



## Childhood Accidents: The Relationship of Family Size to Incidence, Supervision, and Rapidity of Seeking Medical Care

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### Abstract

**Background:** Large family size may be a risk factor for childhood accidents. A possible association with quality of child supervision and rapidity of seeking medical care has not been fully evaluated.

**Objectives:** To determine whether children with multiple siblings are at increased risk for accidents, to assess whether quality of child supervision varies with family size, and to evaluate the relationship of family size with the rapidity of seeking medical care after an accident.

**Methods:** We prospectively studied 333 childhood accidents treated at TEREM (emergency care station) or the Shaare Zedek Medical Center. Details on family composition and the accident were obtained through parental interview. Family size of the study population was compared with that of the Jerusalem population. Families with one to three children (Group 1) and four or more children (Group 2) were compared with regard to type of supervision and different "Gap times" – the time interval from when the accident occurred until medical assistance was sought ("Gap 1"), the time from that medical contact until arrival at Shaare Zedek ("Gap 2"), and the time from the accident until arrival at Shaare Zedek for those children for whom interim medical assistance either was ("Gap 3A") or was not ("Gap 3B") sought.

**Results:** Children from families with 1, 2, 3, 4 and  $\geq 5$  children comprised 7.2%, 18.3%, 14.4%, 18.6% and 41.4% of our sample compared to 20.4%, 21.8%, 18.4%, 14.7% and 24.7% in the general population respectively. Children from Group 2 were less often attended to by an adult (44.5% vs. 62.0%) and more often were in the presence only of other children at the time of the accident (27.0% vs. 10.5%). Gaps 1, 2 and 3A in Group 2 (6.3 hours, 16.5 hours, 27.8 hours respectively) were longer than for Group 1 (2.7, 10.7, 13.3 hours respectively).

**Conclusions:** The risk for accidents is increased among children from families with four or more children. The adequacy of child supervision in large families is impaired. There is a relative delay from the time of the accident until these children are brought for treatment.

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Efforts to reduce the incidence of childhood accidents have led to numerous investigations aimed at identifying potential risk factors. The possible association between large family size and increased accidental injuries in children has been the subject of considerable study yet remains a matter of controversy. This apparently is due to the fact that some of the studies evaluated only one type of accident [1–3], while others were retrospective in design [4–6] or included only hospitalized children [7] or accident fatalities [5,8]. Most importantly, none of the studies prospectively investigated the degree of supervision of the child at the time of the accident in relationship to family size. This issue is particularly relevant in Jerusalem where approximately 40% of families have at least four children [9].

The principal aim of this prospective study was to determine whether or not children with multiple siblings are at increased risk for accidental injuries of various types. We also sought to assess the relationship between family size and two other parameters – the adequacy of childhood supervision, and the time elapsed until medical care was sought after the accident. As a corollary, we also investigated the relationship between family size and other measures related to childhood safety and health-care, including the presence of window guards in the home, immunization rates, and prior accident prevention counseling from healthcare personnel.

### Subjects and Methods

The study was conducted from December 2000 through June 2003 in two medical facilities in Jerusalem: TEREM, the city's main freestanding outpatient emergency care facility, and the Pediatric Department of the Shaare Zedek Medical Center. A structured interview was conducted by one of the investigators (S.S. or Z.A.) with the parent(s) of children under the age of 13 years brought to either of the emergency units following an accidental injury. The interview was conducted shortly after the child's arrival and all data were immediately recorded on a form designed for computer data entry. Accidents in children with a chronic physical disability and injuries that were suspected to be intentionally in-

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flicted were not included in the study. Patients who arrived when the researchers were either not present or unavailable were also not included. Thus, our data were collected as a convenience sample of children brought for medical care after an accident.

Each child's parent (or both parents if they were present) was questioned regarding:

- The composition of the family, including the number of children in the family, the number of adults residing in the child's home, and whether or not both of the child's parents live at home.
- Parameters of general healthcare and safety, including an accidental injury requiring medical care in the same child during the previous 12 months, the child's immunization status, the presence of window bars in the home, and the parental receipt of anticipatory guidance regarding accident prevention at least once since the birth of their first child.
- Details concerning the accident itself, such as the site of the accident, the mechanism of injury, who, if anybody, was with the child at the time the accident occurred (in the same room indoors, or immediately next to the child outdoors), and who brought the child for medical care following the accident.
- The time the accident occurred, the time the child arrived at Shaare Zedek and, for those children for whom interim medical assistance was sought after the accident (either by phone or by bringing the child to a physician or nurse), the time that medical contact occurred. This information enabled us to calculate "Gap times." "Gap 1" was defined as the time interval from when the accident occurred until interim medical assistance was sought; "Gap 2" as the duration of time from medical contact until arrival at the Shaare Zedek emergency department; "Gap 3" as the time from the accident until arrival at the ED in children for whom interim medical assistance either was ("Gap 3A") or was not ("Gap 3B") sought. Gap times for the children treated at TEREM were not documented.

The distribution of family size in our study sample was compared to that of the general Jerusalem population. Reference data concerning the demographics of the Jerusalem population were provided by the Israel Bureau of Statistics [9]. Additionally, we compared the data between two groups of children – those who lived in a family with one to three children (Group 1), and those who lived in a family with four or more children (Group 2). Data were collected and analyzed by EpiInfo 6.04d (Centers for Disease Control, USA) applying the chi-square and the *t*-test. The Gap data were analyzed by the Wilcoxon signed ranks test. Significant *P* value was set as 0.05.

## Results

### Sociodemographic data of children and families [Table 1]

There were 333 accident cases in the study. There were 234 (71%) males; the mean age of the children was  $4.8 \pm 3.4$  years

**Table 1.** Sociodemographic data of children and families (n=333)

Variables	Categories Mean $\pm$ SD	No. (%) (min-max)
Gender	Male	234 (71)
	Female	97 (29)
Age group (yrs)	$\leq 1$	83 (24.9)
	1.1–3.9	83 (24.9)
	4.0–7.9	96 (28.8)
	8.0–10.9	40 (12.0)
	$\geq 11$	31 (9.3)
Age (yrs)	$4.84 \pm 3.4$	0.1–12.6
Trauma-Arrival Gap (hours)	$16.4 \pm 36$	0–316
Medical Center	Shaare Zedek ED	83 (24.9)
	Shaare Zedek pediatric ward	119 (35.7)
	TEREM	131 (39.3)
Origin	Jewish	293 (88.0)
	Arab	40 (12.0)
Dispersion of number of children per family	1	24 (7.2)
	2	61 (18.3)
	3	48 (14.4)
	4	62 (18.6)
	5	34 (10.2)
	6	29 (8.7)
	7	24 (7.2)
	8	20 (6.0)
	9	10 (3.0)
	$\geq 10$	21 (6.3)
Grouped dispersion of number of children per family	1–3	133 (39.9)
	4–6	125 (37.5)
	$\geq 7$	75 (22.5)
Both parents live at home with child	Yes	316 (97.2)
	No	9 (2.8)
Immunizations up to date	Yes	284 (93.7)
	No	19 (6.3)
Prior anticipatory guidance	Yes	67 (22.3)
	No	234 (77.7)
Window bars	Yes	169 (80.1)
	Part	13 (6.2)
	No	29 (13.7)
Required medical treatment for accident in preceding 12 months	Yes	41 (13.1)
	No	273 (86.9)

(range 0.1–12.6 years) and the median age 3.6 years. Of the 333 children, 293 (88%) were Jewish and 40 (12%) were Arab. Forty percent belonged to families with one to three children (Group 1), and 60% to families with four or more children (Group 2). All except 3% of the children lived with both parents in the home. Ninety-four percent of parents reported that their child's immunizations status was up to date. Of families who lived in a residence with windows above ground level, 80%, 6% and 14% reported having window guards in place for all, some but not all, and none of the windows, respectively. Only 22% of parents reported that they had received accident prevention instructions from a physician or nurse since becoming parents. Thirteen percent of the children in the study required medical care for an injury sustained from an accident during the 12 months prior to the current accident. The social class of the families with four

ED = emergency department

**Table 2.** Data of accidents (n=333)

Variables	Categories	N (%)
Site of accident	Home	186 (55.9)
	School	66 (19.8)
	Street	29 (8.7)
	Other	49 (14.7)
	Unknown	3 (0.9)
Was the child alone?	No	237 (71.2)
	Yes	83 (24.9)
	Unknown	13 (3.9)
Who was with the child?	Parent	117 (36.5)
	Other adult	17 (5.3)
	Teacher	35 (10.9)
	Children	68 (21.3)
Adult present when accident occurred	Yes	169 (52.8)
	No	151 (47.2)
Mechanism of injury	Fall	143 (42.9)
	Burn	47 (14.1)
	Poisoning	38 (11.4)
	Laceration	31 (9.3)
	Foreign Body	21 (6.3)
	Motor vehicle accident	13 (3.9)
	Missile	6 (1.8)
	Bicycle	5 (1.5)
	Bite	3 (0.9)
	Assault	1 (0.3)
	Other	23 (6.9)
	Unknown	2 (0.6)
	Trauma stage	Mild
Moderate		106 (32.3)
Severe		5 (1.5)
Required hospitalization	Yes	138 (41.4)
	No	195 (58.6)

or more children (rated by defined criteria of bedroom availability for family size) was significantly lower than that of families with three or less children (data not shown).

#### Accident data [Table 2]

The majority of accidents (56%) occurred in the child's home and 20% at school. In 25% of the cases the child was alone, and in 21% the child was in the company only of other young children. Fifty-three percent of the accidents occurred in the presence of an adult, and in 37% the adult was one of the child's parents. Falls, burns, toxic ingestions, and "being cut by an object" were the mechanisms of injury in 43%, 14%, 11% and 9% of the cases respectively. Overall, 138 children were hospitalized for an average of 6.2 ( $\pm 5.6$ ) days (range 1–28). Injuries were classified as mild in 217 (66%), moderate in 106 (32%) and severe in 5 (1.5%) of the cases.

#### Family size and accident risk

Table 3 presents a comparison of the percentage of children in our study belonging to families with 1, 2, 3, 4 and  $\geq 5$  children as compared to the distribution in the total Jerusalem population. In the study sample 7.2% of the children had no other siblings (single children), far less than the 20.4%

in the general Jerusalem population ( $P < 0.001$ , odds ratio = 0.30). Children with three or more siblings appear to be at incrementally higher risk for accidents than children with less than three siblings. Children with three siblings constituted 18.6% of our study sample, but only 14.7% of the general Jerusalem population ( $P = 0.04$ , OR = 1.33). Children with four or more siblings accounted for 41.4% of our study sample, far greater than the 24.7% in the general Jerusalem population ( $P < 0.0001$ , OR = 2.16). Separate analyses revealed that the greater tendency for accidents among children with three or more siblings (Group 2) was independent of whether the accident occurred at the child's home or elsewhere. No statistically significant differences between the two groups were found regarding the percentage of accidents that occurred at home, the severity of the injuries, or the hospitalization rates [Table 4].

#### Family size and degree of supervision

Comparison of supervision among families with 1–3 (Group 1) and  $\geq 4$  children (Group 2) revealed significant differences [Table 4]. An adult was more often present with the child at the time of the accident among the children from Group 1 (62%) than with children from Group 2 (47%) ( $P < 0.05$ ). The percentage of children injured while in the presence of other children without an adult was significantly greater among children from Group 2 (28.0%) than among children from Group 1 (11%) ( $P < 0.001$ ). The socioeconomic status of the families of children who were attended to by an adult at the time of the accident was higher than that of families of children unattended by an adult, however this difference was not clinically meaningful (2.23 vs. 2.51 persons per room,  $P = 0.009$ ).

Further analysis revealed significant differences in the degree of supervision between the subgroup of children without any siblings (single children) and those with siblings. The percentage of accidents that occurred while the child was unattended was similar among single children (25%) and those with either  $\leq 2$  (28%) or  $\geq 3$  siblings (25%). However, when attended, single children were always accompanied by an adult. No single children were attended to by children without an adult at the time of the accident. In contrast, of the children with siblings who were attended, only 69% were accompanied by an adult. The remaining 31% were in the presence of children only at the time of the accident.

**Table 3.** Prevalence of different family sizes in study children vs. total Jerusalem population

No. of children in family	% of Jerusalem households (n=99,737)	% of study households (n=333)	OR	95% CI	P
1	20.4%	7.2%	0.30	0.19–0.46	<0.0001
2	21.8%	18.3%	0.80	0.60–1.06	NS (0.12)
3	18.4%	14.4%	0.74	0.54–1.01	NS (0.06)
4	14.7%	18.6%	1.33	0.99–1.76	0.04
$\geq 5$	24.7%	41.4%	2.16	1.72–2.69	<0.0001

OR = odds ratio, CI = confidence interval

**Table 4.** Assessment of accident data according to family size

Variables	1-3 children N (%)	≥4 children N (%)	P
Accident at home	78/133 (58.6%)	108/200 (54.0%)	NS
Adult present	80/129 (62%)	89/191 (47%)	<0.05
Children present (without adult)	14/129 (11%)	54/191 (28.0%)	<0.001
Child brought to ED by parent	124/132 (93.9%)	183/196 (93.4%)	NS
Injury stage			
Mild	90 (67.7%)	127 (65.1%)	NS
Moderate	42 (31.6%)	64 (32.8%)	NS
Severe	1 (0.8%)	4 (2.1%)	NS
Injury requiring hospitalization	60 (45.1%)	78 (39.0%)	NS
Gap 1 (hr)	2.7 ± 6.7	6.3 ± 15.0	0.028
Gap 2 (hr)	10.7 ± 27.7	16.5 ± 30.3	0.036
Gap 3A (hr)	13.3 ± 28	27.8 ± 50	0.015
Gap 3B (hr)	7.7 ± 25	7.0 ± 18	0.793

### Family size and “Gap” times

Gap times 1, 2 and 3A were longer for children in Group 2 than in Group 1 [Table 4]. Gap 1 was 6.3 hours for children from Group 2, more than twice the 2.7 hours for children from Group 1 ( $P = 0.028$ ). Gap 2 was 16.5 hours for Group 2 and 10.7 hours for Group 1 ( $P = 0.036$ ). Gap 3A was 27.8 and 13.3 hours for the two groups respectively ( $P = 0.015$ ). Gap 3B was very similar between the two groups (7.0 and 7.7 hours). The differences between the two groups with respect to Gaps 1, 2 and 3A indicate a trend for a time delay in seeking treatment after an accident among children from larger families when interim medical care is sought.

### Family size and indicators of child safety and healthcare

Window guards were present on all windows requiring them in 71% of homes of children from Group 1, as compared to 85% of homes of children from Group 2 ( $P < 0.05$ ). The two groups were similar with respect to the parental report of the child being fully immunized for age (119/125, 95% vs. 165/178, 93%), the parental report of ever receiving anticipatory guidance from medical personnel (30/129, 23% vs. 37/172, 22%), and the rates of a previous accidental injury sustained by the same child during the preceding 12 months (14/128, 11% vs. 27/186, 15%).

## Discussion

An increased risk to sustain a non-accidental injury was found among children with three or more siblings as compared to children with fewer or no siblings. Our data demonstrate that this phenomenon is, at least in part, directly related to inadequate supervision. Children with three or more siblings (Group 2) were less often attended to by an adult, and more often in the presence of other children without an adult than were their injured peers with less than three siblings (Group 1).

The disproportionately low percentage of single children comprising our study sample relative to the Jerusalem popula-

tion provides further evidence of the effect of supervision on accident risk. Somewhat surprisingly, the percentage of single children unattended at the time of the accident was similar for children with siblings. However, when accompanied, single children were far more likely to be attended to by an adult, and none were in the presence of children only (without an adult) at the time of the accident.

Family size did not impact on the time it took to arrive at the emergency room for children for whom interim medical assistance was not sought. However, when interim medical care was sought, this took more than twice the amount of time for children with  $\geq 3$  siblings compared to children with  $< 3$  siblings, and twice the amount of time to ultimately arrive at the emergency room. To our knowledge, this parameter as it relates to childhood accidents has not been previously studied. The relative delay in obtaining treatment after the accident in such cases may be due, at least in part, to the lack of knowledge and general ability of the child supervisor to contact a medical resource once the accident occurs. In addition, the logistic difficulties for the parent to arrange supervision for the other children while the injured child is being brought for medical care may also contribute to the time delay.

One limitation of this study is that the data are from a convenience sample and not from consecutive accident cases. Nonetheless, it is not likely that our study cases were different in any respect from all childhood accident cases that presented to the two medical sites during the study period, since our findings regarding gender ratio, mean age, the most common sites where accidents occurred, and the most common mechanisms of injury are similar to those of several other published studies on childhood accidents [10–13].

The relationship between childhood accident risk and family size has been examined in several studies. Of the studies that implicated multiple siblings as a risk factor for childhood accidental injuries, none actually directly documented supervision of the child at the time of the accident. Nixon and Pearn [1], in their investigation of sociodemographic features surrounding childhood drowning accidents in Australia, found an increased risk among children with multiple siblings. Interviewed parents expressed having a false sense of security when there were older siblings in the vicinity of the child before the drowning occurred. This study, however, was retrospective and therefore suffers from potential recall bias regarding both the impressions of the parent and the actual circumstances of the child's supervision at the time of the accident.

In a British cohort study of over 13,000 children [4], univariate analysis revealed a higher proportion of accidents resulting in hospitalization among children with three or more siblings. Interestingly, older rather than younger siblings conferred a greater accident risk. This finding supports the contention that in large families, inadequate supervision by older siblings predisposes younger children to accidental injuries. However, this study also relied on a questionnaire completed up to 5 years after the accident and did not assess the circumstances regarding supervision at the time the accident occurred.

Low social class, which has been demonstrated in many [6,7,14,15] but not all [3,10,11,16] studies to be a risk factor for childhood accidents, may also play a role in conferring a higher risk for accidents among children with multiple siblings. Indeed, families in our study with at least four children were of a lower socioeconomic status than families with three or less children. Since ours was not a case-control study we could not assess socioeconomic status as an independent risk factor.

Another possible explanation for the higher rate of accidental injuries among children with multiple siblings is that there are more children in the family who may accidentally cause injury to one another. To our knowledge, no studies have investigated this factor, which certainly warrants inquiry.

Of the studies that found no increased risk for accidental injuries among children with multiple siblings [2,11,17,18], one was conducted in northern Israel by Miron et al. [18]. The discrepancy between our findings and those of Miron and co-workers may be due to several factors. First, the study populations were dissimilar, as Miron included accidents occurring among children up to age 18 years old as compared to 12 years in our study. Further, the studies may differ with respect to the severity of injuries. Whereas we studied accidents among children who either presented to an emergency room or were already hospitalized, Miron's team studied accident cases seen in medical clinics in the community. It is also possible that variable cultural factors among different populations impact on specific risk factors for childhood accidents, thereby accounting for the lack of consensus regarding the effect of multiple siblings. Indeed, the populations of Jerusalem and northern Israel are culturally quite distinct.

The prevalence of an accidental injury in the same child during the 12 months preceding the injury included in our study did not vary with the number of children in the family. This is in agreement with the study that evaluated the tendency for repeat accidents in the same child over a 5 year period and found no association with family size [4]. We limited the time frame to one year since we suspected that parental recall over a longer period may be significantly less accurate.

Receipt of anticipatory guidance for injury prevention, immunization coverage rates, and the presence of window guards were used as barometers to compare access to healthcare resources, overall health status and proactive safety measures between the families with  $\leq 3$  and  $\geq 4$  children. Immunizations are a marker of receipt of other preventive health interventions [19] as well as a recognized indicator of overall health status [20]. Our two groups were similar with respect to report of prior receipt of anticipatory guidance, which at 22% was, in comparison to other studies [21], extremely low, and immunization coverage rates which at 94% was relatively high.

The higher percentage of households with window guards on all windows above the ground floor among families with  $\geq 4$  children compared to households with  $\leq 3$  children is most likely due to the fact that parents of larger families are more commonly homeowners, and as such, invest the cost to install window guards. Smaller families more often dwell as tenants in

homes they rent and are therefore less inclined to invest in the installation of window guards.

Thus, it appears that in our study population, parents of multiple children appear to take a similar degree of active measures towards insuring the well-being of their children as do parents of smaller families. We therefore postulate that the higher rate of childhood accidental injuries in large families does not reflect a difference in parental attitudes regarding the healthcare or safety of their children, but is rather, at least in part, a function of the parents' limited ability to supervise multiple children at once. Our study, like others, demonstrates that the "threshold" number of children in the family above which supervision, and thus safety, is compromised is three.

Education plays a vital role in preventing childhood injuries. The American Academy of Pediatrics [22] as well as other prominent societies and organizations recommend that injury prevention counseling be part of routine well-child care. Studies have shown that such efforts are indeed effective in reducing childhood injuries [23,24]. Moreover, targeting high risk groups with more intensive educational efforts has also shown success [25]. The results of our study suggest that healthcare providers, in their efforts to educate parents to take measures that will prevent childhood injuries, should direct specific attention to families with three or more children; secondly, they should emphasize to parents the particular importance of appropriate childhood supervision and not simply rely on older siblings as a proper substitute.

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