Articles

Injuries to Preschool Children and Infection Control Practices in Childcare Programs

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ABSTRACT: *Injuries represent the leading cause of death for children aged 0 to 12 years, and exposure to blood or bodily fluids at the time of injury may pose a health and safety problem. More than 800,000 injuries were reported in 2000, and many occurred in childcare programs. This survey examined rate, type, and extent of injuries in centers and the infection control practices employed by staff. Participants included 131 children aged six weeks to seven years, enrolled in two childcare programs in an urban setting. Eight hundred ninety-seven injury reports with 1,023 (126 simultaneous) injuries were recorded over a one-year period. Results indicated the majority of injuries (39%) were for bites and 11% were self-inflicted. Injuries were classified as minor (99%) or moderate (1%) with 73% receiving first aid by staff. Bleeding from injuries was minimal in 14% of injuries, while no injuries reported moderate or severe bleeding. The rate of medically attended (first aid treatment) injury was 5.31 per 100,000 child hours. Injury rates decreased with age in the center (P = .001), were higher for males (P = .036), and occurred most frequently in the morning (P = .001). Age, gender, and time of the day were significant predictors of injuries in the multivariate model.* (J Sch Health. 2003;73(5):167-172)

Injuries represent the leading cause of death for children aged 0 to 12 years, and thus pose a national health problem.[1,2] Furthermore, injuries that involve bleeding or secretion of bodily fluids may pose a risk of infection.[3] The Consumer Product Safety Commission reported more than 800,000 injuries to children in 2000. Many occurred in childcare programs (CCP).[4] With 20.5% of American children younger than age six receiving part-time to full-time childcare, more research should focus on injuries and control of infections from exposure to blood or bodily fluids in the CCP. Hence, this study examined rate of injuries in childcare centers and infection control practices used by childcare staff associated with blood or bodily fluids.

Rates of injury in CCPs vary in relation to location, type of childcare, definition of injury, and data sources. Annual injury rates range from 0.7 to 5.1 injuries per child.[5] Rates of injury also vary by age of child, time of day, and season of the year, with the highest rates occurring in summer and spring months, and at the peak times of 11 am and 4 pm. The most frequent site of injury is the playground.[6-8] In general, toddlers (12 to 36 months of age) and males face a higher risk of severe injuries than older children and females in CCP.[10-12]

Toddlers face the highest risk for injuries from bites or falls,[12] with 50% of injuries resulting in infection.[13] Bleeding injuries and biting episodes provide potential routes of transmission for blood borne pathogens (microorganism or infectious agent that is present in the blood) in CCP, and a concern for parents.[3] Common blood borne pathogens include Hepatitis C, Hepatitis B, and human immunodeficiency virus (HIV).[14] Infection control practices exist as part of standard precautions that childcare staff apply to blood, all bodily fluids, secretions, non-intact skin, and exposed mucous membranes.[14]

Child-to-child or child-to-adult caregiver transmission of blood borne pathogens can occur in CCP, though rarely.[15] Actual rates of transmission depend on a combination of conditions: 1) presence of one or more infected child in the CCP, and 2) biting or bleeding events that could transmit a blood borne pathogen. Though few seroprevalence studies examined incidence rates of blood borne infectious diseases among children in CCP, asymptomatically infected children are present in childcare environments.[16]

Childcare personnel face a challenging task: to provide a safe environment, prevent injury, and comply with regulations. State and federal regulations mandate amount of space, staff-child ratios, and reportable diseases, but do not deal effectively with the problem of disease transmission or injury prevention.[17] Considerable variation exists among programs, and current infectious disease and injury control policies and practices in facilities often fall short of American Public Health Association and American Academy of Pediatrics guidelines.[18]

Prevention intervention requires that CCP staff intercede quickly when aggressive behavior seems imminent.[19] Staff member qualifications include a training program developed and presented by the state department of human services, the state board of education,[20] or a qualified resource. Appropriate techniques, provided by qualified staff, include cleaning a scratch or bleeding site, preventive practices for minor infections, and monitoring behavior to reduce or proactively defend against aggressive behavior. These first aid and preventive actions reduce the rate of post injury infections, and limit transmission of more serious infections such as HIV or Hepatitis B. Because child care workers respond to and provide reports of injury, they must understand risks and infections associated with intentional (biting behavior) and unintentional injuries.

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RISK ASSOCIATIONS

With Biting

Human bites can cause serious infection.[11,21] A bite that breaks the skin causes concern as a potential mode for transmitting blood borne pathogens. Chang et al[8] reported that human bites resulted in 4.7% of all injuries and were equally divided between self-bites and bites from other children. Less than 1% of all biting injuries require medical attention.[9] Two studies on biting in CCPs reported nearly one-half the children were bitten.[22,23] Frequency of bites was higher in the middle of the morning and at the beginning of the school year (August and September), and more bites were to the upper extremities and face than other body sites. Toddlers were bitten more often than infants and preschool children.[6,12]

Although severe injuries and transmission of infections from bites are rare,[9] bites provide the most likely child-to-child route of transmission for Hepatitis B virus in CCPs.[24,25] Factors that increase risk and severity of infections in childcare sites include close proximity in places where children congregate, presence of infected children, severity of injury, amount of bleeding, and caregiver's response to contain infected materials or blood.

With Unintentional Injuries

Unintentional injuries such as falls, bruises, and bumps commonly occur in CCP. Falls, the most common injury, may vary from minor to severe.[10] The most frequent location of a fall (40.4%) is a school or childcare playground[26] with males and younger children (< 7 years of age) at highest risk to fall.[27] Playground injuries from falls produce the highest risk of bleeding. However, frequency of bleeding incidents in CCP, on or off the playground, has not been adequately documented,[5] and injury reports do not quantify bleeding episodes. For example, Sacks et al[9] reported injuries that required medical care: lacerations, fractures, human bites, crush injuries, dislocations, and concussions. Yet, amount of bleeding was not identified. Similarly, in a study of 1,797 childcare injuries that required medical attention, amount of bleeding was not identified.[28]

With Blood Borne Transmission

Preschool children are more susceptible immunologically than older children, and the number and closeness of children in CCP increases the spread of germs.[11] For instance, the risk of contracting Hepatitis B is substantially higher in children who attend CCPs than children cared for at home.[29,30] In a study on Hepatitis B transmission from possible carriers to other children in a CCP, Hayashi and Seizaburo[23] tested 269 children and found 15 children were positive, with 10 possibly infected while in the childcare center. However, transmission of Hepatitis B or HIV from infected children to others will not occur unless an injury breaks the skin and results in bleeding,[31] or bodily fluids are not contained.[32]

Risk for transmission of blood borne pathogens from infected children to other children in CCP is low due to infrequent opportunities for overt exposure to blood or body fluids.[15] However, the potential for transmission of infection exists whenever an injury or bite occur, representing a concern for childcare staff, and medical specialists, and parents. For example, in a survey of parents and care providers in a Houston day care center, Morrow et al[3] found most parents against allowing an HIV-infected child in the same center as their child.

SURVEY PLANNING

This survey examined age, gender, and race differences in childcare injuries. Rate of injuries, type, location, extent of injuries, and infection control practices associated with blood or bodily fluids used by childcare staff also were examined.

Subjects and Sampling

Data on childcare injuries and incident reports were collected from two privately managed and licensed full-time CCP in an urban metropolitan area over a 12-month period from July 1 to June 30. Compilation of the data and analysis followed in spring 2001. Centers were open 12 hours, from 6 am to 6 pm, Monday through Friday, for 254 days of the year. A full-time program participant was defined as one child in attendance for at least eight hours per day and part-time for at least four hours per day. Study participants included 131 children, six weeks to seven years-of-age (mean age 24 months ± 18.7), enrolled full-time or part-time in the 2 CCPs. A total of 897 incident reports with 1,023 (126 simultaneous) injuries was recorded over the study period. Each injured child, and each injury, were assigned a discreet identification code; 126 reports involved children with more than one injury.

Instrument

All records of injury and bleeding incidents were recorded on a researcher-developed instrument and pilot tested. A panel of childcare and medical experts reviewed the instrument to establish content validity, including a director for pediatric research from a medical school, an executive director of two CCPs, three childcare managers, and an infection control practitioner. The panel also assessed the comprehensiveness of the instrument. A content validity index (CVI) was computed. The six reviewers rated each variable for relevance, clarity, and representativeness. The rating scale was 1-4 (ranging from poor to very good); 97% of items were rated as 4/4 by the reviewers, indicating good content validity.

The instrument collected information on type of injury (bite, fall, scratch, bump, bruise) and bleeding episodes, injury or injuries per occurrence, severity and extent of injury, biting injury (whether the child bit or was bitten), location of the bite, if skin was broken, any evidence of the amount of blood, and history of previous biting. Also, information on the place where injury occurred, anatomic site of the injury, first aid responses to the injury site, who attended the injury or applied first aid, and notification given to parents was collected. Demographic information included center identification number, age of the child, gender, race, number of injury reports, number of children involved in the incident, and time, day, and month when the injury occurred.

Statistical Analysis

Frequency of injuries by respondent characteristics were compared using chi-square analysis to examine differences (age, gender, and race) in type and location of injuries. Medically attended (first-aid) injury rates were calculated

per 100,000 child hours. Total number of child hours in each childcare program was calculated by number of children (full-time and part-time) in the center multiplied by number of working days for the year (254 days) and number of working hours per day (12) for the center. Data analysis was performed using the Statistical Package for Social Science (SPSS) software.

SURVEY RESULTS

Injuries by Age, Gender, and Ethnicity

A total of 897 injury reports was recorded at both centers with center one reporting fewer injuries (40%) than center two ($\chi^2 = 65.8$, P = .001) (Table 1). Ethnic composition of children enrolled in both childcare centers showed children were predominantly White (84%), not reflecting the ethnic composition of the population in the metropolitan area (46% non-White and 54% White). Boys sustained more injuries than girls ($\chi^2 = 7.13$, P =. 03). Regardless of setting, infants and toddlers (1 to 2 years of age) were more likely to be injured than older children ($\chi^2 = 31.75$, P = .001); kindergarteners recorded the least number of injuries (2%). Analysis of injuries by ethnicity showed Whites sustained a significantly greater number (84%) of injuries ($\chi^2 = 9.73$, P = .02) than non-Whites (Blacks, Asians, and Others). However, this result reflected the higher proportion of Whites (84%) enrolled at the centers. Self-inflicted injuries constituted 11% of all injuries.

Type, Extent, and Location of Injuries

Approximately 39% of reported injuries in the childcare settings involved bites (Table 2); 131 children had 270 biting records. Of those children bitten, 87 were bitten multiple times. Location of bites occurred primarily (62.4%) to the upper extremity or torso (hands, fingers, and arms or the chest and back), while 9.7% occurred on the face, head, or lip, and 2% occurred to the lower extremity. More than one-fourth (25.9%) of reports did not describe a site of the bite. Reasons for the lack of record are not known.

In terms of severity, 74% were classified as minor injuries, 0.5% were moderate, and none was severe (Table 2). Twenty-six percent of bites (n = 104) did not indicate severity of injury. Most bites (66.9%) occurred between 6 am and 11:59 am, and staff provided first aid for approximately half the cases (51.5%). Biting injuries rarely were serious enough for a child to leave the center for additional care, and approximately one-half (48.6%) were treated with Tender Loving Care (TLC) by CCP staff.

Fifty-five percent of reported injuries were unintentional injuries (falls, scratches, bumps, bruises, cuts). Simultaneous injuries occurred in 126 reports, such as cut and scratch, and bump and bruise. Most of these injuries (99.5%) were minor, and none was severe. Two reports of moderate injury included a fracture and cut, both from playground falls. Most (61%) unintentional injuries also occurred between 6 am and 11:59 am. First aid was provided for approximately 87% of the injuries, and the rest were provided with TLC by childcare staff.

Injuries occurred on all days of the week but more injuries were reported at midweek on the days the centers had higher enrollment. Center one reported higher injuries

Table 1
Injuries by Age, Gender, and Ethnicity (n = 1,023 injuries)

	Frequency	Extent of Injury		Evidence of Blood	First Aid Treatment
Age*		**Moderate**	**Minor**	**Yes**	**Yes**
Infant (0 - 12 months)	204 (22.7%)	1 (.5%)	194 (95.1%)	3 (0.6%)	149 (19.8%)
Toddler I (12 - 24 months)	338 (37.7%)	1 (.3%)	314 (92.9%)	1 (0.2%)	224 (30.2%)
Toddler II (24 - 36 months)	163 (18.2%)	2 (1.2%)	150 (92%)	1 (0.2%)	112 (15.1%)
Preschool I (36 - 48 months)	125 (13.9%)	0	122 (97.6%)	7 (1.4%)	98 (13.2%)
Preschool II (48 - 60 months)	47 (5.2%)	0	44 (93.6%)	1 (0.2%)	37 (5.0%)
Kindergarten (60 - 72 months)	20 (3.3%)	0	18 (90%)	1 (0.2%)	17 (2.3%)
Gender **					
Male	541 (59.4%)	4 (1%)	497 (99%)	13 (2.7%)	367 (49.4%)
Female	376 (40.6%)	0	345 (100%)	2 (0.4%)	269 (36.2%)
Ethnicity * **					
White	750 (84.1%)	4 (0.5%)	688 (83.6%)	10 (2.2%)	529 (73.4%)
Non-White (Black, Asian or Native American)	147 (15.9%)	0	131 (15.9%)	5 (1.1%)	90 (12.5%)
Center ** **					
One	357 (40.0%)	2 (0.2%)	347 (40.3%)	6 (1.2%)	294 (39.0%)
Two	536 (60.0%)	2 (0.2%)	508 (59.1%)	9 (1.8%)	355 (47.1%)

Percentages indicate percent of total injuries.
* Frequency of Injury, $\chi^2 = 31.75$, df = 1, p = .007
** Frequency of Injury, $\chi^2 = 7.13$, df = 1, p = .03
*** Frequency of Injury, $\chi^2 = 9.73$, df = 1, p = .02
**** Frequency of Injury, $\chi^2 = 65.87$, df = 1, p = .001

on Tuesday, Wednesday, or Thursday; center two reported Monday, Tuesday, and Friday. Reasons for differences in number of injuries by day of the week between the two centers remain unknown.

Infection Control Practices and Bleeding Injuries

Childcare staff at both centers were trained to apply universal precautions related to injury as part of their infection control practices. Table 2 shows the evidence and amount of blood and application of first aid by staff. In cases where blood was noted (n = 76) volume was minimal in 74 reports and moderate in two others. The two cases of moderate bleeding resulted in a visit to a medical care provider, while all reported minimal bleeding episodes were treated with first aid or TLC. For instance, 276 (27%) of treatments rendered were TLC: holding, comforting, reassuring. In 143 incidents of injury, TLC was recorded as the second type of treatment after first aid.

Rate of Injuries

A total of 637 injuries required first aid by CCP staff. Medically attended (first aid) injury rates were calculated per 100,000 child hours. The mean injury rate was 5.31 injuries per 100,000 child hours. Linear multiple regression was performed to determine predictors of injuries in CCP. Results showed that age of the child (P = .001), gender (P = .015), and time of day (P = .001) were significant predictors of CCP injuries and accounted for 8% of the variance in the multivariate model (F = 19.65; P = .001). Injuries in CCP occurred more often among males, younger children, and before noontime. Rate of injuries decreased with age of the child. Season (month) or ethnicity of the child did not attain statistical significance in the multivariate model.

SURVEY IMPLICATIONS

This comprehensive survey represents the first effort to report the rate, type, and extent of injuries, and infection control practices employed by childcare staff over a 12-month period. Furthermore, annual rate of injury (first aid) did not require extrapolation as in prior studies. An estimated 5.31 injuries (first aid provided) per 100,000 child hours was slightly higher than the reported range of medically attended injuries of 0.7 to 5.1 per 100,000 child hours. Injury rate varies based on the definition of

Table 3
Medically Attended Injuries (First Aid Treatment) per 100,000 Child Hours

Age Group	No. of Injuries Receiving First Aid Treatment‡	Hours of Attendance	Injuries*	95% CI†
Infant	149	1,147,876.8	12.98	10.89 - 15.06
Toddler I	224	822,960	27.21	23.64 - 30.77
Toddler II	112	850,087.2	13.17	10.73 - 15.60
Preschool I	98	1,828,495.2	5.35	4.29 - 6.41
Preschool II	37	1,852,574.4	1.99	1.34 - 2.63
Kindergarten	17	1,340,815.2	1.26	0.66 - 1.86
Total	**637**	**7,842,808.8**	**5.31**	**4.90 - 5.72**

* Per 100,000 hours in daycare.
† CI indicates confidence interval.
‡ Injuries that received first aid treatment from CCP staff.

Table 2
Type and Extent of Injuries

Type of Injury*	Frequency Percent	Time AM	Time PM	Extent of Injury Min	Extent of Injury Mod	Extent of Injury Severe	Extent of Injury NR‡	Evidence of Blood Yes	Evidence of Blood No/NR‡	Amount of Blood Min	Amount of Blood Mod	Amount of Blood Severe	Treatment Type No/NR‡	Treatment Type First Aid	Treatment Type TLC	Treatment Type Medical
Bite	402 (39%)	280 (70%)	122 (30%)	296 (74%)	2 (0.5%)	0	104 (26.5%)	0	402 100%	0			402	207 (51.5%)	195 (48.5%)	0
Fall	232 (23%)	127 (55%)	105 (45%)	232 100%		0		37 (16%)	195 (84%)	36 (15.5%)	1 (.5%)	0	195 (84%)	206 (89%)	25 (10.6%)	1 (0.4%)
Bump & Bruise	226 (22%)	119 (53%)	107 (47%)	225 (99.6%)	1 (0.4%)	0		1 (.4%)	225 (99.6%)	1 (0.4%)			225 (99.6%)	183 (81%)	43 (19%)	0
Scratch, Cut, Blister, Fracture	163 (16%)	90 (55%)	73 (45%)	162 (99.4%)	1 (0.6%)	0		39 (24%)	124 (76%)	37 (23%)			126 (77%)	149 (91%)	13 (8.4%)	1 (0.6%)
	1,023 (100%)	616 (60%)	407 (40%)	915 (89.4%)	4 (.4%)	0	104 (10.2%)	77 (7.5%)	1,007 (92.5%)	74 (7.2%)	1 (0.1%)		948 (92.7%)	745* (72.8%)	276 (27%)	2 (0.2%)

Multiple injuries have occurred at the same time, ie, bump and fall, cut and bruise, etc.
‡ NR = No record.
Min = Minimum, Mod = Moderate.

medically attended injury, and rates are reported differently based on center characteristics, staff, and local and state reporting requirements.[28] Moreover, variation depends on rate of injury for medically attended versus severely injured.

In this survey, information on medical attention for a hospital/emergency room visit was unavailable (as defined in prior studies) and hence medically attended injuries were defined as injuries that required first aid by CCP staff.[10] Thus, injury rates reported in prior studies would be expected to be lower than rates reported for this study. Furthermore, medically attended injuries may not necessarily involve severe injuries, because most injuries in this survey were minor and with no severe injury. Prevention efforts should concentrate not only on lowering rate of injury but on protective measures to reduce occurrence of minor injuries in CCP.

Consistent with other studies,[6-9] rate of injury was significantly higher for infants and toddlers than for older children. Rate of injury also varied by gender and time of day, with the highest rates occurring among males and in the morning. However, rate did not vary by day of week indicating the association between type and rate of injury and enrollment of children in CCP may have been underestimated. Alternatively, this result could indicate a persistent routine used in all childcare centers.

Rate of injury did not increase significantly in summer and spring months as reported in the literature.[6-9] This finding could result from low variation in enrollment time per child by month and year. Seasonal variation does not always exist. Leland et al[33] reported that seasonal differences in injury rate existed in two of four centers with wide variation in enrollment time per child by month and year and by centers. Gender and age differences existed in the injury rate, with boys and younger children (infants and toddlers) recording a higher rate than girls and older children, which concurs with other studies.[6,9,22] Minority children, though a small percentage of enrolled students, were injured less frequently. This smaller percent may have some relevance to the lower number of injuries among non-Whites.

Type of injuries reflected the pattern reported by childcare programs nationally: bites, falls, bumps or bruises, cuts and scrapes. Reliability of results increased because human bites were frequent, and most injuries were minor in CCP.[6,8,34] However, biting injuries in this sample were higher (39%) compared to 31% reported nationally.[6] Biting behaviors were exhibited more often in the early hours of the day when enrollments were higher, and provided increased possibilities for distraction by staff and interactions by children that may account for the increased number of injuries. Though the biting episodes did not result in severe injuries, multiple bites to 10% of children suggests a need to identify practices in licensed CCPs and initiation of prevention and behavior modification techniques to decrease the frequency of biting. Biting behavior, common among toddlers, reflects getting their own way, and expressing aggression, anger, or frustration.[35] Application of tender loving care following injury or bite serves two purposes: gathering the child into a circle of loving arms can signify security while removing the child from further harm.

Severity of injury, minimal amount of bleeding, and universal precautions by CCP staff suggest biting and bleeding injuries in CCP do not pose a significant risk for transmission of blood-borne pathogens. No records of severe injury existed and only four reports (0.4%) of moderate injury. CCPs that require children immunizations according to the American Academy of Pediatrics (AAP) recommendations should find the risk for transmission of Hepatitis B reduced.[36] Compliance with this newer infection control standard may help to further reduce the risk for transmission of blood-borne pathogens among children attending childcare programs.

RECOMMENDATIONS

Current state health regulations do not effectively deal with problems of disease transmission or injury prevention in CCP.[17] A need exists for education and training (first aid and practice of standard and universal precautions) for workers to prevent injuries and for injury control. Staff also must receive inservice training on proper documentation of injury events (what, when, and how to document), keeping track of incidents, and completion of records. Missing information for both extent of injury and evidence of bleeding, as found in this survey can be problematic and may impair injury prevention efforts.

Injury reports need to be regularly maintained for enhancing prevention efforts. CCP staff also need further education on categorizing severity of injury (minimal, moderate, severe) and recording volume of blood. This practice cannot be subjective and left to the discretion of staff as revealed in this survey. Knowledge of injury rates, types of injuries, children at risk, and effective intervention strategies by childcare personnel also are necessary.

Injury data (center and national/state) presented periodically at staff meetings would lead to better understanding about the type and extent of injuries in the centers, and children at risk. Childcare staff should use checklists available through the American Academy of Pediatrics and the National Association for Education of Young Children for actual and potential hazards.

Young children do not understand how to be safe, so they need a secure child-appropriate environment with qualified staff providing supervision. Though transmission of blood-borne pathogens in CCPs appears small, further studies still may be necessary to adequately quantify and determine frequency of bleeding from injuries and biting in CCP.

Injuries among children pose a national health problem. Since CCPs now represent an integral component in the social fabric of America, children spend substantially more time in CCPs. Number of injuries will increase unless childcare staff enforce the health and safety standards developed by the American Public Health Association and the American Academy of Pediatrics.[37] In one encouraging finding from this survey, most injuries were minor (with minimal bleeding), and CCP staff provided first aid. However, prevention measures are necessary, especially among young children and males who sustained greater number of injuries. ■

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Statement of Purpose

The ***Journal of School Health***, an official publication of the American School Health Association, publishes material related to health promotion in school settings. ***Journal*** readership includes administrators, educators, nurses, physicians, dentists, dental hygienists, psychologists, counselors, social workers, nutritionists, dietitians, and other health professionals. These individuals work cooperatively with parents and the community to achieve the common goal of providing children and adolescents with the programs, services, and environment necessary to promote health and improve learning.

Contributed manuscripts are considered for publication in the following categories: **Articles, Research Papers, Commentaries, Teaching Techniques**, and **Health Service Applications**. Primary consideration is given to manuscripts related to the health of children, adolescents, and employees in public and private preschools, child day care centers, kindergartens, elementary schools, middle level schools, and senior high schools. Manuscripts related to college-age young adults are considered if the topic has implications for preschool through high school health programs. Relevant international manuscripts are also considered.

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