

A Sample Survey of Home Injuries

By F. M. HEMPHILL, Ph.D.

On the basis of preliminary data from the continuing study of nonfatal home accidents in Washtenaw County, Mich., we can say, with some confidence, that:

1. There were, on the average, six home injuries per person during the year.

2. Females suffered approximately twice as many injuries as males.

3. The most frequent type of injury reported was "cuts," and the part of body most often injured was "fingers and hands."

4. Factors clearly important in planning programs of prevention of home accidents include: age of persons, time spent at home (exposure time), crowding, emotional and psychological states of persons, environmental factors, activity of person.

5. A preliminary study between "height-weight-age" and "rates of injuries" showed no clear association.

6. Injuries from falls, although relatively infrequent, appear important from the standpoint of severity in terms of "days lost," "costs" and "duration of injury."

7. Most nonfatal home injuries occurred in the kitchen. Most kitchen injuries were burns incurred during food preparation.

8. Forty to fifty percent of home injuries occur between 10 a. m. and 12 noon and between 4 and 6 p. m.

Dr. Hemphill is associate professor of public health statistics at the School of Public Health, University of Michigan. This paper was presented June 19 at the Second Conference on Public Health Statistics, School of Public Health of the University of Michigan, Ann Arbor.

The Washtenaw County Health Study

An investigation of the extent and causes of nonfatal accidental injuries occurring in the homes of Washtenaw County, Mich., as reported by householders, was conducted by the School of Public Health of the University of Michigan from February 1, 1951, to January 31, 1952. Funds were provided by the Division of Research Grants, Public Health Service.

The study did not purport to solve all problems of home accidents. Its primary purposes were to find the rate of accidental injury occurring within the homes of Washtenaw County from study of a segment of the population and to study selected factors—environmental, physical, and psychological—associated with injuries and injured persons. Many subsidiary phases of the study were contemplated, all of them dependent on fulfillment of the primary purposes.

Methods of study included interviews of responsible members of dwelling units by trained interviewers, the dwelling units being a probability sample of the dwelling units of the county, and a detailed appraisal of selected environmental factors found in a subsample of dwelling units selected from the original probability sample.

At the time this study was planned, reports of scientifically designed sampling studies of nonfatal accidental injuries incurred within homes were scarce, and lacking in essential criteria. Therefore, there were no estimates of expected rates for planning of optimum sample size and sampling procedures. Definitions were inadequate for research purposes. Acceptable questionnaires were not available. Codes for data were undeveloped. There were no interviewers

available who had experience in this field of inquiry. Data were inadequate for prediction of rates of refusal to be interviewed. These inadequacies were recognized before the investigation was proposed.

Furthermore, there was cognizance that success of such a study would be dependent on organized cooperative effort of several agencies and of the citizens of Washtenaw County. This study was a cooperative undertaking and not the result of individual research.

Interviewers comprised the largest and most important of the cooperative working groups. These citizens of Washtenaw County submitted to long hours of preparatory training in techniques of interviewing, adjusting themselves to rigid supervision, filling quotas of work, becoming skillful in gaining the confidence of respondents, avoiding dog bites, repairing tires and cars, explaining their activities to understanding police officers, and developing proficiency in other necessary techniques of experienced and confident interviewers.

All the consultation, action, supervision, and skills would have been in vain had there not been cooperation in the study by the selected respondents. Approximately 2,500 dwelling units were visited by the interviewers. Less than 4 percent of these calls resulted in no information. Outright refusals to give interviews were very rare. Each of the staff of the investigation will long remember and appreciate the gracious persons who gave freely of their time and registered interest in the success of the study. The extraordinarily high response rate bespeaks skill on the part of interviewers sincerely interested in their work. Moreover, such rates of response may indicate recognition of the problem of accidental injuries and genuine desire on the part of our citizens to avoid these unfortunate events. Approximately 1 percent of the citizens in the sample proved exceptions to the rule by refusing to be interviewed. Other losses were relegated to the inevitable "not at home," "illness," and "out of town" categories.

Several noteworthy observations were made regarding the conduct of sample surveys of home injuries. Other investigators might profitably consider the following:

1. The word "accident" has different meanings to different persons. The term may include torn dresses, runs in hosiery, loss of jewelry, and other unexpected events not associated with injury. The word "accident" was used rarely in this study.

2. The cost of interviewing persons about all "accidents" was prohibitive in both time and funds. Accordingly, the investigation was limited to "accidental injury to persons" while in their homes, that is, in their dwelling quarters and immediate yard, lawn, and garage (Census Bureau definition of dwelling unit).

3. Effort spent in training interviewers was highly profitable in quality of data elicited and in saving of field survey time.

4. Change of interviewers on "call backs" to persons refusing to answer questions on the first call often resulted in successful interviews. Other techniques were useful in gaining entry to the home and in getting data, but all involved courtesy, a pleasant attitude, and sincerity of purpose.

5. Persons have difficulty in recalling accidental injuries, even relatively severe injuries. There is great loss in recall of injury with the passage of time.

6. Reporting of information given to "open end" questions—those allowing complete freedom of response—brought forth disclosures loaded with valuable information. However, skillful probing and "funnel-type" questions—transitional questions, from the general to the specific—were useful in providing uniformity of opportunity to impart information, attitudes, and ideas.

7. Methods used in this investigation produced reliable results from sample to sample, in terms of rates of injuries.

8. Survey methods can be used as practical tools for determining rates of accidental injuries. These methods can be made economical in time and in costs.

Scope and Design of the Sample

Washtenaw County was the study area or universe. However, institutions, hotels, dormitories, and fraternity, sorority, and rooming houses with more than eight roomers were not included. The basic principle of the sample

design was that every dwelling unit within the universe had a known chance of being selected in the sample. The Survey Research Center of the University of Michigan advised stratified-area sampling methods (see diagram) to fulfill this aim and, on the basis of previous survey experience and a conservative estimate of expected rates of injury, also advised the preparation of a total sample of approximately 3,000 households—one-twelfth of the total dwelling units (36,000) of the universe.

This total sample was divided into six subsamples of approximately 500 dwellings each, from which interviews were to be collected over a 6-month period. The principal reasons for planning six subsamples were to study seasonal trends and characteristics of home injuries, to avoid any possible effect of repetitive interviewing on occupants of dwelling units, and to economize by training and administration of a small staff for 6 months rather than of a large staff for a shorter time.

Considering that the interviewing would require 6 months, it would be necessary to conduct interviews in 1 out of 72 of the dwelling units in the county each month. Since a minimum of 500 interviews was desired from each monthly subsample, an additional 10 percent of the dwelling units in the county were selected to allow for sampling losses and nonresponses. Monthly subsamples were therefore set at approximately 550 dwelling units each—a total sample of approximately 3,300. This represented about one-eleventh of the total, establishing a sampling interval of 1 in 66 dwelling units for each monthly subsample.

When the sampling error had been computed for the first two monthly subsamples, it was concluded that reliable estimates of incidence of home injuries could be established by fewer than the planned six monthly subsamples of 500 interviews each. Therefore, the sixth and last subsample was deleted from the proposed total sample. The desired size of the revised sample (5 subsamples) was 2,500 completed interviews, of which 2,453 interviews (98 percent) were obtained.

The chosen area sampling procedure produced a total of 311 sampling strata. These were outlined on maps after a detailed study of aerial photographs.

Stratified Sampling Terminology Washtenaw County Survey

1. **Dwelling unit (D. U.).** A group of rooms or a single room, occupied or intended for occupancy as separate living quarters by a family or other group of persons living together, or by a person living alone. A group of rooms occupied or intended for occupancy as separate living quarters is a dwelling unit if it has separate cooking equipment (1).

2. **Stratified sampling.** Classification of the universe into strata and the drawing of a sample from each stratum.

3. **Stratum.** A division of the universe (county) containing homogeneous counterparts. In this study, a stratum contained approximately 66 dwelling units, except in lake and rural areas, where the stratum size was about 132 units.

4. **Block.** A subdivision of a stratum, bounded by streets or other recognizable boundaries (1).

5. **Section number.** A number assigned to designate a prescribed number of dwelling units within a stratum. In this study, each number from 1 through 11 represented approximately 6 dwelling units. Therefore, a complete set of these numbers, from 1 through 11, inclusive, represented a stratum of about 66 dwelling units.

6. **Block listing.** The recording in consecutive order of the address or description of every dwelling unit within a sample block.

7. **Listing sheet.** The form on which block listing was recorded. This form contained a diagram of the block to be listed, showing the point at which the listing was to commence and proceed in a clockwise direction.

8. **Within-block-interval.** The interval between selected addresses on a block listing sheet. In this study the interval was 6 or a multiple of 6, and was determined by the number of section numbers contained in any one sample block. For example, if a block contained three section numbers, the within-block-interval number would be 3 times 6, or 18.

9. **Segment number.** The 20 townships of Washtenaw County were each designated by a segment number from 1 through 20. The segment numbers had no significance in the sampling procedure but facilitated the geographical grouping of interviewers' assignments and the computation of work and mileage records.

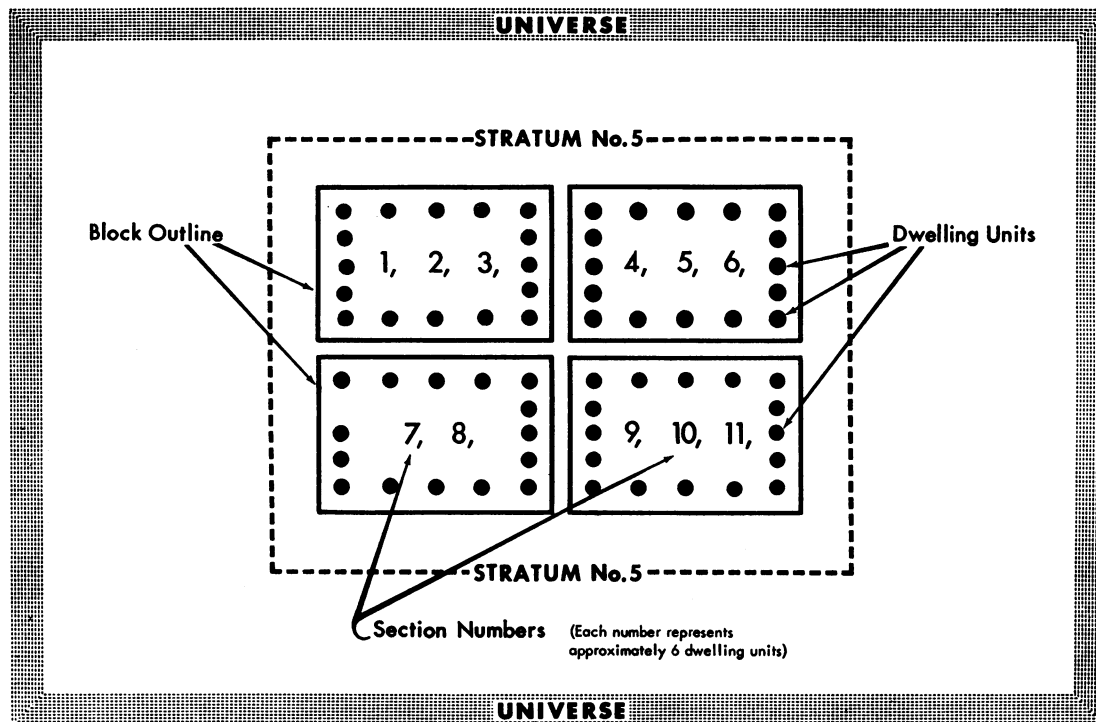
Strata-Block Designation

For this study, Washtenaw County's population was considered to be of six general population groups. As an aid in distinguishing the

general population types from which the various strata were drawn, the strata (and their representative blocks) were classified and numbered in distinct groups. This arrangement

provided efficiency in planning travel, in assigning interviews, and in other phases of the survey as well as allowing for rapid tabulation by population types, as follows:

Example of two-stage stratified sample address selection as applied in Washtenaw County survey



The probability of selecting any dwelling unit in this stratum was $\frac{C_i}{11} \times \frac{1}{6 \times C_i} = \frac{1}{66}$ where $\frac{C_i}{11}$ was the probability for selecting the i^{th} block and $\frac{1}{6 \times C_i}$ was the probability for selecting dwelling units within the i^{th} block. To determine which block represented the stratum, a number between 1 and 11, the range of section numbers, was selected from a table of random numbers. For example, if the number was 7, this would indicate that the block which contains section No. 7 was selected for sampling. In this sample, the selected block also contained section No. 8, thus C_i was equal to 2, the number of section numbers assigned to the i^{th} block.

In this example, the selected block was found to contain 15 dwelling units. Since this block had two section numbers, the within-block-interval to be used for selecting the addresses—total section numbers times 6 (2×6)—was 12. A systematic selection was then made from this block by first drawing a random number (not greater than the within-block-interval) between 1 and 12 to designate the first or starting address on the block listing sheet. In this case, the random number was 2, which designated the first address selected in the block. By adding the within-block-interval (12) to the first address (2), the second address was determined as number 14. These two selected addresses, therefore, represented stratum 5 for one subsample and were identified on the listing sheet for future use.

<i>Code</i>	<i>Areas</i>	<i>Population type</i>
1-102	Ann Arbor	Urban.
110-162	Fringe areas of and between Ann Arbor and Ypsilanti	Congested rural.
163-172	Pittsfield Village	Emergency housing.
201-270	Ypsilanti	Urban.
286-299	Willow Run Village	Emergency housing.
301-330	Small town: Chelsea, Dexter, Manchester, Milan, and Saline	Towns and villages.
401-408	Lake areas	Seasonal residence.
501-524	Open country or rural areas	Rural.

Listing

Block listing was done in March 1951 by the interviewers as part of their training by the Survey Research Center. One block from each of the 311 strata was listed at this time and used for the selection of the addresses for the first two subsamples. As residents of successive subsamples were interviewed, small blocks were depleted and new blocks were listed in Ann Arbor, Ypsilanti, and congested rural areas, and the small towns prior to interviewing the third and fifth subsamples.

Selection of the third and fourth subsample addresses required the listing of 202 new blocks from the 311 strata. These blocks were assigned "A" numbers to distinguish them from the original and subsequent block listings. The fifth subsample required the listing of 149 new blocks, which were assigned "B" numbers.

In the rural and lake areas, the "blocks" (clusters of D. U.'s) were depleted slowly. Therefore, in these areas, the same blocks were used throughout the five subsamples, as were the listings of Willow Run and Pittsfield Villages.

The listing of every dwelling unit in Willow Run Village and Pittsfield Village was practicable by the use of address-location maps of these developments furnished by their respective managements. These areas were treated as unblocked strata and, therefore, having been completely listed, were sampled systematically at an interval of 66 for the entire survey.

The listers were instructed to inquire at large dwelling structures to determine the number of dwelling units in the structure. When there was no response to the inquiry, it was necessary for the lister to use ingenuity to deduce the number of dwelling units within a structure. Counting mailboxes, doorbells, TV antennas, and meter boxes, and inquiring of mailmen, milkmen, and neighbors were useful methods in determining the number of dwelling units at one address or structure.

After the listing and selecting of dwelling units had been completed, identifying information was transcribed to questionnaires and to a registry kept in the survey office. This registry proved an efficient device to account for each questionnaire at all times.

Subsample for Environmental Appraisal

A subsample of dwelling units for environmental appraisal was drawn from the total sample subsequent to completion of the injury-interview phase of the study. Selection was designed to facilitate comparison of environmental findings between homes from which injuries had been reported and homes which had reported no injuries. Selection of the units, therefore, admitted approximately an equal number of "injury" and "noninjury" homes for the environmental study. Known probability of the selection of each dwelling unit in this subsample was preserved. Appraisal was completed at 263 of the 330 dwelling units selected for this study.

Household safety appraisal forms prior to this study dealt separately with specific environmental features, such as water systems and heating systems. Environmental survey schedules which allowed complete and systematic recording of appraisal items and conditions for each room were developed for this study by repeated field tests and subsequent revisions until their content, sequence of items, and format were realistic.

Results of the environmental appraisal will be available later. Findings to date indicate:

1. A larger percentage of refusals to cooperate may be expected in environmental appraisals than from injury interviews.
2. Training of personnel for environmental appraisal is essential.
3. The type of appraisal schedule developed in this study is far superior in arrangement to schedules previously used.

4. Concepts of sampling surveys should be employed in environmental appraisal for the sake of economy and time, and perhaps for accuracy of results.

5. Environmental hazards are important factors in causing accidents in homes.

The size of sample taken for appraisal in this study will produce a relatively large sampling error for most or all items of the schedule. However, as heretofore stated, the primary purpose of the substudy was to investigate differences between hazards found in homes from which accidents had been reported and homes which had not reported accidents.

Administrative Controls

Supervisory controls were established over interviewers, content of completed interview schedules, production rates of interviewers, and coders. Fiscal controls were established independent of supervisory controls.

Applications of interviewers were screened. Those selected were trained by lecture, demonstration, and supervised interviewing. All completed interview schedules were edited for completeness and quality of content before acceptance.

Coding of the data was begun subsequent to

acceptance of interviewers' records for the first two subsamples of the injury study. Controls over coding were evolved. Coders were trained, and their work checked for accuracy and completeness. Coded data were punched on IBM cards and checked for punching mistakes preparatory to tabulations.

Evaluating the Method of Study

In planning the investigation, certain criteria of consistency of findings from monthly sample to monthly sample were formulated for evaluation of methods used. Among the topics to be evaluated for consistency were male-female ratio of sample population, room-person ratio, and injury rates.

Male-to-female ratios for the five consecutive subsamples were 0.98, 0.98, 0.96, 0.94, 0.94, respectively. Variations of subsample ratios from the total-sample ratio were less than 2 percent. Room-person ratios varied by subsample from 1.6 to 1.7. Injury rates (table 1) were highly consistent from subsample to subsample, ranging from superficial injuries to females from 14 to 16 per 100 and males from 7 to 8 per 100; major injuries to females ranged from 57 to 62 per 1,000; to males, from 33 to 52 per 1,000.

Consistency of findings between subsamples

Table 1. Injury rates, by sex and degree of injury

Item	Females					Total sample	Males					Total sample
	Monthly sample						Monthly sample					
	1	2	3	4	5		1	2	3	4	5	
Superficial injuries within 1 week prior to date of interview												
Number of persons.....	819	801	796	787	793	3,996	801	785	774	739	743	3,842
Number of injuries.....	130	118	112	116	125	601	64	55	62	57	55	293
Injury rate, percent.....	15.9	14.7	14.1	14.7	15.8	15.0	8.0	7.0	8.0	7.7	7.4	7.6
Standard error of sampling, percent.....	1.8	1.4	1.4	1.1	1.1	.7	1.2	1.0	1.0	1.4	.8	.5
Major injuries within 1 year prior to date of interview												
Number of persons.....	819	801	796	787	793	3,996	801	785	774	739	743	3,842
Number of injuries.....	50	43	49	44	45	231	42	31	36	24	25	158
Injury rate, percent.....	6.1	5.4	6.2	5.6	5.7	5.8	5.2	4.0	4.7	3.3	3.4	4.1
Standard error of sampling, percent.....	.7	1.0	.9	1.1	.9	.3	.8	.6	.8	.7	.7	.3

led to the following conclusions: The sampling methods and procedures used in the study were reliable; data of the study might be considered as one sample; and efficiency of the sample was satisfactory considering the estimates on which the design was based.

Examples of Findings

The illustrative findings here reported are subject to limitations of the methods used, the universe from which the sample was selected, and the interpretations applied to the data. Application of these findings to populations or environments which are distinctly different from those of Washtenaw County, Mich., in 1951 would be unwarranted.

Types of Injuries

Injuries which resulted in either: costs, lost time, kept from usual activity, or required treatment outside the home, were classified as "major" injuries. All other injuries were considered as "minor" or "superficial."

Superficial injuries were based on reported injuries sustained within 1 week prior to the date of interview. Major injuries were based on reported experiences within 1 year prior

to the interview date and occurring in the dwelling unit at which the interview was taken.

Injury Rates and Sites

Procedures used, definitions imposed, loss of recall with passage of time, and perhaps other restrictions led to the conclusion that injury rates as determined by this study were minimal.

Highly significant differences resulted between rates of the two sexes for both major and minor injuries (table 1). Rates of major injuries to females approximated 6 injuries per 100 females per year; to males, 4 per 100 per year. Rates of superficial injuries to females approximated 15 injuries per 100 per week; to males, 8 per 100 per week (see chart and table 1). Simple extension of rates for 1 week to that of 1 year indicates that each female may average eight superficial injuries per year while males may average four such injuries per year.

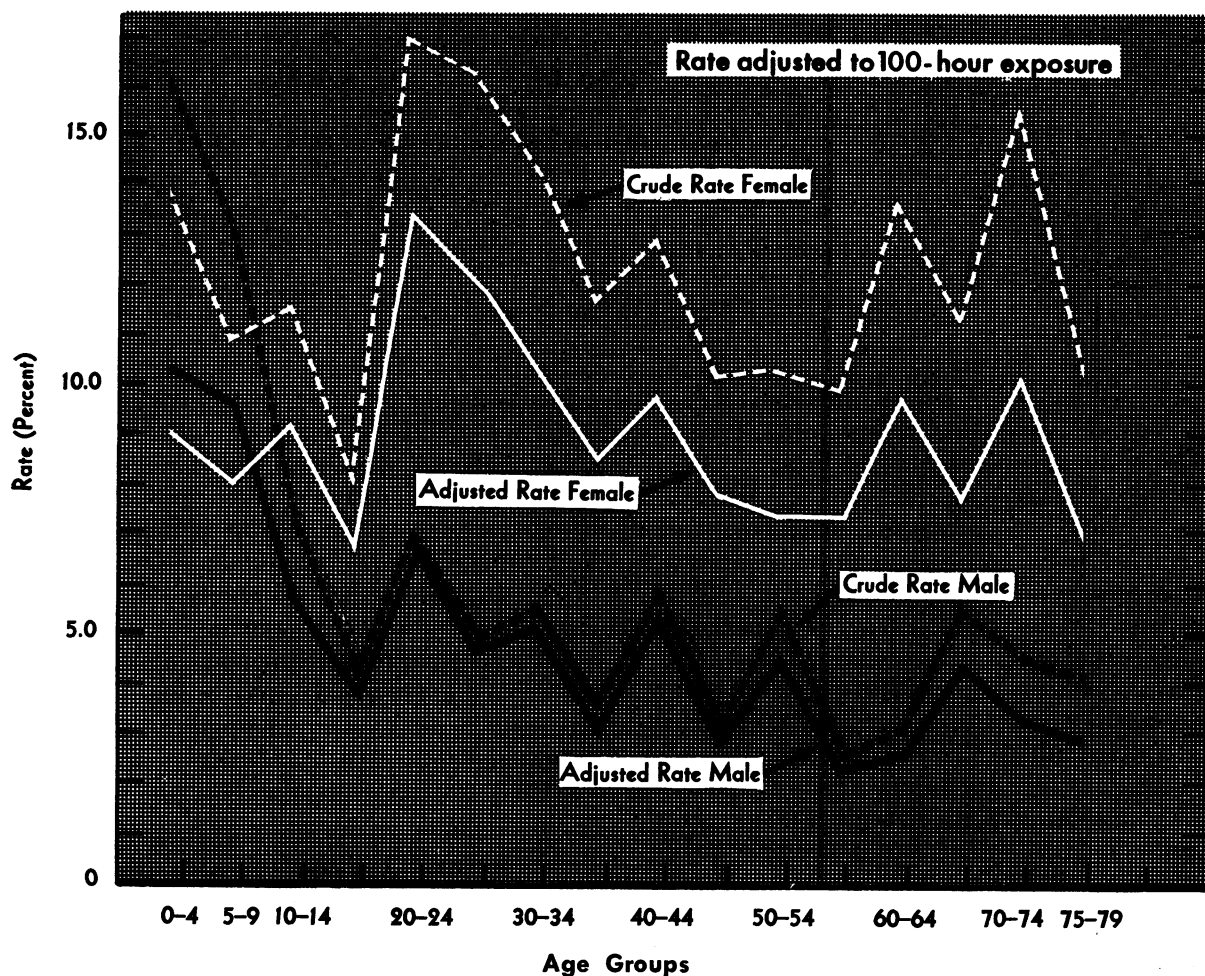
These higher rates of injuries to females were associated with greater number of hours spent in the home (see chart) and perhaps with occupational pursuits of housewifery.

Kitchens were the room-site of the greatest number of injuries (table 2). Actions in which

Table 2. Room-site of reported injuries, total sample

Location	Superficial injuries within 1 week prior to date of interview			Major injuries within 1 year prior to date of interview			Total injuries by location
	Male	Female	Total	Male	Female	Total	
Inside:							
Kitchen.....	54	260	314	19	53	72	386
Living room.....	21	35	56	13	20	33	89
Bedroom, nursery.....	20	16	36	6	11	17	53
Stairway.....	3	9	12	7	18	25	37
Porch.....	10	14	24	4	9	13	37
Bathroom.....	8	9	17	5	5	10	27
Entrance, doorway.....	5	10	15	3	5	8	23
Dining room, breakfast room.....	2	6	8	5	2	7	15
Other inside (hall, recreation room, workshop, laundry, utility room).....	4	12	16	2	10	12	28
Outside:							
Yard, lawn.....	88	90	178	61	45	106	284
Driveway.....	13	22	35	6	6	12	47
Steps.....	11	15	26	1	13	14	40
Walk.....	9	13	22	6	3	9	31
Garage.....	3	7	10	3	7	10	20
Other outside.....	2	1	3	1	2	3	6
Undetermined.....	47	75	122	20	17	37	159
Totals.....	300	594	894	162	226	388	1,282

Comparison of crude and adjusted superficial injury rates, by age group and sex, for total sample.



the burns were incurred were predominantly other than handling of hot objects and materials. This finding indicates that programs to prevent burns in kitchens should aim largely at actions such as reaching over boiling pots and tea kettles, and avoiding splatter of hot fats, rather than concentrating on care in handling hot objects and materials. Preparation of food, cooking of food, disposal of remnants, and cleaning of dishes and utensils were practices often mentioned as resulting in major as well as superficial injuries. Cuts, burns, and bruises, were predominant types of injuries suffered in kitchens (table 3). Accidents attendant on use of knives and handling tin cans and broken glass were frequently associated with cuts and pierces. Accident prevention may well be directed to these areas. Unsafe ladders and kitchen stools, ill-advised uses of chairs and

boxes for reaching high storage places, improper storage, slippery floors, cluttered floors, and inadequate lighting were mentioned often in relation to falls and resultant bruises and fractures occurring in kitchens. References to unwise practices, states of distraction, hurry, worry, anger, excitement, and other emotional and psychological deviations were recognized in reports of many of these injuries.

These reported injuries occurring in kitchens are mentioned to demonstrate the types of complex studies now under way in attempts to specify points of attack in prevention. This much we can report with full confidence: "There's someone in the kitchen with Dinah." "Accident Hazard" is his name. His intentions are to cause bloodshed, to burn, to bruise, to break, to suffocate, to electrocute, and to poison. This villain is no respecter of sex. He

Table 3. Reported injuries in kitchen, by type of injury

Type of injury	Superficial injuries within 1 week prior to date of interview			Major injuries within 1 year prior to date of interview			Total injuries
	Male	Female	Total	Male	Female	Total	
Burn.....	30	133	163	6	15	21	184
Cut.....	12	95	107	5	24	29	136
Bruise.....	7	13	20	-----	6	6	26
Other.....	5	19	24	8	8	16	40
Total.....	54	260	314	19	53	72	386

attacks strong, virile males with much success. His victims assist him, often seemingly encourage his attack by providing accident-inviting arrangements in the environment. Unplanned acts, unknowing acts, emotional and other psychological conditions contribute to the villain's success. Elder family members "plant" well-sharpened knives for themselves and others to discover. Youths reciprocate by leaving tripping hazards and bruising barricades for elders and themselves.

Resultant injuries occur regularly in the population surveyed; the injury rate was remarkably constant. Many persons in the survey expressed the opinion that injuries in homes were inevitable, while others did not recall having any injuries at any time.

Findings from this study are for nonfatal injuries. There is considerable variance between implications from these data and from mortality data. For example, some studies show that the bedroom is the place of most accidental injuries resulting in death. This study shows that relatively few major and minor injuries were reported as having occurred in the bedroom. Other discrepancies with mortality data are discernible between reported findings from various sources. These variations should be evaluated in terms of definitions set forth in the respective studies. Many of the apparently differing findings from fatal and nonfatal home injuries may be complementary in their description of the total problem of accidental injuries incurred within homes.

Superficial-Major Injury Ratios

Findings from the Washtenaw County research indicate there is a stable ratio of super-

ficial to major injuries under the methods, definitions, and restrictions adopted for this study. If this relationship is accepted, certainly appraisal of the problem in local areas becomes economically feasible because of the high rates of superficial injuries. Importance of this implication should not be lightly considered. A practicable and economical plan for determining relative degree of the problem of accidental injuries occurring within homes has long been sought. Methods used in the Washtenaw research should be modified for application in local health jurisdictions. Experience gained in the study will be relayed to those wishing the information. Relatively small but well-designed sample surveys of dwelling units promise good returns in this field. Studies now in progress should produce further evidence on applicability of such an approach.

ACKNOWLEDGMENT

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