

egories besides assault but also homicide incidents.

4. Use any resulting data to modify or initiate community policies that address prevention of family violence and other assaults among intimates. It will help if efforts can be made to establish (or strengthen) communication links between criminal justice and public health agencies, and between those agencies and community advocacy groups concerned about FIA. □

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The Cost and Frequency of Hospitalization for Fall-Related Injuries in Older Adults

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Introduction

The risk of falls and of fall-related injury increases with age owing to loss of agility and visual acuity, predisposition to dizziness and syncope, and side effects from medications.¹⁻⁷ Approximately 30% of older adults will experience a fall annually, and 20% to 30% of those people will suffer moderate to severe injuries^{6,8} leading to loss of mobility and independence and to an increased risk of death.^{1,2,9-11} A growing body of literature is available on risk factors for fall-related injuries, especially fracture of the hip, and has been reviewed by others elsewhere.^{1,2,5} However, complete data on these injuries in a population, along with attendant cost and morbidity information, have not been well presented. To characterize the frequency and cost of fall-related injuries that result

in hospitalization, a population-based study was conducted of all persons aged 65 years and older in Washington State who were hospitalized in 1989 after a fall.

Methods

Hospital discharge data were obtained from the 1989 Washington State

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ABSTRACT

Using a population-based hospital discharge registry with E codes, we examine the 1989 hospitalizations of older adults in Washington State for fall-related injuries. Fall-related trauma accounted for 5.3% of all hospitalizations of older adults, with hospital charges totaling \$53 346 191, and resulted in discharge to nursing care more often than other such hospitalizations. An annual hospitalization rate of 13.5 per 1000 persons and an annual cost of \$92 per person is reported. The importance of preventing fall-related injuries in older adults is discussed. (*Am J Public Health*. 1992;82:1020-1023)

TABLE 1—Characteristics of Patients by Discharge Category

Variable	Trauma ^a			Nontrauma			Total (n = 149 504) %
	Fall Related (n = 7873) %	Nonfall Related (n = 1371) %	Cause Unknown (n = 2357) %	Noninjury (n = 123 759) %	Injury, Cause Known (n = 2066) %	Injury, Cause Unknown (n = 12 078) %	
Age, y							
65–69	12.4	26.7	19.9	23.9	24.6	29.0	23.7
70–74	15.5	24.1	21.1	24.3	25.6	27.9	24.1
75–79	19.1	20.0	21.0	21.9	21.2	22.1	21.7
80–84	22.0	16.0	17.8	16.0	16.7	13.0	16.2
85+	31.1	13.3	20.3	13.8	11.9	7.9	14.3
Gender							
Female	73.6	51.2	58.8	53.5	55.7	46.5	54.1
Male	26.4	48.8	41.2	46.5	44.3	53.5	45.9
Discharge status							
Self care	42.7	68.6	60.9	72.4	71.5	73.4	70.7
Nursing care	42.8	16.6	21.5	11.8	14.0	10.3	13.5
Hospital	2.5	3.0	2.9	3.0	3.3	2.1	2.9
Home/aide	8.9	7.7	9.0	6.7	6.9	8.3	7.0
Left against medical advice	0.1	0.1	0.1	0.2	0.4	0.1	0.2
Died	2.9	4.2	5.6	6.0	3.9	5.8	5.8
Hip fracture ^b	55.2	16.0	23.9	3.4
Other fracture	28.6	39.2	20.2	2.2

Note. Totals may fall short of or exceed 100% because of rounding.

^aICD discharge codes 800–904, 910–957.

^bFracture of the hip, femur, or pelvis (ICD 820, 821, 808).

Commission Hospital Abstract Reporting System, which collects discharge data from all Washington State hospitals, excluding Veterans Administration and military hospitals.

Patients were initially divided into the following six mutually exclusive categories, based on *International Classification of Diseases (ICD)* discharge codes and E codes indicating, respectively, presence or absence of trauma and the external cause of injury.

1. *Fall-related trauma*: ICD trauma code (800–904, 910–957) and an E code for a fall (E880–E889).

2. *Nonfall-related trauma*: ICD trauma code and an E code for trauma excluding falls and intentional injury (E800–E848, E890–E899, E916–E928).

3. *Trauma of unknown cause*: ICD trauma code but no E code recorded.

4. *Noninjury hospitalizations*: All ICD discharge codes lower than 800.

5. *Nontrauma injuries*: ICD code for late effects from external cause (905–909) or late effects of trauma, poisonings, or medical misadventure (958–998); and an E code for poisoning (E850–E869), medical misadventure (E870–E876), environmental effects (E900–E909), suffocation or submersion (E910–E915), late effects of injury (E929),

adverse effects of medication (E930–E949), or intentional injury (E950–E999).

6. *Nontrauma injuries, unknown cause*: ICD codes 905–909, 958–998 but no E code recorded. Groups 4, 5, and 6 were ultimately combined to form an “all nontrauma” category. Population-based rates were calculated using age- and sex-specific denominator data for Washington in 1989 based on projections from 1980 and 1990 census data.¹²

The frequency of hospitalizations in each discharge category for persons over age 65 in Washington State in 1989 was broken down by age, gender, source of admission, and discharge status; and age- and sex-specific hospitalization rates for falls, other trauma, and nontrauma among this population were calculated. The cost of fall-related injuries was based on hospital charges only, exclusive of professional fees.

Results

Of the 149 504 patients aged 65 years and older who were discharged from Washington State hospitals in 1989, 7873 (5.3%) were hospitalized for injuries from falls (Table 1). Compared with persons hospitalized for other reasons, persons admitted for falls were more frequently female and tended to be older.

Patients hospitalized for fall-related trauma were discharged to a nursing facility more often than were those hospitalized for other reasons (Table 1). This finding was independent of age and patient status prior to admission. Patients admitted from home with fall-related injuries were discharged to a nursing facility more often than were patients hospitalized both for other trauma combined and for reasons not related to trauma (42% vs 23% and 14%, respectively) (Table 2).

The rate of hospitalization for fall-related trauma, 13.5 per 1000 persons aged 65 and older, was five times that of nonfall-related trauma (Table 3). The rate for falls increased with age and was higher among women than among men.

Of the \$995 499 233 in hospital charges in 1989 for persons in Washington State aged 65 and older, \$53 346 191 (5.3%) were attributable to hospitalization of patients with fall-related trauma. The annual per capita cost of such hospitalizations was higher for women and increased remarkably with age (Table 4).

Discussion

Population-based hospital discharge data with E codes were used to describe

TABLE 2—Age-Adjusted Distribution of Discharge Destinations for Patients Admitted from Self Care

Destination upon Discharge	Trauma ^a			Nontrauma ^b (n = 137 903) %
	Fall Related (n = 7485) %	Nonfall Related (n = 1296) %	Unknown Cause (n = 2180) %	
Self care	43.3	62.8	58.0	68.5
Nursing care	42.1	21.4	23.4	14.1
Hospital	2.5	2.4	2.8	2.1
Home/aide	9.1	9.1	9.5	6.9
Left against medical advice	0.2	<0.1	<0.1	0.1
Died	2.9	5.9	5.9	6.3

Note. Totals may fall short of or exceed 100% because of rounding.
^aICD discharge codes 800–904, 910–957.
^bAll nontrauma combined.

TABLE 3—Age- and Sex-Specific Rates of Hospitalization per 1000 Adults Aged 65 Years and Older in Washington State in 1989

Sex and Age, y	Trauma ^a			Nontrauma ^b (n = 137 903)	Total (n = 149 504)
	Fall Related (n = 7873)	Nonfall Related (n = 1371)	Unknown Cause (n = 2357)		
Female	17.3	2.1	4.2	218.5	242.1
65–69	6.2	1.6	2.2	158.3	168.2
70–74	10.0	2.0	3.1	202.3	217.4
75–79	16.4	2.3	4.5	248.7	271.8
80–84	30.1	2.9	6.4	286.1	325.5
85+	46.6	2.5	7.9	279.6	336.6
Male	8.4	2.5	3.9	262.2	277.2
65–69	3.7	2.2	2.6	186.6	195.1
70–74	5.9	2.4	3.1	256.9	268.8
75–79	10.2	2.8	4.5	317.7	335.2
80–84	17.1	3.8	5.6	376.8	403.2
85+	27.9	4.7	8.6	389.4	430.5
Total	13.5	2.4	4.1	1212.4	257.0

^aICD discharge codes 800–904, 910–957.
^bAll nontrauma combined.

TABLE 4—Total Costs and Annual Per Capita Costs of Fall-Related Hospitalizations of Older Adults in Washington State

Costs	Female	Male	Total
Total costs, \$ millions	37.98	15.36	53.35
Average cost per hospitalization, \$	6559	7379	6776
Annual per capita cost, \$, by age, y			
65–69	35	25	30
70–74	62	41	54
75–79	108	84	98
80–84	206	129	178
85+	310	200	279
Total	114	62	92

the frequency and cost of hospitalization for fall-related injuries in the older adult population of Washington State. These data confirm other research that implicates falls as the leading cause of injury in the aged.^{2,5,13,14} The rates of such injuries in Washington were similar to national estimates reported by Rice et al.¹³

Fall-related injuries profoundly affect the activity and life-style of older adults. Forty-three percent of patients injured in falls were discharged to a nursing facility, a figure similar to that reported by Sattin et al.¹⁵ Noninstitutionalized persons injured in falls were discharged to nursing care three times more often than were persons hospitalized for nontrauma causes.

Hospital costs for fall-related injuries in older adults is one of the more striking findings of this analysis. However, these hospitalized fall injuries account for only a fraction of the total cost.¹³ Among an elderly population in Florida, only 42% of those who sought medical attention for a fall were hospitalized.¹⁵ And the more than \$53 million spent in hospital costs do not take into account the long-term sequelae of fall-related injuries, which include loss of independence, loss of confidence, susceptibility to future falls, and poor survivorship.^{9,10} Clearly, the entire cost of falls among older adults in Washington State, whether measured in monetary or in human terms, is much greater than \$92 per person per year (Table 4).

The Washington State Commission data have limitations typical of hospital discharge registries. Because the five discharge diagnosis codes are not prioritized, some falls may be secondary to comorbid conditions. Furthermore, E coding, though mandated by law, is not 100% complete; consequently, some of the injuries with unknown cause in fact may have been incurred by falls. Finally, no information is available regarding the course of the patient once discharged.

Although the etiology of falls is complex, fall injury research has identified several potentially modifiable risk factors^{1–3,6,7,16} and fall prevention strategies.⁵ Faulty vision, improper footwear, and common household hazards such as loose rugs are examples of previously identified risk factors. Currently unproven but potentially effective one-time interventions to reduce these risks deserve further attention. The cost-effectiveness of such interventions will increase over time as the risk and annual per capita cost of falls in older adults increase with age. These interventions may not prevent all falls, but

they could reduce the effect of falls on the older adult population. □

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Carcinogens in Tobacco Smoke: Benzo[a]pyrene from Canadian Cigarettes and Cigarette Tobacco

Murray J. Kaiserman, PhD, and William S. Rickert, PhD

ABSTRACT

We evaluated the benzo[a]pyrene (BaP) content in the smoke from 35 brands of Canadian cigarettes and 5 brands of Canadian tobaccos for roll-your-own cigarettes. For the cigarettes, mean values of BaP ranged from 3.36 ng to 28.39 ng per cigarette, roughly in proportion with declared tar values. The relationship between declared tar and yields of BaP, however, does not allow accurate prediction of one from the other. For the tobaccos, mean BaP values ranged from 22.92 ng to 26.27 ng (average, 24.7 ng) per cigarette. The implications of these findings are discussed with respect to overall exposure. (*Am J Public Health.* 1992;82:1023-1026)

Introduction

The particulate fraction of tobacco smoke ("tar") is composed of a complex mixture of constituents,^{1,2} some of which are regulated under environmental legislation.³⁻⁶ One constituent is benzo[a]pyrene (BaP), a polynuclear aromatic hydrocarbon formed during the incomplete combustion of organic matter such as gasoline, garbage, and plants. BaP has been identified by the International Agency for Research on Cancer as an animal carcinogen and a probable human carcinogen (Class 2A)⁷ with inhalation, oral ingestion, and dermal absorption as the important routes of entry.

Human data are unavailable, but oral ingestion of about 7 to 9 mg of BaP per kilogram has produced cancers in laboratory animals.⁸ With respect to tobacco smoke, BaP has been detected in concentrations ranging from 20 to 40 ng per cigarette in mainstream cigarette smoke¹ to 40 to 79 ng per cigarette in sidestream smoke¹ and 96 to 292 ng per cigar in mainstream cigar smoke.⁹

On January 1, 1989, the Tobacco Products Control Act came into force in Canada. One of the purposes of this legislation is to "enhance public awareness of the hazards of tobacco use by ensuring the effective communication of pertinent information to consumers of tobacco products."¹⁰ To achieve this goal, the Health Protection Branch of Health and Welfare Canada has undertaken a series of studies to develop and validate analytical test methods for toxic constituents.

In this paper we report on the BaP delivery of 35 brands of commercially available Canadian cigarettes and 5 brands

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