the United States [CD ROM]. National Climatic Data Center: US Department of Commerce. National Oceanic and Atmospheric Administration (NOAA). 2006. http://lwf.ncdc.noaa.gov/oa/about/cdrom/climatls2/info/atlasad.html. Accessed 6 May 2008.
13. Kalkstein LS, Jamason PF, Greene JS, Libby J, Robinson L. The Philadelphia hot weather health watch/warning system: development and application, summer 2005. B Am Meterorol Soc. 1996;77:1519–28.
14. National SAFE KIDS Campaign (NSKC). Childhood injury fact sheet. Washington (DC): NSKC; 2004.
15. Collins JM. Crime and parenthood: the uneasy case for prosecution of negligent parents. Legal Studies Paper No. 05-08. NC: Wake Forest University Press. 2005. http://ssrn.com/abstract=673451. Accessed 15 Dec 2007.
16. Pleck JH. Paternal involvement: levels, sources, and consequences. In: Lamb ME, editor. The role of the father in child development. Hillsdale: Erlbaum; 1997.
17. MacKinnon CE, King D. Day care: a review of literature, implications for policy, and critique of resources. Fam Relat. 1998;37:229–36.
18. Heat-related deaths—United States, 1999–2003. Morbidity and mortality weekly report (MMWR). 2006;55(29). http://www.cdc.gov/mmwR/preview/mmwrhtml/mm5529a2.htm. Accessed 4 May 2008.
19. Whitman S, Good G, Donoghue ER, Benbow N, Shou W, Mou S. Mortality in Chicago attributed to the July 1995 heat wave. Am J of Public Health. 1997;87:1515–8.
20. Earl J, Martin A, McCarthy JD, Soule SA. The use of newspaper data in the study of collective action. Annu Rev Sociol. 2004;30:65–80.
21. Haider AH, Risucci D, Omer S, Sullivan T, DiRusso S, Slim M, et al. Determination of national pediatric injury prevention priorities using the injury prevention priority score. J Pediatr Surg. 2004;39:976–8.