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FALL RELATED HOSPITAL ADMISSIONS AMONG SENIORS IN POLAND IN 2010

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ABSTRACT

BACKGROUND. Falls among elderly people causing hospitalization are considered one of the most important public health problems. Our objective was to analyse fall related hospital admissions among seniors (≥65 years old) in Poland in 2010. The analyses were conducted with regard to gender, place of residence and age. Additionally, the health consequences of falls among elderly people were studied.Injuries and other consequences of external causes, were expressed in the form of three-character ICD-10 codes representing the underlying disease (S00-T98).
METHODS. Data on hospital admissions resulting from falls among seniors were obtained from the database held at the Department - Centre for Monitoring and Analyses of Population Health Status and Health Care System by the National Institute of Public Health - National Institute of Hygiene.
RESULTS. Analysis has shown that the hospitalization ratio due to falls is much higher for women than for men. On average, 1 024 per 100 000 women are hospitalized due to a fall, while the number for men is 649. For every analysed age group women are at a higher risk of hospitalization due to a fall than men. In 2010 nearly 70% of hospital admissions of elderly people due to a fall were caused by a fall on the same level as a result of tripping or slipping (31 712 hospitalizations). No differences in relation to gender were observed. Risk of hospitalization due to a fall increases with age. For people over 80 years of age it is 2.5 times higher than for people in the 65-69 age group (1 459 and 570 per 100 000 respectively). It was observed that the length of hospital stay increases with age. There were no significant differences between the number of hospitalizations depending on the place of residence. The analysis showed that differences in the length of stay for women and men are statistically significant. However, there was no statistically significant difference between the lengths of stay depending on a place of residence. Almost one-third of hospitalizations (31.4%) resulted from femur fracture (14 356 hospitalizations). Women are more likely to suffer from a femur fracture.
CONCLUSIONS. A comparison of results of research conducted, among other countries, in the United States, the Netherlands, and Denmark, as well as Polish demographic prognosis, has shown that an increase of fall related hospital admissions among senior citizens is to be expected in Poland in oncoming years.

Key words: *falls, hospital admission, senior-aged, public health*

INTRODUCTION

Falls among elderly people leading to hospitalization are often recognized as one of the most important issues in public health (1). In 2012 people of 65 years and older constituted over 13% of the population of Poland. It is estimated that every year 1 in every 4 people experiences a fall (2), and approximately 10% of all the falls lead to hospitalization of the injured person (1). World trends indicate that, as a result of current demographic trends, the nominal number of hospitalizations due to falls among senior citizens is on the rise. Similarly, the hospitalization rate per 100 thousand inhabitants is growing.

As per the International Statistical Classification of Diseases Related Health Problems (ICD-10), falls are classified as external causes of morbidity and mortality. Falls are divided into 20 subgroups, each marked with a code W00-W19. Among them we can find, among other causes, falls on same level from slipping, tripping and stumbling, falls on and from stairs and steps, falls involving bed, falls involving chair, and falls on same level involving ice and snow.

The purpose of this work is to evaluate the frequency of hospitalization of seniors as a result of falls, depending on their gender, place of residence, and age. We have also analysed the results of falls among elderly people, i.e. injuries and other results, expressed in the form of three-character codes representing the underlying disease (S00-T98).

MATERIALS AND METHODS

The data on hospital admissions resulting from falls among seniors were obtained from the database held at the Department - Centre for Monitoring and Analyses of Population Health Status and Health Care System by the National Institute of Public Health - National Institute of Hygiene. The data included in this study concern person of 65 years and older, who have been hospitalized in Poland in 2010. The number of cases of hospitalization due to falls has been determined for each category of falls, depending on gender, place of residence and age of the injured person.

The quantitative data were divided into five age groups: 65-69, 70-74, 75-79, 80-89 and over 90 years of age. For the purpose of calculating the ratios of hospitalization, the latter two groups were merged into one i.e. over 80 years of age, due to the way the data is presented by the Central Statistical Office in Poland (GUS). The hospitalization rate was calculated using data obtained from the Central Statistical Office in Poland (GUS) on the size of the population in 2010 for each age group per 100 thousand inhabitants. Additionally, we have analysed the injuries resulting from falls (as three-character ICD-10 code: S00-Y98).

The calculations were conducted using the SPSS statistical package. For the purpose of evaluating the significance of the observed differences we assumed $p \leq 0.05$. The data were analysed using one-way ANOVA, followed by the Duncan's test, in order to quantify the significance of differences between the means for each group. The homogeneity of variance was tested using the Levene's test.

RESULTS

In 2010 45 672 people aged 65 and over were hospitalized in Poland due to falls (883 per 100 thousand inhabitants). Women constituted over 72% of all the hospitalized persons (33 016 women compared to 12

Table I. Types of falls by ICD-10 codes (International Statistical Classification of Diseases and Related Health Problems 10th Revision. World Health Organization - WHO)

ICD-10 code	Type of fall
W00	Fall on same level involving ice and snow
W01	Fall on same level from slipping, tripping and stumbling
W02	Fall involving ice-skates, skis, roller-skates or skateboards
W03	Other fall on same level due to collision with, or pushing by, another person
W04	Fall while being carried or supported by other persons
W05	Fall involving wheelchair
W06	Fall involving bed
W07	Fall involving chair
W08	Fall involving other furniture
W09	Fall involving playground equipment
W10	Fall on and from stairs and steps
W11	Fall on and from ladder
W12	Fall on and from scaffolding
W13	Fall from, out of or through building or structure
W14	Fall from tree
W15	Fall from cliff
W16	Diving or jumping into water causing injury other than drowning or submersion
W17	Other fall from one level to another
W18	Other fall on same level
W19	Unspecified fall

Table II. Fall related hospital admissions among seniors in Poland in 2010 by groups age and sex. Hospitalization rate per 100 thousand (number of fall related hospitalizations)

Age group (years)	Fall related hospital admission					
	Males		Females		Total	
65 - 69	527[a]	(3 110)[b]	604	(4 688)	570,4	(7 799)
70 - 74	547	(2 990)	743	(6 064)	664,1	(9 054)
75 - 79	653	(2 768)	992	(7 197)	866,9	(9 965)
80 +	977	(3 786)	1665	(15 067)	1458,7	(18 854)
Ogółem (≥ 65)	649,3	(12 654)	1024,2	(33 016)	883,0	(45 672)

[a] hospitalization rate per 100 thousand

[b] number of fall related hospitalizations

654 men; gender was not specified for two people). When we take into account demographic data on the number of senior citizens (in 2010 in Poland there were 1.7 times more women than men over 65 years of age), we can see that the hospitalization rate due to falls is much higher for women than for men. On average out of every 100 thousand women 1 024 are hospitalized due to falls, whereas for men the rate is 649. (Table I and Table II)

Types of falls. In 2010 almost 70% of cases of hospitalization among seniors due to falls, were caused by a falls on same level from slipping, tripping and stumbling (31 712 cases of hospitalization). Falls on and from stairs and steps were the cause of 4.3% of hospitalizations (1 951 cases), and falls on same level involving ice and snow accounted for 3.6% of hospitalizations (1 638 cases). Falls from one level to another, and falls on and from ladder caused the total number of hospitalizations of 1 167 cases among seniors. Almost 600 cases of hospitalizations resulted from falls involving chair and falls involving bed (each causing 0.7% of cases of hospitalizations) (Table III). For the analysed population significant difference was not observed between the frequency of occurrence of a particular type of fall, and gender of a patient.

Table III. Fall related hospital admissions among seniors in Poland in 2010 by type of fall (ICD-10 codes) and gender. Total number and percentage of fall related hospitalizations

ICD-10 code	Total number of hospitalization by type of fall, frequency					
	Males		Females		Total	
W01	7 886	62,3%	23 824	72,2%	31 712	69,4%
W19	1 927	15,2%	4 177	12,7%	6 104	13,4%
W10	733	5,8%	1 218	3,7%	1 951	4,3%
W18	515	4,1%	1 343	4,1%	1 858	4,1%
W00	485	3,8%	1 153	3,5%	1 638	3,6%
W17	255	2,0%	356	1,1%	611	1,3%
W11	419	3,3%	137	0,4%	556	1,2%
W07	68	0,5%	230	0,7%	298	0,7%
W06	74	0,6%	223	0,7%	297	0,7%
W09	76	0,6%	85	0,3%	161	0,4%
W08	21	0,2%	106	0,3%	127	0,3%
W02	29	0,2%	70	0,2%	99	0,2%
W13	55	0,4%	28	0,1%	83	0,2%
W14	57	0,5%	7	0,0%	64	0,1%
W03	17	0,1%	26	0,1%	43	0,1%
W12	28	0,2%	0	0,0%	28	0,1%
W05	4	0,0%	15	0,0%	19	0,0%
W04	2	0,0%	16	0,0%	18	0,0%
W15	2	0,0%	1	0,0%	3	0,0%
W16	1	0,0%	1	0,0%	2	0,0%
Total	**12 654**	**100%**	**33 016**	**100%**	**45 672**	**100%**

[a] ≥ 65 years

The age of the hospitalized patients. The analysis of falls in each age group shows significant differences in the frequency of their occurrence. The risk of hospitalization due to a fall increases with age. For persons aged 80 years and older it is 2.5-fold higher that for persons in the 65-69 age group (1 459 and 570 per 100 thousand inhabitants respectively). Moreover, the frequency varies as a function of age. Women in each analysed group are at a higher risk of hospitalization due to a fall than men. The probability that a woman of 80 years of older will be hospitalized is 1.7-fold greater than for men of the same age. (Table II)

Additionally, for women the probability of hospitalization increases faster with age. The risk of hospitalization for a woman aged 80 or over is 2.8-fold higher than for women aged between 65-69 (1 665 and 604 per 100 thousand women respectively). For men the risk increases only up to 1.8 (977 compared to 527 per 100 thousand men).

The length of hospital stay. The mean length of hospital stay due to a fall equalled 7.4 days (σ=8.9) in 2010. Our analysis showed statistically significant differences between the lengths of hospital stay for each age group (ANOVA, $F_{(4.45667)} = 148.63$, $p<0.01$, Duncan's test). For the analysed group of elderly people it was observed that the length of hospital stay increases with age. In the 65-69 age group the mean length of hospital stay equals 5.9 days. For the 75-79 age group it increases up to 7.4 days. Persons aged 90 years and over were hospitalized for 8.7 days due to a fall. The maximum length of hospital stay was observed for persons in the 80-89 age group, and it reached 219 days. (Table IV)

Table IV. Length of fall related hospital stay LOS in days by age in Poland in 2010

Age groups (years)	Number of hospitalisation	LOS[a] (standard deviation)		LOS		MAX value.
				From	To	
65 - 69	7 799	5,86	(8,33)	5,68	6,05	189
70 - 74	9 054	6,54	(8,80)	6,36	6,72	181
75 - 79	9 965	7,36	(9,04)	7,18	7,54	188
80 - 89	9 536	8,12	(9,25)	7,93	8,30	219
90 +	9 318	8,72	(8,60)	8,55	8,90	121
Total	**45 672**	**7,38**	**(8,89)**	**7,30**	**7,46**	**219**

[a] Length of stay

No statistical significance was observed between the length of hospital stay of the patients and their place of residence. Both for the inhabitants of rural and urban areas the mean length of hospital stay due to a fall equalled 7.4 days (σ=9.0 and σ=8.6 respectively) (Table V).

The analysis also demonstrated that the observed differences in the length of stay for men and women are

statistically significant: $t_{(22751)} = 2.88$ $p<0.01$. However, despite their statistical significance, the nominal differences in the length of hospital stay are small (0.3 days), and the length of hospitalization equals 7.5 days (σ=8.9) for women and 7.2 days (σ=8.9) for men (Table V).

Table V. Length of fall related hospital stay (LOS) in days among seniors (≥65 years old) in Poland in 2010 by place of residence and sex

	Number of hospitalisation	Mean length of stay (LOS)	Standard deviation
Place of residence			
Urban area	27 827	7,41	(9,05)
Rural area	17 845	7,32	(8,64)
Gender			
Male	12 654	7,18	(8,94)
Female	33 016	7,45	(8,87)

Place of residence. Our analysis has shown that the frequency of hospitalization among seniors, depending on a place of residence, is directly proportional to the size of the population of elderly people inhabiting urban and rural areas in Poland. Among all persons hospitalized due to a fall, 61% (27 827) lived in urban areas, and 39% (17 845) lived in rural areas. There were no significant differences in the number of hospitalized persons depending on their place of residence. However, for both groups in this study (urban and rural inhabitants) the rate of hospitalization (per 100 thousand inhabitants) is 1.5-fold higher for women than for men. These differences are also observed with regard to the frequency of hospitalization among men and women for different causes of hospitalization, expressed in the form of three-character ICD-10 codes (W00-W19).

Results of falls. We have also analysed the results of falls that lead to hospitalization (Table VI). In each studied group almost 1 in every 3 cases of hospitalizations (31.4%) was caused by a fracture of femur (14 356 cases of hospitalization). Women suffered from femoral fractures more often than men; a femoral fracture was the cause of hospitalization for 1 in every 3 women, and for 1 in every 4 men. The analysis of hospitalization rates (per 100 thousand inhabitants) demonstrated that the risk of hospitalization is twice as high for women as it is for men (346 and 165 cases of hospitalization per 100 thousand inhabitants respectively).

The second most common result of falls was a forearm fracture (10% of hospitalizations due to falls). Significant differences depending on gender were observed; the hospitalization ratio for women aged 65 and older is 5-fold greater than for men. That means that 132 women in every 100 thousand were hospitalized due to a fall, which resulted in a forearm fracture. For men this rate equals 24 in every 100 thousand.

Among other common result of falls among seniors, the following can be listed: intracranial injuries (6.6%), fracture of lower leg, including ankle (6.4%), and fracture of shoulder and upper arm (5.8%).

DISCUSSION

The organisation of healthcare system and ways of allocating public healthcare resources should be based on current epidemiological data, and should also take into account statistical and demographical prognoses. Epidemiological data clearly indicate that the number of cases of hospitalization among seniors will continue to rise. Falls among elderly people and fall-related hospitalizations are a growing challenge for the healthcare system.

It is estimated that in Poland almost one in every four persons (23%) aged 65 or over experiences at least one fall (2). Taking the data presented in this work into consideration, that means that 3.8% of all the falls among seniors result in serious injuries leading to hospitalization. A comparison of the number of falls among seniors in Poland with the international statistics suggests that the number of registered falls in Poland in 2010 may be underestimated. According to international statistics, the problem of falls may concerns one in every 3 persons aged 65 or over. Moreover, approx. 10% of all the falls result in serious injuries and require hospitalization of the injured person (3-6).

Additionally, the international data suggest that, as a result of the current demographical trends, including population ageing, the number of people hospitalized due to falls continues to grow. In the Netherlands the number of seniors hospitalized due to falls rose by

Table VI. Number of seniors (aged ≥ 65 years) hospitalized for fall-related injuries (by ICD-10 codes) in Poland in 2010 by sex (5 most frequent injuries)

ICD-10 code	Type of injury	Number of hospitalisation by gender			Percentage
		Males	Females	Total	
S72	Fracture of femur	3 214	11 141	14 356	31,4%
S52	Fracture of forearm	468	4 242	4 710	10,3%
S06	Intracranial injury	1 518	1 488	3 006	6,6%
S82	Fracture of lower leg, including ankle	865	2 071	2 936	6,4%
S42	Fracture of shoulder and upper arm	577	2 058	2 635	5,8%

137% between 1989 and 2008. The hospitalization rate increased by 61% (from 877 to 1412 cases per 100 thousand inhabitants). The biggest increase was observed for the group aged 75 years and over (1). Similarly, in the USA within the last few years (2001-2008) a significant increase (by 50%) in the number of seniors hospitalized due to falls was observed. Currently, the rate of hospitalization due to falls among elderly people in Poland is at a similar level as in the Netherlands in 1989 - 883 cases per 100 thousand inhabitants.

The results obtained through our analyses indicate that the structure of cases of hospitalization, depending on gender and age, does not differ from the structure in other countries. In Poland, as well as in other countries, the rate of hospitalization among seniors due to falls is significantly higher for women than for men. In the USA the hospitalization rate for 2008 was 1.5-fold greater for women, and equalled 1 559 per 100 thousand inhabitants. (1,064 per 100 thousand men) (7). Similarly, in the Netherlands for each age group this rate is higher for women (1). Additionally, our analysis has demonstrated that the risk of hospitalization increases with age, which matches the trends observed in the USA, England, the Netherlands and Denmark (1, 5, 7, 8).

At the same time, in the Netherlands the total number of fall related hospital days decreased by 20% for the studied group (1). This change may however be explained by the decreasing mean length of stay. Representative research on changes in total number of hospitals days in Poland is not available.

Falls among elderly people and fall-related hospitalization constitute a large financial burden for the healthcare system. International research shows that the costs of hospitalization among seniors (mainly women), due to femoral fractures and lower-leg fractures, are disproportionate compared to the total amount of financial resources available, and the costs also increase with age (8, 9). Moreover, the results of falls lead to increased costs of long-term care. (10)

Multiple studies prove that the frequency of hospitalization among elderly people is approx. 1/3 times greater than for other age groups. It is therefore possible to assume that the costs of healthcare system in Poland will increase in coming years.

SUMMARY AND CONCLUSIONS

1. The hospitalization rate due to falls is much higher for women than for men. On average out of every 100 thousand women 1 024 are hospitalized due to falls, whereas for men the rate is 649.
2. The risk of fall among seniors, compared to people in the 55-59 age group is 2-fold higher (2). The study has also demonstrated that the rate of hospitalisation increases with age and reaches its peak for persons older than 80 years.
3. The risk of hospitalization due to a fall increases with age. For persons aged 80 years and older it is 2.5-fold higher that for persons in the 65-69 age group (1 459 and 570 in every 100 thousand inhabitants respectively). The length of hospital stays increases with age.
4. Based on the length of hospital stay due to a fall, it is possible to determine that the results of falls among seniors tend to become more serious with age. Hospitalization due to a fall lasts 5.9 days on average for a person aged 65-96; whereas, on average persons aged 80 years and over tend to stay in hospitals for an additional 2 days (80-89 : 8.1 days; 90+ : 8.7 days).
5. The analysis demonstrated that the differences in the length of hospital stay between men and women are statistically significant. At the same time, the differences between the length of hospitalization of patients depending on their place of residence were found insignificant.
6. In 2010 almost 70% or cases of hospitalization of seniors due to falls, were caused by falls on same level from slipping, tripping and stumbling (31 712 cases of hospitalization). There were no differences depending on gender.
7. In each studied group almost every 1 in 3 cases of hospitalizations (31.4%) was caused by a femoral fracture (14 356 cases of hospitalization). Women suffer from femoral fractures more often than men.
8. Based on a comparison of the results of research from the USA, the Netherlands and Denmark, as well as Polish demographic prognosis, we may expect that the number of cases of hospitalization among seniors due to falls in Poland will rise.

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