This study is another indication of the need for careful reporting, backed up by epidemiological investigation, as a basis for analyses of accidents that will lead to logical design of control measures. It also suggests the value of further work that will more accurately relate accident experience to exposure and risk.

Epidemiology of Childhood Accidents in Two California Counties

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THE SIGNIFICANCE of accidents as a cause of death and disability in childhood has been noted repeatedly in recent years in many parts of the world, and a large number and variety of investigations have been undertaken (*1*). Few of the reported studies, however, allow an assessment of the risk of accident within a definable population. Under these circumstances, comparison of the experience of different communities has been difficult, and quantitative evaluation of the effectiveness of prevention programs has been virtually impossible.

In 1956 the child welfare committee of the Alameda-Contra Costa Medical Association (Alameda and Contra Costa Counties, Calif.) and the bureau of maternal and child health of the California State Department of Public Health, sharing an interest in the problem of accidents among children, initiated a study with these primary objectives: to develop a method of estimating the extent of accidents in the two counties, to gather information on which to base

preventive measures, to establish measurements of accidental injuries for use in evaluating prevention programs, and to provide background for more intensive study of specific accidents.

Method of Study

Alameda and Contra Costa Counties lie adjacent on the eastern side of San Francisco Bay. The 1957 population, as estimated by the California State Department of Finance, was 1,229,700, of whom about 353,000 were under 15 years of age. Along the eastern shore of San Francisco Bay is a densely populated urban region, composed of San Leandro, Alameda, Oakland, Berkeley, Richmond, and a number of smaller municipalities. The coastal valleys farther east are filled with suburban commuter communities. In the extreme eastern portion of the counties, beyond easy commuting distance, are farms and ranches. Generally, the area is prosperous, and the population is reasonably representative of other urban-suburban complexes in California and elsewhere.

The topography and population distribution in these counties are such that there is relatively little drift outside the counties for emergency medical care. For example, only 5.2 percent of the 1957 resident births of the two counties oc-

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curred in other counties, including 2.2 percent in San Francisco, 1.4 percent in Santa Clara, and 0.7 percent in Solano.

The study of accidents was primarily descriptive, designed to determine the frequency of medically attended accidents in a defined child population and to describe their occurrence in time and space. The administrative officers of all 24 hospitals in the two counties (excluding the federally supported institutions) were contacted, and 23 agreed to cooperate by submitting reports on children under the age of 15 years admitted to the emergency rooms for treatment of an accidental injury. The report card was brief, giving the name, address, age and sex of the child, type of accident, and type of injury. The single hospital not included in this study was small and, we believe, represents a loss of less than 1 percent. The reporting system has been described in more detail elsewhere (2).

Preliminary reporting began on July 1, 1956, but complete reporting and analysis did not start until January 1, 1957, when the reporting system was adopted as a continuing function. The main part of this report covers the calendar year 1957; preliminary tabulations of data collected for 1958 are also presented. The analyses were based on a count of separate admissions, not an unduplicated count of individuals. When multiple injuries were reported for a single accident, the case was classified according to the most serious injury, insofar as this could be judged.

In addition to the hospital reports, a survey of accidental injuries seen in physicians' offices was conducted October 14–27, 1957, and again August 11–24, 1958. All physicians likely to treat children were sent copies of a roster form on which to record a few items of information about each case seen during the 2-week periods.

All Accidents

A total of 27,623 accidents in children less than 15 years of age were reported for 1957 from the emergency services of the hospitals of Alameda and Contra Costa Counties for an overall attack rate of 78.2 per 1,000 children per year. These cases were classified by type of accident and by type of injury, and the data are presented in table 1. Since an injury may be cared for at home, treated in a physician's office, or referred or admitted directly to a hospital, the relative frequency of various types of accidents and injuries cannot be presumed to be reflected in these data taken only from the hospital emergency room reports, for certain types are more likely than others to come to the attention of these facilities because of various social, medical, and legal implications.

Well over half the reported injuries were minor as judged by the diagnosis. Another

Table 1.   All childhood accidents reported by hospitals, by type of accident and by type of injury, Alameda and Contra Costa Counties, Calif., 1957

| Type of accident | Type of injury | | | | | | | | | |
	Contusion or abrasion	Laceration	Sprain or strain	Fracture	Head injury	Burn	Poisoning	Other and not stated	Total	Percent of total
Automobile accident	657	222	35	122	114	0	0	390	1, 540	5. 6
Fall	1, 291	4, 096	832	1, 385	529	50	0	939	9, 122	33. 0
Caught in device or object	736	466	26	83	1	3	0	145	1, 460	5. 3
Hit by object	753	2, 818	181	216	181	404	4	582	5, 139	18. 6
Stepped on object	69	425	4	0	0	30	0	912	1, 440	5. 2
Fire or explosion	2	4	1	1	1	56	0	7	72	0. 3
Firearms	2	1	0	1	1	3	0	20	28	0. 1
Ingestion	0	8	0	0	0	0	2, 109	509	2, 626	9. 5
Strangling or suffocation	0	1	0	1	0	0	1	18	21	0. 1
Other and not stated	792	2, 031	272	241	53	235	22	2, 529	6, 175	22. 4
Total	4, 302	10, 072	1, 351	2, 050	880	781	2, 136	6, 051	27, 623	100. 0
Percent of total	15. 6	36. 5	4. 9	7. 4	3. 2	2. 8	7. 7	21. 9	100. 0	_____

Table 2. All childhood accidents reported by hospitals, by age and sex, with attack rates per 1,000 population, Alameda and Contra Costa Counties, Calif., 1957

Age (years)	Males			Females			Both sexes			Ratio of male to female attack rates
	Estimated population [1]	Cases	Attack rate	Estimated population [1]	Cases	Attack rate	Estimated population [1]	Cases [2]	Attack rate	
Under 1 _____	13, 654	396	29. 0	13, 172	319	24. 2	26, 826	719	26. 8	1. 20
1 _____	13, 356	1, 342	100. 5	12, 936	973	75. 2	26, 292	2, 331	88. 7	1. 34
2 _____	13, 447	2, 263	168. 3	13, 128	1, 530	116. 5	26, 575	3, 826	144. 0	1. 44
3 _____	13, 527	1, 744	128. 9	13, 259	1, 166	87. 9	26, 786	2, 947	110. 0	1. 47
4 _____	13, 561	1, 488	109. 7	12, 977	939	72. 4	26, 538	2, 461	92. 7	1. 52
5–9 _____	62, 671	5, 613	89. 6	60, 941	3, 102	50. 9	123, 612	8, 813	71. 3	1. 76
10–14 _____	49, 351	4, 135	83. 8	47, 227	2, 004	42. 4	96, 578	6, 210	64. 3	1. 98
Not stated _____	_____	204	_____	_____	77	_____	_____	316	_____	_____
Total _____	179, 567	17, 185	95. 7	173, 640	10, 110	58. 2	353, 207	27, 623	78. 2	1. 64

[1] Estimates for midyear 1957.
[2] Includes those with sex not stated.

indication that most of the injuries were not serious was the small proportion of cases admitted to inpatient services following the emergency room visit. Of the 27,623 cases, only 1,256 (4 percent) were admitted to inpatient services for treatment or further observation.

To estimate the total load of childhood accidents on the medical facilities of the community, patients treated in physicians' offices must be added to the hospital group. During the 2-week period in 1957, 318 physicians (38 percent of 832 asked to report) recorded 530

Table 3. All reported childhood accidents, by day of week, Alameda and Contra Costa Counties, Calif., 1957

Day of week	Hospital reports		Physicians' reports [1]	
	Total number accidents	Average cases per day	Total number accidents	Average cases per day
Monday _____	3, 703	71	108	54
Tuesday _____	3, 539	67	93	47
Wednesday _____	3, 513	68	66	33
Thursday _____	3, 638	70	74	37
Friday _____	3, 496	67	82	41
Saturday _____	4, 617	89	50	25
Sunday _____	4, 880	94	57	29
Not stated _____	237	_____	0	_____
Total _____	27, 623	76	530	38

[1] 2-week period.

visits. Of these 530, 89 were also reported to us by a hospital. On the basis of these incomplete returns, we estimate that 1,000 to 1,100 cases were seen in physicians' offices during the 2-week survey in addition to those reported by the hospitals. During this same 2-week period 973 cases were reported by the hospitals. From these figures, we estimate that the total number of medically attended accidental injuries for 1957 was 50,000 to 55,000 for an incidence rate of roughly 150 cases per 1,000 children per year.

The physicians' reports included a considerably higher proportion of accidents occurring at school than the hospitals' reports. This confirms an opinion that school officials customarily refer ill or injured children to a particular practitioner, according to the families' requests, rather than to an institution.

Age and Sex Distribution

For both boys and girls the attack rates were lowest in those under 1 year of age. They rose rapidly to a peak between ages 2 and 3 years and declined thereafter throughout the age span covered in this study (table 2).

There were 17,185 boys and 10,110 girls in the 27,623 case reports (for 328 cases the sex was not recorded). The attack rates were 96 and 58 per 1,000 children per year for boys and girls respectively. Boys had higher attack rates at all ages, but the preponderance increased with age from a slight excess in infancy to almost

Age- and sex-specific attack rates for childhood accidents reported by hospitals, Alameda and Contra Costa Counties, Calif., 1957
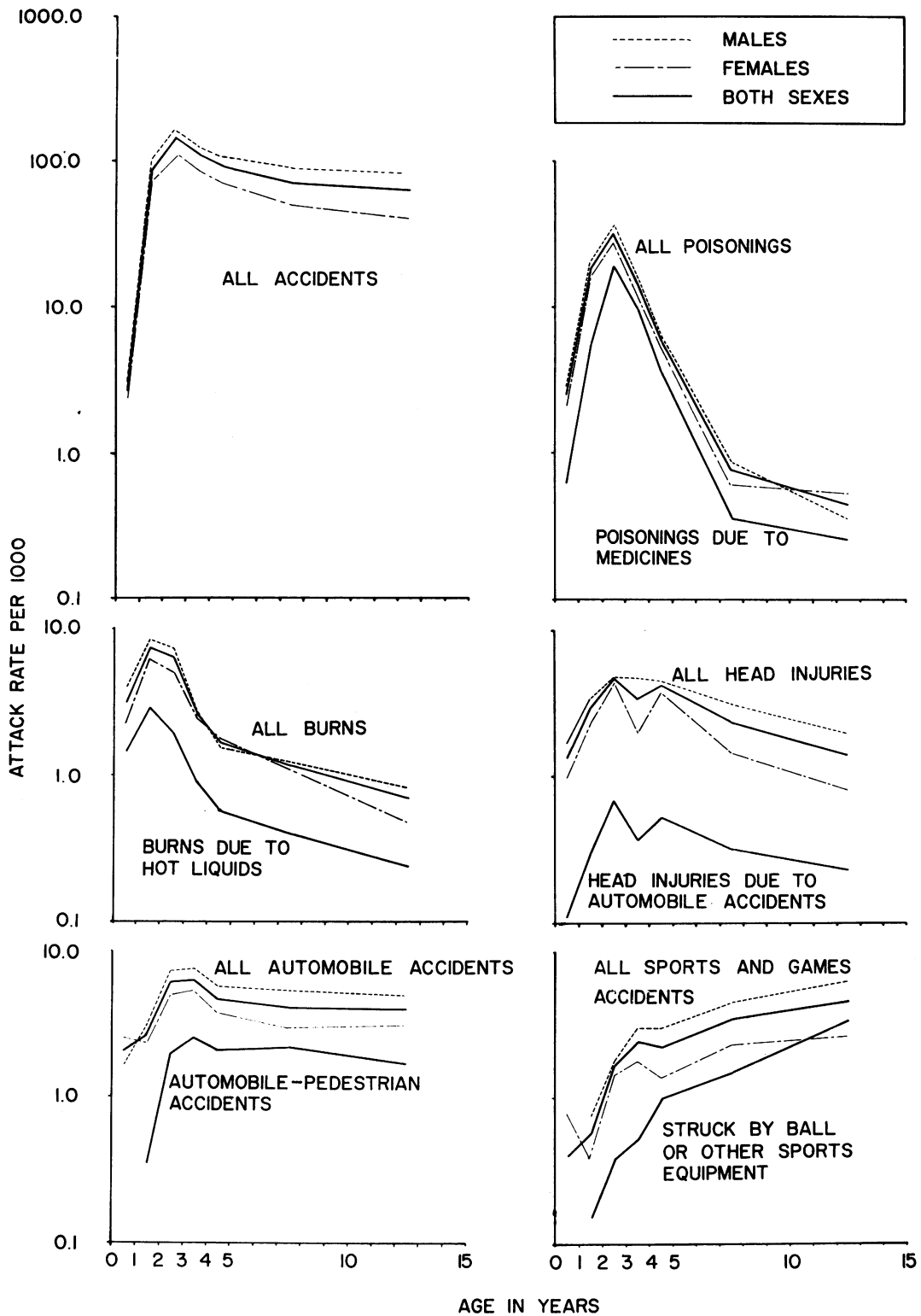
double the rate for girls among the 10- to 14-year olds (table 2).

Distributions by Season and Day

Since the population during this period was relatively constant, the average number of cases per day for each month can be treated as a rate. The curve described by these statistics had its lowest point in January with 50 cases per day, rose steadily to a peak of 102 per day in June, and then fell during the latter half of the year to 53 per day in December.

The cases seen in hospitals tended to occur more frequently on Saturdays and Sundays than on other days of the week, but there was no consistent pattern of high and low for the weekdays; conversely, the frequency of cases reported by private physicians was low on Saturdays and Sundays (table 3). If, as we believe, the cases reported to us by physicians represented almost half the actual number treated, then the Saturday-Sunday excess of cases reported by the hospitals just about balanced the deficit in the physicians' reports.

Selected Accidents and Injuries

For the cases reported by the hospitals in 1957, three specific types of injury and two specific types of accidents were selected for detailed analysis.

Poisoning

The hospitals reported 2,136 cases of accidental poisoning in 1957 (8 percent of the total accidents). Fifty-three percent were the result of ingestion of medicines, and 15 percent involved ingestion of insecticides. Seven percent of the cases were admitted to the inpatient services of the hospitals, a proportion similar to that for burns.

The age of greatest risk was between 2 and 3 years for both boys and girls (see chart). The curve rose steeply and fell sharply so that about four-fifths of the cases occurred in children under 4 years of age. The risk was similar for boys and girls, with boys showing a slight preponderance over girls except in the age groups under 1 and 10–14 years. The age curve for poisonings reached a peak about a year later than that for burns. Also interesting was the finding that the risk of ingesting insecticides

reached a peak earlier and fell more rapidly than the risk for medicines. This difference suggests that unpleasant experiences of touch and taste (and perhaps odor) are important in the development of avoidance reactions and thereby decrease the likelihood of accidental injury.

There was a significant seasonal swing for all poisonings combined, but the pattern differed for different substances. Ingestion of medicines and other miscellaneous substances was most frequent in the autumn, whereas poisoning with insecticides showed a marked excess in summer over winter. The summer increase in insecticide poisonings is undoubtedly related to the availability of these materials, but the reason for the seasonal variation in poisonings attributed to medicaments is not apparent.

The distribution by day of week showed that cases of medicine ingestion were relatively more frequent during midweek than on the weekend, while cases of insecticide ingestion had a reverse pattern. These findings may well be related to the availability of the materials and the variation in family activities.

Burns

A total of 781 cases were reported as burns (3 percent of the total accidents reported). Of these, 36 percent resulted from contact with a hot liquid, 7 percent from fire or explosion, and the remainder, 57 percent, from striking or falling against a hot object or in some manner not specified.

Seven percent of these cases were admitted to the inpatient services of the hospitals. For burns due to open fire or explosion, however, 29 percent were admitted (but this percentage is based on a small number of cases).

The highest incidence was for children between 1 and 2 years old, a younger age than for most other accidents (see chart), and thereafter the frequency decreased, rapidly at first, then more slowly. The same general pattern held for both sexes and for each of the categories. There were, however, some differences between the sexes. For burns of all types together, the risk for boys exceeded that for girls at all ages, except for a very slight preponderance among girls at age 4. For burns attrib-

uted to contact with hot liquids, boys suffered a higher attack rate up to age 4, but thereafter girls had the higher rates.

No significant differences were observed by season of the year for any of the types of burns recorded. The absence of a seasonal variation for burns caused by household heating devices is attributed to the benign and equable climate in the region surrounding San Francisco Bay.

Burns tended to occur more frequently at the beginning and end of the week. The difference is greater than would be expected by chance when tested against the hypothesis that all days should be equal ($X^2=16.9$; $P\approx0.01$).

Six hundred and ninety-eight (89 percent) of the reported cases occurred at home. Of these, 44 percent occurred in the kitchen; by far the majority of the remainder were reported as having occurred in some unspecified location in the home. For burns due to hot liquids, 66 percent were said to have occurred in the kitchen. Thus, the places of occurrence seem to reflect accurately the relative risk of exposure to fire and hot liquids.

Head Injuries

Head injuries are of special interest because of their potential seriousness. In this series, 20 percent of the cases were admitted to the hospital inpatient services as compared with 7 percent of the burns, 7 percent of the poisonings, and 4 percent of all accidents reported.

Of 880 head injuries, 60 percent were due to falls, 21 percent resulted from being struck by an object, and 13 percent occurred in automobile accidents.

Boys had 562 (64 percent) of the head injuries for an attack rate of 3.13 per 1,000 compared with 1.77 per 1,000 for girls. More boys than girls suffered head injuries at all ages, and in the age group 10–14 years, the ratio was about 2.5 to 1 (see chart). The only exception to the preponderance among boys was for injuries incurred in falls by children aged 2 years: the rate for girls was 3.35 per 1,000 compared with a rate for boys of 2.75 per 1,000.

For both sexes, the age of highest risk was 2 years, although the attack rate did not decline as sharply as for burns and poisonings, remaining relatively high through 4 years of age.

The seasonal distribution was somewhat irregular, but the rates were higher from March through August than during the late fall and winter. Head injuries in automobile accidents peaked in March, April, and May; the peak months for those due to being struck by an object were March through July; and head injuries incurred in falls were most frequent in June, July, and August.

The usual Saturday and Sunday excess was noted, although this was most evident in the categories of automobile accidents and falls and not at all consistent in the group injured by contact with objects.

Except for those incurred in automobile accidents, most of the head injuries occurred at home, mainly in the yard.

An interesting consideration with respect to head injuries is their relationship to the physical development of children. This may be seen by comparing the age variation in the proportion of head injuries resulting from a specific kind of accident. For example, automobile accidents occurred with an overall frequency of 4.36 per 1,000 children, while head injuries due to automobile accidents had a frequency of 0.32 per 1,000. But the proportion of automobile accidents which resulted in head injuries varied with age, being highest at age 2 and lowest in infancy and in the upper ages in the study, indicating an age specificity for head injuries, independent of the age distribution of automobile accidents.

Automobile Accidents

The hospitals reported 1,540 injuries due to automobile accidents, characterized as collisions, automobile-pedestrian accidents, and all other automobile accidents. The accidents in which the child was a pedestrian tended to be more severe than those in which the child was a passenger, as evidenced by the higher proportion of the cases which resulted in fractures and head injuries. Of the 640 automobile-pedestrian cases, 144 (22 percent) were admitted to the hospital, whereas of the remaining 900 cases, only 80 (9 percent) required hospital care.

Boys experienced a somewhat greater risk of automobile accidents than girls, 5.17 cases per 1,000 compared with 3.36 cases per 1,000. This

difference was largely attributable to accidents involving pedestrians, in which boys exceeded girls by a ratio of 2.2 to 1. It may be assumed that the propensity of boys to engage in more active games than girls, perhaps playing in the street more often, is reflected in their higher rates. For collisions there was virtually no difference between sexes. The male preponderance varied by age, and again this effect was produced primarily by the automobile-pedestrian category.

Automobile accidents were not nearly as age selective as burns or poisonings (see chart). The risk was low in infancy, but increased rapidly and remained high thereafter.

Automobile accidents tended to accumulate on weekends, especially for the category of collisions, and in the spring and summer. Collisions contributed heavily to the summer peak, and pedestrian accidents to the spring and summer incidence.

In some sections of the country, hazardous driving conditions in the winter months apparently cause an accumulation of automobile accidents in that season. However, here the climate appears to operate in a different way, increasing the risk of injury during weather which attracts our wandering population to the open road. This increased exposure to risk surely operates on weekends and during summer vacation from school when there are more cars and more children competing for the same amount of space on the streets.

Playground and Games Accidents

During the survey, 1,060 accidents were reported to have occurred in games and sports activities; 494 were due to falls from playground equipment, and 566 were due to being struck by balls or other sports equipment.

As would be expected, the risk of an accident in this category increased with age, being rare in the infant and the preschool child. There was a definite difference between the two categories; falls increased more rapidly to age 3 and tended to decrease in the older ages, while injuries from sports equipment rose more slowly but continued to increase throughout the age span studied. Boys were more frequently hurt than girls, with an attack rate of 3.91 per 1,000 compared with 1.94 per 1,000 (see chart).

This group of accidents holds particular promise for further study. Since a major share occur at school, they are relatively well documented. Moreover, if the study is limited to school children, the accident cases can be related to a definite population from which they came, and for this population group many social, economic, physical, and mental characteristics are already recorded.

Preliminary Data for 1958

During 1958, 28,622 accidents were reported by the hospital emergency rooms, an increase of 999 over 1957. The distributions of the cases by type of accident and type of injury were remarkably similar to those for the 1957 cases (table 4). The age distributions were also very similar (table 5). The occurrence of cases by month showed greater variation in 1958 than in 1957, but the pattern was no different. Thus, we have some evidence that the data reported by hospitals in 1957 were reliable.

The 1958 survey of physicians was much

Table 4. Relative frequency of various categories of childhood accidents, Alameda and Contra Costa Counties, Calif., 1958

Type of accident	Number	Percent	Type of injury	Number	Percent
Automobile accident	1, 521	5. 3	Contusion or abrasion	5, 517	19. 3
Fall	8, 740	30. 5	Sprain or strain	1, 088	3. 8
Caught in device or object	1, 439	5. 0	Fracture	2, 032	7. 1
Hit by object	5, 641	19. 7	Head injury	989	3. 5
Fire or explosion	99	0. 3	Burn	758	2. 6
Ingestion	2, 633	9. 2	Poisoning	2, 307	8. 1
Other	8, 549	30. 0	Other	15, 931	55. 6
Total	28, 622	100. 0	Total	28, 622	100. 0

more satisfactory in terms of completeness of reporting. Of 724 physicians asked to participate, 474 (66 percent) cooperated in the survey. A total of 753 case reports were submitted, and of these, 131 patients were referred to a hospital, leaving 622 who would not otherwise have been reported to us. On the basis of the percentage response, we estimate that about 950 accidents occurred during the 2 weeks. During the same 2 weeks, 1,358 accidents were reported from the hospitals. Thus, a higher proportion of our estimate of the total medically attended injuries came from the hospital reporting system in 1958 (59 percent) than in 1957 (46 percent).

There seemed to be a tendency in 1958 for more seriously injured patients to seek treatment in hospital emergency rooms rather than in physicians' offices; for example, 4 percent of the cases reported by the hospitals were admitted to inpatient services as compared with 2.9 percent of the cases reported by the physicians during the same time period. The chance of a poisoning case being seen in a hospital was about 4 times greater than in a physician's office. As in 1957, a relative excess of cases was reported on Saturday and Sunday from the hospitals and a relative deficit for those days from the physicians. When the two groups are combined, there is little variation according to day of the week of the accident.

Discussion

An epidemiological study of accidental injury illustrates many of the problems common to studies of conditions for which an etiological

Table 5. All childhood accidents reported by hospitals, by age, Alameda and Contra Costa Counties, Calif., 1958

Age (years)	Number	Percent
Under 1	840	2. 9
1	2, 899	10. 1
2	3, 693	12. 9
3	2, 876	10. 1
4	2, 432	8. 5
5–14	15, 556	54. 3
Unknown	326	1. 1
Total	28, 622	99. 9

agent is not well defined and the spectrum of illness is not clearly demarcated.

Consideration of etiology in relation to accidental injury may easily become bogged down in a semantic mire, for in the complex of events leading to an observed injury many different kinds of factors may be considered causal. For example, when a child falls from a high chair to the floor and suffers an injury, the cause may be considered to be a hard floor, an unwary child, a careless mother, or such an abstraction as height. This line of thinking seems profitless, and we therefore suggest that no attempt be made to define etiology in such restricted terms. Rather, the personal, social, and environmental factors should be considered as a whole, and patterns should be sought in the interrelationship of all of these.

What constitutes an accident can only be determined arbitrarily. An incautious child, in the care of a distracted mother, sitting in a high chair over a hard floor may be considered to be an accident about to happen. However true this may be, precise measures of the risk of such a circumstance are not easily determined. At some age nearly all children are incautious, at some time all mothers are distracted, high chairs by definition are high, and most floors are hard. If this incipient accident, then, is characteristic of the great majority of households with small children, and if injury is a random event within such households, no epidemiological study is needed, for the purposes of the study, to determine high-risk groups and to explain the reasons for the increased risk, cannot be satisfied.

One of the difficulties in many accident control programs has been the tacit acceptance of the philosophy of universal risk. Obviously, given our example, a control program may be proposed and carried out without detailed study. Mothers can be warned (repeatedly) of the general lack of healthy acrophobia in normal children; a widely publicized campaign to saw the legs off high chairs may be instituted; and more efficient shock-absorbing floor coverings may be designed and their purchase urged. To date, however, control programs of this nature have not been attended by striking success in reducing accidents.

Alternative hypotheses are (a) that hazards

are usually not uniformly distributed and (b) that in environments where certain hazards are almost always present injuries are not randomly distributed, but are related to other measurable attributes of the persons and objects involved. These hypotheses imply that accidents are not truly accidental but are determined and, to a degree, are predictable. Studies directed toward discovering the factors involved in accidents other than those physical objects immediately apparent may provide clues to new approaches to accident control or may indicate ways to increase the effectiveness of control programs of the kind mentioned previously.

Given an accident, the result may be no detectable injury through mild to severe to fatal injuries. Generally, the events that are most susceptible to study are the injuries of sufficient seriousness to require medical attention. While these may constitute only a small fraction of the total injuries of a given class, they are the most important group in terms of disability and therefore command a higher priority of attention.

Medically attended accidental injuries may be subdivided according to the place where treatment is given—at home, in a physician's office, a hospital emergency room, or a hospital ward—and by the subsequent disposition of the case. In this study, major effort was concentrated on cases seen in hospital emergency rooms, although some of these were referred to the hospital after first visiting a physician's office or following a physician's home visit. This information has been supplemented to some degree by the inclusion of a brief period of reporting of cases seen in physicians' offices. But our data omit accidental injuries not seen by a physician at all and some of those which required direct admission to the inpatient services of the hospitals. The extent of the distortion which these omissions introduced cannot be evaluated at present, although additional studies underway and being planned will help to clarify this point.

The occurrence within one year of more than 27,000 accidents actually or potentially serious enough for the patient to be seen in a hospital emergency room in a population of about 350,000 children is ample evidence of the magnitude of this problem and its impact on the medical facilities of a community. The evidence from the survey of practicing physicians' experience suggests that a like number are seen and treated in their offices. Our estimate, then, is that about 1 in every 6 or 7 children under 15 years of age receives medical attention for accidental injury in the course of a single year.

The observed variations in the risk of accidental injury related to differences in age and sex are consistent with previous reports. For example, the male-female differences probably reflect the greater venturesomeness of boys and their greater propensity for engaging in vigorous, poorly restrained physical activity. It would be expected that the sex differential in activity would increase with age, and the data fit this idea well as the relative excess among boys increases consistently throughout the age span included in this study.

With respect to the age-specific occurrence of accidents, the curves are surely related to important factors of exposure and physiological and emotional maturity. The low risk of accidental injury in the first year of life is determined by the relative insulation of the infant from the hazards of his environment, achieved by parental care and protection and by the limited mobility of the infant. The peak incidence in early childhood is a composite of a number of different kinds of accidents, many of which show a coincidence of their highest risk in this age period. This seems to be due to a rapid but still imperfect neuromuscular development of these children which provides them with the physical capacity for getting into hazardous situations before their emotional development has progressed far enough to provide them with the caution and recognition of danger which later modify the risk of accident.

Not all accidents follow this pattern, however. Automobile accidents and certain types of accidents related to sports continue to increase in frequency throughout the age span included in this study. These instances are almost entirely attributable to increasing exposure to the risk of accidents of this type, and in these cases maturation plays a significant role in increasing the risk, as the child graduates from jungle gym to football and from tricycles to automobiles.

The seasonal distribution found here is probably largely determined by the seasonal variation in exposure to risk. The summer peak is thus attributed to the larger number of daytime hours spent outside in activities which are less likely to be closely supervised by an adult. The same sort of argument may be applied to explain the distribution by day of week, with Saturday and Sunday offering the possibility of longer exposure. Also, the presence of two parents on the scene, reinforcing each other's worries, may increase the chances of an injured child being brought to treatment. Finally, the fact that many physicians do not keep weekend office hours may play a part in increasing the chances of an accident patient coming to the hospital instead of receiving office treatment. The relative importance of these various possible explanations cannot be evaluated from our data.

The findings relating to the places where the accidents occurred are not remarkable. In general, accidents occur in and around the house about as would be expected from our knowledge of probable location of hazards.

Comparison of these data with those reported in other studies clearly would be desirable. Our attempts to do this have not, however, been very successful. Comparison is hampered by:

1. Differences in classification of accidents and in definitions for similar classifications.

2. Differences in study design, especially with respect to the inclusion or exclusion of certain segments of the population, the exclusion of particular classes of accidents, and the methods used to collect information.

3. The lack of rates. Most of the reported

Table 6. Percentage distribution of different types of accidents in children aged 0–14 years, from selected studies

Type of accident	San Francisco home accident study [1]	San Francisco emergency hospital reports [1]	Santa Barbara study [1]		Alameda-Contra Costa study
			1955	1956	
Automobile accident	([2])	4. 6	5. 7	5. 4	5. 6
Fall	34. 1	35. 0	36. 7	32. 2	33. 0
Caught in device or object	10. 3	4. 8	4. 4	5. 7	5. 3
Hit by object	24. 3	21. 6	26. 2	25. 5	18. 6
Stepped on object	2. 4	5. 4	4. 5	3. 8	5. 2
Fire or explosion	2. 6	0. 5	0. 8	0. 5	0. 3
Firearms	0. 0	0. 0	0. 0	0. 0	0. 1
Ingestion	14. 5	4. 6	7. 5	9. 4	9. 5
Strangling or suffocation	0. 1	0. 0	0. 6	0. 4	0. 1
Other and not specified	11. 8	23. 6	13. 5	17. 1	22. 4
All types	100. 1	100. 1	99. 9	100. 0	100. 0

[1] Reference 3.   [2] Excluded.

Table 7. Attack rates per 100 persons per year for accidental injuries, by age and sex, from selected studies

Age (years)	New Bedford, Mass.[1]		Washtenaw County [2]		National Health Survey [3]		Alameda and Contra Costa Counties [4]	
	Males	Females	Males	Females	Males	Females	Males	Females
Under 1	1. 5	1. 6	8. 6	8. 8	32. 7	20. 9	2. 9	2. 4
1–4	8. 1	5. 1					12. 7	8. 8
5–9	7. 8	4. 2	9. 4	8. 0	30. 1	18. 3	9. 0	5. 1
10–14	6. 7	2. 6	5. 5	4. 2			8. 4	4. 2
Total	7. 1	3. 9	8. 2	7. 4			9. 6	5. 8

[1] Reference 4.   [2] Reference 5.   [3] Reference 6.   [4] Based on hospital reports only.

studies are based on a series of cases which cannot be related to a definable population.

In comparing the relative frequency of the different types of accidents, the problem of classification is very significant. Even making allowances for minor differences in terminology will not allow comparisons to be made between studies employing a dual method of classification, such as we used, and those using only a single list of categories. Therefore, only data from other studies made in California (*3*) may be used. This comparison is given in table 6. The results of these five sets of data are very similar, well within the limits of error when it is remembered that the studies were done in different ways, with different people classifying the individual accidents, and that there was a spread of some 5 years from the first to the most recent.

A limited comparison between studies was possible in terms of age- and sex-specific attack rates (table 7). Again the data show similar patterns. The study reported by Rice and co-workers (*4*) was based on data collected from hospitals, private physicians, schools, and other sources in New Bedford, Mass. The Washtenaw County cases (*5*) were collected by interviewing a probability sample of households, and the data presented relate to injuries of a severity comparable to those included in our data. The National Health Survey data (*6*) were obtained from interviews of a probability sample of about 36,000 households throughout the United States during the period July 1957 through June 1958. Since our estimated attack rates for Alameda and Contra Costa Counties for all medically attended accidental injuries are approximately twice the rates given in table 7, which are based on hospital reports only, there is considerable difference between the estimates derived from the various studies. The Massachusetts and Washtenaw County rates are about half as great as those from Alameda and Contra Costa Counties and the National Health Survey rates are about a third higher. The reasons for these differences are not apparent.

The Alameda-Contra Costa Counties study has fulfilled three of its stated purposes well. First, the magnitude of the problem of childhood accidents is clearly demonstrated, for the incidence is high even after the minor injuries are discounted. Second, the results of this study have already been used in planning two additional studies, one on poisonings and one on burns. Third, the data collected for 1957 are confirmed by the 1958 findings, and a continuation of this reporting procedure is planned so that variations in incidence over a longer period of time may be reckoned and a well-defined baseline may be developed.

The fourth goal, to gather information on which preventive programs may be based, was not so well fulfilled, however. Certainly, these data have given us a clearer picture of the relative significance of various types of accidental injuries and have raised many provocative questions needing further study, but the findings are too crude to identify the specific factors in the etiology of accidents which are most vulnerable to attack.

Summary

By means of brief report cards completed by the staffs of the emergency rooms of the hospitals in Alameda and Contra Costa Counties, Calif., the incidence of accidental injuries to children under 15 years of age is calculated as 78.2 per 1,000 children per year. Reports from practicing physicians indicate that an approximately equal number are receiving office treatment, for a total incidence of medically attended accidents in these counties of about 150 per 1,000 children per year.

More than half the cases reported from the hospitals were minor and only 4 percent required inpatient care, although the severity varied widely for different types of accidents and different categories of injury. The age at greatest risk of accidental injury was between 2 and 3 years; certain categories, however, showed an increasing risk with increasing age throughout the age span under study.

The data collected are not detailed enough to allow intensive analysis, but the findings will be useful in planning future studies of specific kinds of accidents.

REFERENCES

(*1*) Berfenstam, R.: A critical review on different types of accident morbidity studies. Courrier 7: 349–360, July–August 1957.

(2) Cobb, O., Williams, J. H., and Corsa, L., Jr.: Childhood accident prevention: Program and statistical survey by a county medical society. California Med. 91: 62–64, August, 1959.

(3) Home safety project: Final report, 1953–1957. Monograph. Berkeley, Calif., State Department of Public Health, 1957.

(4) Rice, R. G., Starbuck, G. W., and Reed, R. B.: Accidental injuries to children. New England J. Med. 255: 1212–1219, December 27, 1956.

(5) An investigation of the causes of home accidents. Progress report. Ann Arbor, University of Michigan School of Public Health, Department of Public Health Statistics, March 1952.

(6) U.S. National Health Survey: Persons injured by class of accident, United States, July 1957–June 1958. PHS Pub. 584–B8. Washington, D.C., U.S. Government Printing Office, 1959, p. 29.

PUBLICATION ANNOUNCEMENTS

Blondie Mental Health Calendar (1961–62) and *Blondie Mental Health Bookmark.* Office of Mental Health Education and Information, New York State Department of Mental Hygiene, 240 State Street, Albany.

Housing Codes. The Key to Housing Conservation. Vol. 1. Background of Code Enforcement. Vol. 2. Model Housing Code Applicable to One- and Two-Family Dwellings, Multiple Dwellings, Mobile Homes, and Mobile Home Courts. Vol. 3. Administrative Guide. A demonstration project by the New York State Division of Housing in cooperation with the Housing and Home Finance Agency. 1960; 42 pages. New York State Division of Housing, New York.

Group Health & Welfare News. Vol. 1, No. 1, September 1960; 8 pages; $4 per year. Group Health Association of America, Inc.. 343 S. Dearborn Street, Chicago 4.

Protein and Amino Acid Requirements in Early Life. By L. Emmett Holt, Jr., Paul György, Edward L. Pratt, Selma E. Snyderman, and William M. Wallace. 1960; 63 pages; $1. New York University Press, Washington Square, New York 3.

Schistosome Dermatitis (Swimmer's Itch), Its Cause, Prevention, and Control. Leaflet. Minnesota Department of Health, University Campus, Minneapolis 14, Minn.

Report of the Subcommittee on Organization for Health. Committee on Medical Care, Maryland State Planning Commission. Publication 109. June 1960; 22 pages; 50 cents. State Planning Department, 1108 State Office Building, Baltimore 1, Md.

If Your Child Has a Congenital Heart Defect. 1960; 47 pages. American Heart Association, 44 East 44th Street, New York 10.

Increasing the Effectiveness of Western Science. 1960; 18 pages. National Science Foundation, 1951 Constitution Avenue NW., Washington 25, D.C.

Looking Ahead to Retirement. Manual for discussion leaders. 1960; 43 pages. *Looking Ahead to Retirement.* A retirement education program. Discussion guide. September 1960; 369 pages. *Older and Retired Workers Plans, Programs, and Services in the Field of the Aging.* 1960; 31 pages. Committee on Retired Workers, United Steelworkers of America, 1001 Connecticut Avenue NW., Washington 6, D.C.

The Challenge to Labor Following the White House Conference on Aging. Paper delivered by B. W. Ohler at Conference on Aging, Ann Arbor, Mich., June 27, 1960. 8 pages. Committee on Retired Workers, United Steelworkers of America, 1001 Connecticut Avenue NW.. Washington 6, D.C.

Sunlight and the Skin. 11 pages. Committee on Cosmetics, American Medical Association, 535 North Dearborn Street, Chicago 10.

Funds for Research and Development in Industry, 1957. Performance and financing. Surveys of Science Resources Series. NSF-60-40. 1960; 119 pages; 65 cents. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

SEC Technical Reports

A limited number of the following reports are available from the Sanitary Engineering Center, Public Health Service, Cincinnati, Ohio. Order by number.

Radiation Surveillance of the Environment. Technical Report R59–5. By Conrad P. Straub. 1959; 16 pages.

Radionuclide Analysis of Environmental Samples. A laboratory manual of methodology. Technical Report R59–6. Edited by Paul F. Hallbach. November 16, 1959.

The Bacteriological and Chemical Behavior of Silver in Low Concentrations. W60–4. By Cecil W. Chambers and Charles M. Proctor. 1960; 18 pages.

Air Pollution in Hamilton, Ohio. A60–8. By Paul A. Kenline. 1960; 12 pages.

Publications. Section 2. Milk and food. F60–1. 1960; 11 pages.

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