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## ABSTRACT

Norwegian injury register data were analyzed to examine unintentional home injuries among persons aged 25 to 64 years residing in Stavanger, Norway, during 1992. A total of 782 persons received medical treatment for injury during 1992 (15.4 per 1000 population). The incidence was similar for males and females (15.8 and 14.9 per 1000 population); however, the exposure-specific injury rate was significantly higher for males (6.0 vs 4.1 per 1 million person-hours). This difference was entirely due to the much higher injury rate among males aged 25 to 44 years. The estimated first-year cost (direct and indirect) per injury was \$2700. Home injuries among adults appear to be an overlooked public health problem that warrants increased attention. (*Am J Public Health*. 1996;86:400-404)

# Home Injuries among Adults in Stavanger, Norway

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## Introduction

Home is the place where people of all ages spend most of their time. It is also the place where many injuries occur. The highest incidence of home injuries is among children and elderly persons, but adults sustain injuries as well. For example, a Swedish study<sup>1</sup> found that 36% of all unintentional home injuries occurred among people aged 25 to 64 years. Another study found that approximately 20% of all sick-leave days were due to unintentional injuries occurring at home.<sup>2</sup> Investigations of home injuries in the total population have been conducted,<sup>1,3</sup> but these have not reported detailed data on the occurrence, incidence, type, or diagnosis of injuries specific to the adult population. Further, the true underlying risk of home injury among adults remains unclear because exposure-specific incidence data have not been analyzed. We performed such an analysis. This study reports exposure-specific home injury rates among Norwegian adults and analyzes the occurrence, causes, and consequences of these injuries.

## Methods

The study setting was Stavanger, Norway, a coastal town located in the southwestern part of the country with a population of approximately 100 000. The population involved in this study consisted of 50 873 persons aged 25 to 64 years residing in Stavanger in 1992. In terms of sociodemographic factors, Stavanger is similar to many cities in the United States and other industrialized countries.

We identified cases for this study through a prospective ongoing registration system operated by the Central Hospital and the Emergency Clinic in

Stavanger. These two institutions provide inpatient and outpatient medical care to the total population in Stavanger. No other medical facilities that treat acute injuries exist in the town. The registration includes all inpatients and outpatients treated for injuries. The registration is provided according to the common classification and protocol for registration of injuries in the Nordic countries and includes extensive structured information about the circumstances in which the injury occurred.<sup>4</sup>

Cases of unintentional home injuries occurring during the 12-month period ending December 31, 1992, among people aged 25 to 64 years were selected for study. All injuries that occurred in private residences or on the premises of private residences, regardless of whether the actual place of injury was the individual's own home or someone else's home (e.g. injuries during visits to friends), were included as cases. Injuries resulting from occupational services provided in the home were excluded from the study. The following information was obtained for all cases: age, sex, date and time when the accident occurred, place of occurrence, mechanism of the accident, external factor(s) causing injury, medical diagnosis, type of treatment provided (hospitalization or clinic or physician care), and Abbreviated Injury Severity Score.<sup>5</sup> If an

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injured person had multiple visits to the hospital or clinic for the same injury, only the first visit was included in the analysis. Cases were classified into two categories: (1) injuries occurring inside the residence and (2) injuries occurring on the outside premises. Inside residence included all indoor areas (e.g., kitchen, living room) as well as outdoor areas connected to the residence (e.g., balcony, terrace). Outside premises included all outdoor areas of the home (e.g., garden, lawn, walk).

To calculate exposure at home, we used information from the Norwegian Time Budget Survey 1990 and 1991,<sup>6</sup> which provides information about average amount of time spent throughout the year at home for a nationally representative sample of the Norwegian population. In calculating base estimates, we subtracted sleep time because very few injuries occur during sleeping. Separate exposure estimates were calculated for males and females in two age groups: 25 to 44 and 45 to 64 years. On average, there were 8 hours and 32 minutes of effective daily exposure to home environment. The exposure figures for subjects 25 to 44 and 45 to 64 years old were, respectively, 7 hours and 9 minutes and 7 hours and 27 minutes for males and 9 hours and 44 minutes and 10 hours and 2 minutes for females. Available data did not permit us to break down exposure by area: inside residence vs outside premises.

As part of a larger ongoing study,<sup>7,8</sup> we gathered data on direct medical costs from hospital medical records and on the indirect costs of injuries (foregone productivity) through a special survey involving 116 randomly selected patients (response rate = 67%). We performed analyses to determine whether possible validity problems of nonresponse and recall bias existed. We found no evidence of these problems.

Differences in the incidences of injuries and severity scores were examined by chi-square tests. Statistical significance of the differences in the exposure-adjusted incidences was evaluated by a test for comparisons of person-time incidence rates.<sup>9</sup>

## Results

Within the study population, 782 persons (15.4 per 1000 population) aged 25 to 64 years received medical treatment for an unintentional home injury during

**TABLE 1—Number, Incidence, and Exposure-Specific Incidence of Unintentional Home Injuries among Adults in Stavanger, Norway**

Subject Characteristics	Residence		Premises		Total		Exposure-Specific Incidence <sup>a</sup>
	No. Injuries	Incidence (per 1000)	No. Injuries	Incidence (per 1000)	No. Injuries	Incidence (per 1000)	
Age 25–44 y							
Male	165	9.8	113	6.7**	278	16.6**	6.3**
Female	169	10.6	37	2.3	206	13.0	3.6
Age 45–64 y							
Male	73	8.1	58	6.4	131	14.5	5.3
Female	122	13.3**	45	4.9	167	18.2*	5.0
Total 25–64 y							
Male	238	9.2	171	6.6**	409	15.8	6.0**
Female	291	11.6**	82	3.3	373	14.9	4.1

Note. Statistical significance was based on comparison of incidences for males and females within the residence and on the outside premises.

<sup>a</sup>Exposure-specific incidence was per 1 000 000 person-hours.

\* $P < .05$ ; \*\* $P < .01$ .

1992 (Table 1). Of these, 409 (15.8 per 1000 population) were males, and 373 (14.9 per 1000 population) were females. Compared with females, younger males (25–44 years old) had significantly higher ( $P < .01$ ) injury rates, and older males (45–64 years old) had lower injury rates ( $P < .05$ ). The majority of injuries (68%) occurred in the residence. Younger males had higher ( $P < .01$ ) injury rates for the outside premises (6.7 vs 2.3 injuries per 1000 population), but older females had higher ( $P < .01$ ) injury rates for inside the residence (13.3 vs 8.1 injuries per 1000 population).

The amount of time spent at home differed for males and females and for younger and older persons, which resulted in injury rates different from those indicated by the population-based figures noted above. The exposure-specific injury rate of males was higher than that of females (6.0 vs 4.1 per 1 million person-hours;  $P < .01$ ). This higher overall rate among males was due to the much higher injury rate for 25- to 44-year-old males (6.3 vs 3.6 per 1 million person-hours;  $P < .01$ ).

Information on the distribution of injuries by mechanism of occurrence is presented in Table 2. Injuries sustained in residences were often caused by falls (44%, 232/529), almost half (41%) of which occurred on stairs. Injuries on the outside premises were often caused by cut, sting, puncture, or scratch (34%; 86 of 253) and also by falls (29%; 74 of 253). The exposure-specific injury rate for males was significantly higher ( $P < .01$ ) for two

injury categories: cut, sting, puncture, or scratch (20.5 vs 8.9 injuries per 10 million person-hours) and foreign body in eye (4.5 vs 0.4 injuries per 10 million person-hours).

Although not shown in Table 2, we analyzed data on the external factors (products) causing injury. Of the injuries caused by cut, sting, puncture, or scratch, 43% involved persons using machinery or a hand tool (e.g., electrical drill, hammer). Forty-eight percent of injuries involving a cut, sting, puncture, or scratch and 68% of the injuries involving a foreign body in the eye resulted from use of machinery or a hand tool. Machinery and hand tools accounted for 12% of all residence injuries, household appliances and equipment for 6%, and product packages for 4%. Three external factors dominated injuries that occurred on the outside premises: outdoor artificial ground surfaces (20%; 51 of 253), machinery and hand tools (19%; 49 of 253), and raw materials, particles, and construction materials (19%; 48 of 253).

As shown in Table 3, the most common diagnoses for injuries sustained in the residence were open wounds (29%; 154 of 529), fractures (22%; 117 of 529), sprains and strains (19%; 103 of 529), and bruises (14%; 76 of 529). Almost half (48%) of the open wounds were on fingers. Although not shown in Table 3, 54% of these injuries were caused by a hand tool. Most of the fractures that occurred involved body bones or upper limbs. Fractures of the toe usually in-

**TABLE 2—Mechanism of Occurrence of Unintentional Home Injuries**

Mechanism of Injury	Residence				Premises				Exposure-Specific Incidence <sup>a</sup>	
	Male		Female		Male		Female		Male	Female
	No. Injuries	Incidence (per 1000)	No. Injuries	Incidence (per 1000)	No. Injuries	Incidence (per 1000)	No. Injuries	Incidence (per 1000)		
Fall on stairs	43	1.7	53	2.1	0	0.0	0	0.0	6.3	5.9
Other fall	58	2.2	78	3.1	38	1.5	36	1.4	14.0	12.7
Collision with objects/animal/person	34	1.3	45	1.8	25	1.0*	11	0.4	8.6	6.2
Cut, sting, puncture, scratch	72	2.8	62	2.5	68	2.6**	18	0.7	20.5**	8.9
Foreign body in eye	8	0.3	2	0.1	23	0.9**	2	0.1	4.5**	0.4
Acute overexertion	15	0.6	35	1.4**	12	0.5	12	0.5	3.9	5.2
Other	4	0.2	8	0.3	1	0.0	0	0.0	0.4	0.6
Unknown	4	0.2	8	0.3	4	0.2	3	0.1	1.2	1.2
Total	238	9.2	291	11.6**	171	6.6**	82	3.3	59.8**	41.5

Note. Statistical significance was based on comparison of incidences for males and females within the residence and on the outside premises.

<sup>a</sup>Exposure-specific incidence (per 10 million person-hours) was based on injuries occurring in the residence and on the outside premises combined.

\* $P < .05$ ; \*\* $P < .01$ .

**TABLE 3—Diagnoses in Unintentional Home Injuries: Number and Exposure-Adjusted Incidence**

Type of Injury	Residence				Premises				Exposure-Specific Incidence <sup>a</sup>	
	Male		Female		Male		Female		Male	Female
	No. Injuries	Incidence (per 1000)	No. Injuries	Incidence (per 1000)	No. Injuries	Incidence (per 1000)	No. Injuries	Incidence (per 1000)		
Fracture of body bones	15	0.6	11	0.4	5	0.2	2	0.1	2.9	1.4
Fracture of upper limb	15	0.6	26	1.0	4	0.2	10	0.4	2.8	4.0
Fracture of ankle	4	0.2	13	0.5	6	0.2	2	0.1	1.5	1.7
Fracture of toe(s)	8	0.3	14	0.6	3	0.1	1	0.0	1.6	1.7
Other fracture of leg	3	0.1	8	0.3	1	0.0	3	0.1	0.6	1.2
Dislocation	6	0.2	6	0.2	4	0.2	0	0.0	1.5	0.7
Sprain or strain, ankle	11	0.4	39	1.6**	10	0.4	17	0.7	3.1	6.2**
Other sprain or strain	17	0.7	36	1.4**	13	0.5	10	0.4	4.4	5.1
Brain concussion	2	0.1	5	0.2	0	0.0	0	0.0	0.3	0.6
Open wound, fingers	39	1.5	35	1.4	32	1.2**	6	0.2	10.4**	4.6
Other open wound	47	1.8	33	1.3	33	1.3**	13	0.5	11.7**	5.1
Superficial injury	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0
Bruise	41	1.6	35	1.4	24	0.9*	10	0.4	9.5**	5.0
Foreign body	7	0.3	5	0.2	18	0.7**	3	0.1	3.7**	0.9
Burn injury	5	0.2	3	0.1	1	0.0	0	0.0	0.9	0.3
Poisoning/intoxication	3	0.1	0	0.0	0	0.0	0	0.0	0.4	0.0
Other and missing diagnosis	6	0.2	7	0.3	10	0.4	0	0.0	2.3*	0.8
Multiple diagnoses	9	0.3	15	0.6	7	0.3	5	0.2	2.3	2.2
Total	238	9.2	291	11.6**	171	6.6**	82	3.3	59.8**	41.5

Note. Statistical significance was based on comparison of incidences for males and females within the residence and on the outside premises.

<sup>a</sup>Exposure-specific incidence (per 10 million person-hours) was based on injuries occurring in the residence and on the outside premises combined.

\* $P < .05$ ; \*\* $P < .01$ .

volved a collision with a standing object, in most cases furniture. Almost half of the sprains and strains resulted from ankle

injuries. Sprains and strains in the residence occurred more frequently ( $P < .01$ ) among females.

The distribution of diagnoses of injuries occurring on outside premises was similar to that inside the residence. Open

wounds accounted for 33% (84 of 253) of the cases, sprains and strains for 20% (50 of 253), fractures for 15% (37 of 253), and bruises for 13% (34 of 253). Males had significantly higher ( $P < .01$ ) injury rates for two diagnostic categories: open wounds on fingers and foreign bodies. For both of these, the injury rate among males was six times greater than that among females.

The majority (80%) of the injuries overall were of minor severity (Abbreviated Injury Severity Score = 1). Moderately severe injuries (Abbreviated Injury Severity Score = 2) accounted for 17% of the cases, and severe injuries (Abbreviated Injury Severity Score = 3) occurred in 3% of the cases. One patient suffered very severe injury (Abbreviated Injury Severity Score = 4), and another suffered critical injury (Abbreviated Injury Severity Score = 5). There was no statistically significant difference in the severity score of injuries occurring inside the residence vs on the outside premises.

Of the 782 persons injured, 61 required hospitalization (1.2 per 1000 population). The hospitalization rate was significantly ( $P < .05$ ) higher for injuries occurring inside the residence than on the outside premises (9.3% vs 4.7%, respectively). The proportions of males and females requiring hospitalization were similar (7.6% and 8.0%, respectively). The mean total direct cost of hospital care or care provided in the emergency clinic was \$500 per injury (1994 values) (SD = \$1011; range = \$145–\$5807). The average duration of sick leave among patients who returned to work ( $n = 26$ ) was 18 working days (SD = 19). The estimated average (indirect) cost of lost work time per injury among employed persons in the 12-month period after injury was \$1605 (SD = \$4763; range = \$0–\$27 499). The average duration of incapacity for housekeeping duties was 25 days (SD = 29) among the 40 respondents who were able to resume housekeeping duties. The implied value of the foregone housekeeping productivity (for the 68 respondents) in the 12-month period after injury was \$644 per injury (SD = \$2139; range = \$0–\$14 516).

## Discussion

This study suggests that unintentional home injuries among adults in Norway—and perhaps elsewhere—may be an overlooked public health problem.

Approximately 1.5% of the people aged 25 to 64 years in our study population sustained a home injury during the 12-month study period. Among people aged 25 to 44 years, the incidence and risk (exposure-specific incidence) of injuries were higher for men than women. Among the people aged 45 to 64 years the incidence was higher for women than men, but the (exposure-specific) risks were similar. The main source of differences in injury incidence and risk between men and women were injuries occurring on the outside premises, which were much more common among men.

The problem of home injuries among adults deserves attention for several reasons. First, adults constitute a large population group, whose injuries account for a large number of cases. Second, these injuries have measurable economic consequences. We calculated that in the initial year after injury the average cost per injury was \$2700 (1994 values), including both direct and indirect (foregone market and household services productivity) costs. Extrapolating the incidence and injury costs from our study to the Norwegian and US populations implies aggregate costs for the year after injury in the range of \$100 million and \$5 billion, respectively.

Third—and perhaps most important—there may be significant potential to prevent many of these injuries. Our study suggests several possible prevention targets. Many injuries, particularly among women, involve the ankle or toe. Ankle injuries were frequently caused by sprains, strains, or fractures; toe fractures were most often caused by collisions with objects in the home, especially furniture. It is possible that these mechanisms of ankle and toe injuries are affected by the type of footwear people use. Wearing footwear that offers better protection might reduce the risk of these injuries. It is well known that stairs present risk of injuries for elderly persons, but many adults are injured on stairs as well. Measures to reduce the risk of injuries on stairs are needed, such as improving lighting or modifying environmental conditions (e.g., widening the run of the step, putting in banisters). Further, a significant portion of injuries, particularly among men, are related to the use of machinery or hand tools. Two types of injuries dominate these cases: eye injuries caused by foreign bodies and finger cuts. Adopting industrial safety measures such as

using personal safety equipment (e.g., eye safety goggles) may substantially reduce the risk of these injuries.

This study has several limitations that deserve mention. First, it is possible that a small number of minor injuries among our study population were treated in general practitioners' offices and were never referred to and registered with the emergency clinic or hospital. Although the extent of underreporting in our study population is unknown, we are confident that our data include the great majority of injury cases and that the incidence rates reported here are accurate. Second, the limited scope of the study precluded gathering primary data on exposure. Instead, we used data from the Norwegian Time Budget Survey 1990 and 1991 to estimate exposure. Although use of this data introduced a potential source of error in the estimation of exposure, the survey involved a large (more than 3000 people) representative sample of the Norwegian population and used sophisticated sampling techniques to obtain time use estimates for each day of the week and each month of the year. Third, the reported cost estimates lack precision because of the relatively small number of cases used in the cost estimation. On the other hand, our estimates of activity restriction are consistent with those reported by other similar studies,<sup>2</sup> providing increased confidence in the results.

Unintentional home injuries among adults have been a largely overlooked problem whose costs to society are significant. Given the nature and frequency of many of these injuries, preventive efforts have the potential to be quite cost-effective. Increased attention should be given to the problem of unintentional home injuries among adults and to the development of appropriate prevention strategies. □

## Acknowledgment

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### ***Call for Nominations for the 1996 Eileen Basker Memorial Prize for Studies in Gender and Health***

The Eileen Basker Memorial Prize was established by the Society for Medical Anthropology to promote superior research in the area of gender and health. The \$1000 award is made annually to scholars from any discipline or nation for work (book, article, film, exceptional PhD thesis) produced within the preceding 3 years.

Individuals must be nominated by a person who should indicate the impact of this work on the field. Self-nomination is not considered. Submit letters of nomination with three copies of the work by *June 1, 1996*, to Robert A. Hahn, Epidemiology Program Office, CO8, Centers for Disease Control and Prevention, Atlanta, GA 30333.