



## Epidemiology of Geriatric Trauma in an Urban Kazakhstani Setting

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### Abstract

**Background:** External causes of death are still among the main causes of death in the countries of the former Soviet Union. We studied epidemiology of injuries among elderly in a typical Kazakhstani city.

**Methods:** Data on all injuries among individuals aged 60 yr or older in the city of Semey (former Semipalatinsk) from 2010 to 2012 was collected from medical files. We present absolute numbers and incidence rates for the main ICD-codes in Chapters XIX and XX of ICD-10 by gender, ethnic background and place where the injury occurred.

**Results:** Altogether, there were 6065 injuries in 2010-2012. The overall incidence of increased from 4746.6 per 100000 in 2010 to 5577.7 per 100000 in 2012. Injuries to the elbow and forearm, injuries to the shoulder and upper arm, and injuries to the knee and lower leg were the most common and comprised 17.3%, 15.5% and 14.6% of all injuries, respectively. Falls constituted 82.2% of all injuries. Most injuries occurred at home and among ethnic Russians.

**Conclusion:** The incidence and the absolute number of injuries among elderly in Semey increased during the study period in both men and women. Given that the population of Kazakhstan is getting older, injuries are expected to require more attention from the public health professionals and health authorities. More than four-fifths of traumas resulted from falls making this cause of injury the first target for preventive measures.

**Keywords:** Injury, Trauma, Falls, Epidemiology, Kazakhstan, Central Asia

### Introduction

Injuries represent a major public health problem associated with considerable health care expenditures in many countries, particularly in the developing world (1-2). Almost 16 thousand people die from injuries every day worldwide (1). Injuries occur in all age and income groups and their incidence varies substantially between countries (3). Despite survival of trauma patients has substantially improved over the years in most parts of the world external causes of death are still among

the main killers in the countries of the former Soviet Union (4-5).

Elderly have an increased risk for trauma given their partly impaired motor and cognitive functions combined with increasing demands of the modern society (6-8). The proportion of elderly patients seen in trauma units is rapidly increasing in all parts of the world (9). Most of the patients in the age-group 70 yr or more are women (10). Trauma in the elderly population is associated

with higher mortality than among middle-aged patients due to age-related factors, such as decreased physical reserves, underestimation of injury severity, preexisting comorbidity, and insufficient ability for systemic compensation (11-12). Besides, higher case fatality, elderly patients have on average more complications and longer hospital stays than their younger counterparts (13-16).

Most elderly patients with injuries get their traumas at home (17) followed by streets and highways, work, off-road, farm and under unknown circumstances, although there is a considerable variation between countries in the place of trauma depending on the peculiarities of lifestyle of the elderly and preventive measures (18).

World population is getting older with elderly people gradually becoming a substantial part of the population (19). While in 1950, only 8% of the world population was 60 yr or older, by 2050 this proportion is projected to reach 22% accounting for more than two billion people already in 2015 (20-21).

Kazakhstan is a former Soviet republic, which became an independent state in 1991. Life expectancy in Kazakhstan is among the lowest in the European WHO region with one of the greatest gender gaps in the world: 63.6 yr for men and 73.5 yr for women in 2009 (22). External causes of death are the third main killers in Kazakhstan with 102.5 deaths per 100 000 in 2011 (23). Moreover, Kazakhstan has the highest mortality from traffic injuries in the world – 30.6 per 100 000 compared to 25.2 in Russia, and 5.0 in Norway (24).

Kazakhstan is classified as a country with accelerated aging with a population of elderly increasing from 6.7% in 1999 to more than 25% by 2050 (25). Given rapid aging of the Kazakhstan population combined with high rates of death from external causes particularly in urban settings makes prevention of injuries particularly among the elderly one of the most urgent tasks for public health authorities. Effective prevention is possible only when there is a clear understanding of the pattern and underlying factors of the problem. However, the information about injuries in

Kazakhstan is very scarce. We identified only one publication on this topic based on Kazakhstani data, but it covered only road traffic accidents (26) warranting further research.

We studied epidemiology of injuries among elderly in a typical urban Kazakhstani setting during a three-year period.

## **Materials and Methods**

This descriptive study was conducted in a city of Semey (former Semipalatinsk), which is a typical middle-sized urban setting in East Kazakhstan. Semey is an industrial city known for being a test site for Soviet nuclear weapons until the early 1990s. The population of Semey was 335.4 thousand in 2013 (27).

Data on all cases of injuries, which occurred in the city of Semey between 1 Jan 2010 and 31 Dec 2012 and required medical attention, were collected from the medical records at the Semey emergency medical service hospital and all emergency units which serve the whole city. Only cases in the age-group 60 yr or more were selected for this study. This age limit was selected because of low life expectancy in Kazakhstan, particularly among men (23). The following information was extracted from the medical files: age, gender, ethnic background, date of admission, diagnosis, location of injury, and type of injury. Diagnoses were identified through the International Classification of Diseases, 10th edition (ICD-10), Chapter XIX “Injury, poisoning and certain other consequences of external causes” (Codes S00-T98). Causes of trauma were identified through Chapter XX “External causes of morbidity and mortality” (Codes V01-Y98) of ICD-10. We present data for the main groups of ICD-codes in Chapters XIX and XX. Cases with multiple injuries are presented as a separate group. Moreover, we present the data by ethnic background and by place where the injury occurred.

Data on all traumas are presented as absolute numbers and proportions. Continuous variables with non-Gaussian distribution were presented as medians, the first, and the third quartiles (Q1 and

Q3, respectively). Data on population size for calculating incidence rates were obtained from the Agency of Statistics of Kazakhstan and from the Department of Statistics of East Kazakhstan (27-28).

The study was approved by the Ethical Committee of the Semey State Medical University.

## Results

Altogether, there were 6065 injuries during the study period. Sixty-seven percent of them occurred among women. Median age of men was 68 yr (Q1=62, Q3=73). Corresponding numbers for women were 71 year (Q1=64, Q3=76).

**Table 1:** Absolute numbers of injuries by localization and incidence rates per 100000 among  $\geq 60$  yr old women in Semey, Kazakhstan

ICD-10 code	2010		2011		2012	
	n	Incidence per 100000	n	Incidence per 100000	n	Incidence per 100000
S00-S09: Injuries to the head	19	75.3	7	27.2	7	26.5
S10-S19: Injuries to the neck	0	0	0	0	0	0
S20-S29: Injuries to the thorax	108	428	113	438.6	162	613.1
S30-S39: Injuries to the abdomen, lower back, lumbar spine and pelvis	34	134.8	32	124.2	28	105.9
S40-S49: Injuries to the shoulder and upper arm	200	793.0	203	788.0	247	934.8
S50-S59: Injuries to the elbow and forearm	261	1034.9	274	1063.6	298	1127.8
S60-S69: Injuries to the wrist and hand	110	436.1	123	477.4	151	571.5
S70-S79: Injuries to the hip and thigh	138	547.2	145	562.8	193	730.4
S80-S89: Injuries to the knee and lower leg	207	820.8	201	780.2	215	813.7
S90-S99: Injuries to the ankle and foot	124	491.7	120	465.8	164	620.6
T20-T32: Burns and corrosions	23	91	17	66.0	24	90.8
T33-T35: Frostbite	4	15.9	6	23.3	8	30.3
Injuries to several segments	21	83.3	40	155.3	38	143.8
Total	1249	4952.6	1281	4972.4	1535	5809.5

**Table 2:** Absolute numbers of injuries by localization and incidence rates per 100000 among  $\geq 60$  yr old men in Semey, Kazakhstan

ICD-10 code	2010		2011		2012	
	n	Incidence per 100000	n	Incidence per 100000	n	Incidence per 100000
S00-S09: Injuries to the head	12	86.3	10	69.9	9	61.3
S10-S19: Injuries to the neck	0	0	2	14.0	0	0
S20-S29: Injuries to the thorax	101	726.4	132	923.1	162	1102.9
S30-S39: Injuries to the abdomen, lower back, lumbar spine and pelvis	10	71.9	4	27.9	10	68.1
S40-S49: Injuries to the shoulder and upper arm	94	676.1	93	650.3	101	687.6
S50-S59: Injuries to the elbow and forearm	56	402.8	77	538.5	85	578.7
S60-S69: Injuries to the wrist and hand	84	604.1	87	608.4	109	742.1
S70-S79: Injuries to the hip and thigh	60	431.5	57	398.6	68	462.9
S80-S89: Injuries to the knee and lower leg	89	640.1	79	552.4	95	646.7
S90-S99: Injuries to the ankle and foot	59	424.3	50	349.6	85	578.7
T20-T32: Burns and corrosions	22	158.2	15	104.9	10	68.1
T33-T35: Frostbite	3	21.6	13	90.9	8	54.5
Injuries to several segments	18	129.4	15	104.9	16	108.9
Total	608	4372.8	634	4433.6	758	5160.7

The overall incidence of injuries among the elderly in the study setting progressively increased from 4746.6 per 100000 in 2010 to 5577.7 per 100000 in 2012. By localization of injury, categories S50-S59 (injuries to the elbow and forearm), S40-S49 (injuries to the shoulder and upper arm) and S80-S89 (injuries to the knee and lower leg) were the most common and comprised 17.3%, 15.5% and 14.6% of all injuries, respectively in the study population. Gender-specific incidences by year and location of trauma are presented in Table 1 and 2.

By cause, most injuries resulted from falls (W00-W19, 82.2%) followed by exposure to inanimate (W20-W49) and animate mechanical forces (W50-W64). Injuries of pedestrians in traffic accidents comprised 1.5% of all injuries. Gender-specific incidences by year and cause of trauma are presented in Table 3 and 4.

Fifty percent of all injuries occurred among ethnic Russians while 47.4% of injuries occurred in ethnic Kazakhs. Most injuries (51.9%) occurred at home, on a street (39.4%) and in yards next to home (5.2%).

**Table 3:** Absolute numbers of injuries by reason and incidence rates per 100000 among  $\geq 60$  yr old women in Semey, Kazakhstan (2010–2012)

ICD-10 code	2010		2011		2012	
	n	Incidence per 100000	n	Incidence per 100000	n	Incidence per 100000
V01-V09: Pedestrian injured in a transport accident	9	35.7	27	104.8	25	94.6
V10-V19: Pedal cyclist injured in transport accident	10	39.7	2	7.8	11	41.6
V20-V29: Motorcycle rider injured in transport accident	1	4.0	0	0	0	0
V70-V79: Bus occupant injured in transport accident	0	0	0	0	4	15.1
V80-V89: Other land transport accidents	0	0	0	0	0	0
W00-W19: Falls	1048	4155.6	1103	4281.5	1319	4992.1
W20-W49: Exposure to inanimate mechanical forces	86	341.0	78	302.8	75	283.9
W50-W64: Exposure to animate mechanical forces	60	237.9	44	170.8	66	249.8
W75-W84: Other accidental threats - breathing	1	4.0	0	0	0	0
W85-W99: Exposure to electric current, radiation and extreme ambient air temperature and pressure	0	0	0	0	0	0
X00-X09: Exposure to smoke fire and flames	3	11.9	2	7.8	1	3.8
X10-X19: Contact with heat and hot substances	21	83.3	14	54.3	21	79.5
X30-X39: Exposure to forces of nature	5	19.8	5	19.4	7	26.5
X60-X84: Intentional self-harm	0	0	0	0	0	0
X85-Y09: Assault	5	19.8	5	19.4	5	18.9
Y10-Y34: Event of undetermined intent	0	0	1	3.9	1	3.8
Total	1249	4952.6	1281	4972.4	1535	5809.6

## Discussion

This is the first paper describing epidemiology of traumas among elderly in Central Asian republics of the former Soviet Union in details to the best of our knowledge. Semey is a typical city of Kazakhstan regarding living conditions of the elderly, their day-to-day activities and preventive

measures taken by the society which allows us to generalize the results of the study to other middle-sized urban settings in Kazakhstan, although generalization to either rural areas or other Central Asian countries is not recommended because of considerable socio-economic differences between countries and between urban and rural areas.

**Table 4:** Absolute numbers of injuries by reason and incidence rates per 100000 among  $\geq 60$  yr old men in Semey, Kazakhstan (2010–2012)

ICD-10 code	2010		2011		2012	
	n	Incidence per 100000	n	Incidence per 100000	n	Incidence per 100000
V01-V09: Pedestrian injured in transport accident	4	28.8	15	104.9	13	88.5
V10-V19: Pedal cyclist injured in transport accident	2	14.4	3	21.0	6	40.8
V20-V29: Motorcycle rider injured in transport accident	2	14.4	2	14.0	1	6.8
V70-V79: Bus occupant injured in transport accident	0	0	0	0	2	13.6
V80-V89: Other land transport accidents	1	7.2	1	7.0	0	0
W00-W19: Falls	457	3286.8	476	3328.7	585	3982.8
W20-W49: Exposure - inanimate mechanical forces	75	539.4	72	503.5	79	537.9
W50-W64: Exposure - animate mechanical forces	34	244.5	30	209.8	45	306.4
W75-W84: Other accidental threats - breathing	0	0	0	0	0	0
W85-W99: Exposure - electric current, radiation and extreme ambient air temperature and pressure	1	7.2	0	0	0	0
X00-X09: Exposure – smoke, fire and flames	4	28.8	0	0	1	6.8
X10-X19: Contact with heat and hot substances	16	115.1	13	90.9	9	61.3
X30-X39: Exposure - forces of nature	3	21.6	12	83.9	8	54.5
X60-X84: Intentional self-harm	0	0	2	14.0	0	0
X85-Y09: Assault	8	57.5	7	49.0	9	61.3
Y10-Y34: Event of undetermined intent	1	7.2	1	7.0	0	0
Total	608	4372.8	634	4433.6	758	5160.7

The results demonstrate a considerable increase in the incidence of injuries during the study period in both men and women while in most other countries there is a steady decrease in both incidence of and mortality from injuries. Although, our findings on the distribution of injuries by location and circumstances of are generally in line with the results of the most of the studies conducted in neighboring countries, direct comparisons are difficult due to different definitions of elderly across the studies. Although, there is no universal definition of the elderly population the United Nations suggest 60 yr of age as the lower limit of the older population (29). Although, the age-cutoff is greater in most of the studies conducted in Europe and Asia, we consider our cutoff acceptable given low life expectancy particularly among men in Kazakhstan (22).

One of the advantages of this study is the fact that we included all patients in all clinics serving the city and manually went through all medical

files to verify the diagnoses according to ICD-10 and studied circumstances around injury to assure the quality of V-codes in the classification of injuries. However, in a small proportion of cases the information on the place where injury outside the home occurred was missing. Moreover, exact information on the address where injury occurred if it occurred on the street limiting our opportunities for the identification of dangerous crossroads, pavements or other places for further action.

The overall incidence of injuries in the Republic of Kazakhstan was 4075.8 per 100000 of population in 2007, which is 21.7% lower than what was reported during the last year of the Soviet period (5204.8 cases per 100000 population in 1990). However, the mortality resulting from injuries during this period increased by 45.6% (145.2 per 100000 population in 2007 compared with 103.5 per 100000 population in 1990 (30). These rates are considerably higher than in other Central Asian republics and more than four times as high

as the EU15 average. In 2009, mortality from external causes in Kazakhstan was the third highest in the WHO European Region after Russia and Lithuania (22). The proportion of elderly patients among all trauma patients increases in most countries (31), but our findings on the increase of the incidence of injuries among elderly in the city of Semey should increase awareness of regional and national public health authorities in Kazakhstan.

The observed increase in the incidence of traumas among the elderly is not in line with the overall injury statistics in both regional and national levels during the study period. While the regional data for East Kazakhstan show a reduction in the incidence of injuries from 4873.8 in 2010 to 4693.0 in 2012, the corresponding rates for the whole country are 3865.3 per 100000 and 3615.6 per 100000 (32). While the rates of injuries among the elderly tend to decrease in Western Europe, in many other countries it remains stable (33-36). There is no official statistics of injuries for the elderly in Kazakhstan, but our data should raise awareness of the fact that officially reported data may mask an alarming trend in certain population groups.

Epidemiological studies from many countries show a predominance of women in among elderly with injuries (37-39) with few exceptions where the incidence of injuries in men is greater (40). In our study, confidence intervals for overall incidence rates for all years for men and women overlap suggesting no significant gender differences although incidences for the most common gender-specific injuries (S50-S59 for women and S20-S29 for men) reached the level of statistical significance. This study demonstrates that the injuries of the elbow and forearm are the leading localizations of trauma among women and in the full sample. This finding corresponds to the national data for all ages, which show that the most common injury in Kazakhstan is the injury of the upper extremities accounting for 33.4% of all injuries (41). Incidence of injuries of the forearm increased from the 1950s until the 1990s then it leveled off and started to decline (42). This was not the case for our study setting during the study period. Some researchers suggest that poor

prevention and treatment of osteoporosis may be an important contributor to the injuries among the elderly (43, 44). Although, the incidence of most injuries in Semey increased from 2010 through 2012, the incidence of head injuries substantially decreased particularly among women. Similar trend was observed, for example, in Canada where head injuries were common (45).

In spite of the fact that proportions of injuries among ethnic Kazakhs and ethnic Russian are similar (47.3% vs. 49.8%). These findings suggest that Russians may be at greater risk of injuries, because Russians constitute only 27.8% of the total population of Semey. There is no official statistics on the distributing of ethnic groups among the elderly, thus we cannot test our hypothesis on ethnic variations in the incidence of injuries in Semey.

Most of the injuries in our study occurred at home. Moreover, this proportion increased during the study period (data not shown). The proportion of traumas at home varies also across age-groups (46). Types of housing vary considerably between and within countries warranting further research on circumstances around traumas at home in the study area.

Similarly to most other settings, the most common mechanism of injury in our study was falls. The elderly are particularly susceptible to significant injury from falls. More than 6% of all falls result in fractures and from 10% to 30% result in significant injury (47). Semey is located in East Kazakhstan – an area with hot summers and cold winters. Poor conditions of the pavements covered with ice and snow during the cold period, which lasts for more than 4 months, may contribute to the falls outside home. Environmental factors have been shown by others as important risk factors for falls (48). Further research is needed to identify risk factors for injuries and falls in particular in Kazakhstan.

This study includes only those injuries registered at medical institutions. This implies that our data may underestimate the real incidence of injuries. However, the degree of underestimation is small since most of traumas, which required medical attention, are generally attended by either ambul-

ance service or other parts of the health care system. Another limitation of this study is its descriptive nature, which does not allow making conclusions about factors, which increase the risk of injury in the study population. However, the first step, which is need for development of preventive program, is a thorough description of the problem and our study contributes to this step.

## Conclusion

The incidence and the absolute number of injuries among elderly in the study setting increased during the study period in both men and women. Given that the population of Kazakhstan is getting older, injuries are expected to require more attention from the public health professionals and health authorities. More than a half of injuries among elderly occur at home warranting measures directed at development of safe home environment. More than four-fifths of traumas, which require medical attention in the study population, resulted from falls making this cause of injury the first target for preventive measures.

## Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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The authors declare that there is no conflict of interests.

## References

1. Mock C, Nkrumah K (2001). Injury in the developing world. *West J Med*, 175 (6):372-4.
2. Chiara O, Cimbanassi S, Pitidis A, Vesconi S (2006). Preventable trauma deaths: from panel review to population based studies. *World J Emerg Surg*, 1:12.
3. Krug EG, Sharma GK, Lozano R (2000). The Global Burden of Injuries. *Am J Public Health*, 90 (4):523-6.
4. Shackford SR, Mackersie RC, Holbrook TL, Davis JW, Hollingsworth-Fridlund P, Hoyt DB, Wolf PL (1993). The Epidemiology of Traumatic Death. A Population-Based Analysis. *Arch Surg*, 128 (5):571-5.
5. Demetriades D, Murray J, Charalambides K, Alo K, Velmahos G, Rhee P, Chan L (2004). Trauma fatalities: time and location of hospital deaths. *J Am Coll Surg*, 198 (1):20-6.
6. Callaway DW, Wolfe R. Geriatric trauma (2007). *Emerg Med Clin North Am*, 25(3):837-60.
7. Yıldız M, Bozdemir MN, Kılıçaslan I, Ateşçelik M, Gürbüz Ş, Mutlu B, Onur MR, Gürger M (2012). Elderly trauma: the two years' experience of a University-affiliated Emergency Department. *Eur Rev Med Pharmacol Sci*, 16 (1):62-7.
8. Spaniolas K, Cheng JD, Gestring ML, Sango-sanya A, Stassen NA, Bankey PE (2010). Ground level falls are associated with significant mortality in elderly patients. *J Trauma*, 69(4):821-5.
9. Moore L, Turgeon AF, Sirois MJ, Lavoie A (2012). Trauma center outcome performance: A comparison of young adults and geriatric patients in an inclusive trauma system. *Injury*, 43(9):1580-5.
10. Jamrozik K, Samarasinghe E, Miracle R, Blair M, Sethi D, Saxena S, Bowen S (2008). Attendance for injury at accident and emergency departments in London: a cross-sectional study. *Public Health*, 122(9):838-44.
11. Lonner JH, Koval KJ (1995). Polytrauma in the elderly. *Clin Orthop Relat Res*, 318:136-43.
12. Chang WH, Tsai SH, Su YJ, Huang CH, Chang KS, Tsai CH (2008). Trauma mortality factors in the elderly population. *Int J Gerontol*, 2(1):11-7.
13. Champion HR, Copes WS, Buyer D, Flanagan ME, Bain L, Sacco WJ (1989). Major trauma in geriatric patients. *Am J Public Health*, 79(9):1278-82.
14. Morita S, Higami S, Yamagiwa T, Iizuka S, Nakagawa Y, Yamamoto I, Inokuchi S (2010). Characteristics of elderly Japanese patients with severe burns. *Burns*, 36(7):1116-21.
15. Goodmanson NW, Rosengart MR, Barnato AE, Sperry JL, Peitzman AB, Marshall GT (2012).

- Defining geriatric trauma: when does age make a difference? *Surgery*, 152(4):668-74.
16. Johnson CL, Margulies DR, Kearney TJ, Hiatt JR, Shabot MM (1994). Trauma in the elderly: an analysis of outcomes based on age. *Am Surg*, 60(11):899-902.
  17. Tolulope A, Oyetunji, Sharon K, Ong'uti, Oluwaseyi B, Bolorunduro, Dani O, Gonzalez, Edward E, Cornwell, Adil H, Haider (2012). Epidemiologic Trend in Elderly Domestic Injury. *J Surg Res*, 173(2):206-11.
  18. Adam SH, Eid HO, Barss P, Lunsjo K, Grivna M, Torab FC, Abu-Zidan FM (2008). Epidemiology of geriatric trauma in United Arab Emirates. *Arch Gerontol Geriatr*, 47(3):377-82.
  19. World Health Organization, National Institute of Aging, National Institute on Health (2011). Aging Global health and aging. [http://www.who.int/ageing/publications/global\\_health.pdf](http://www.who.int/ageing/publications/global_health.pdf)
  20. United Nations (2011). *World Population Prospects: The 2010 Revision*. New York.
  21. United Nations (2006). *World Population Ageing 2006*. New York.
  22. Katsaga A, Kulzhanov M, Karanikolos M, Rechel B (2012). *Kazakhstan: health system review. Health systems in transition*. 14(4):1-154.
  23. Agency of Statistics of the Republic of Kazakhstan (2012). *Demographic year-book of Kazakhstan*. Astana.
  24. WHO Regional Office for Europe (2009). *European status report on road safety: towards safer roads and healthier transport choices*. Copenhagen.
  25. United Nations (2002). *World Population Ageing 1950-2050*. New York.
  26. Myssaev A, Meirmanov S, Rakhypbekov T, Bulgenov T, Semenova Y (2014). The Characteristics of Road Traffic Fatalities in Kazakhstan's Semey Region, 2006-2010: A Descriptive Retrospective Study. *Iran J Public Health*, 43(6):760-8
  27. Statistics Department of East-Kazakhstan Region Government. <http://www.akimvko.gov.kz/en/rule/akimat-vostochno-kazaxstanskoj-oblasti/oblastnyie-departamentnyi/departament-statistiki-vko.html>
  28. Agency of Statistics of the Republic of Kazakhstan. [http://www.stat.gov.kz/faces/NavAbout/aboutAboutAgencyHistory?\\_adf.ctrl-state=ib75wr4t5\\_4&lang=en&\\_afzLoop=10885496948269587#%40%3F\\_afzLoop%3D10885496948269587%26lang%3Den%26\\_adf.ctrl-state%3Df0hhritff\\_4](http://www.stat.gov.kz/faces/NavAbout/aboutAboutAgency/aboutAgencyHistory?_adf.ctrl-state=ib75wr4t5_4&lang=en&_afzLoop=10885496948269587#%40%3F_afzLoop%3D10885496948269587%26lang%3Den%26_adf.ctrl-state%3Df0hhritff_4)
  29. WHO. Definition of an older or elderly person. <http://www.who.int/healthinfo/survey/ageingdefnolder/en>.
  30. Ministry of Healthcare, Republic of Kazakhstan (2008). Population Health and Health Care System in the Republic of Kazakhstan in 2007. [https://www.fundamental-research.ru/pdf/2016/2016\\_3\\_1.pdf](https://www.fundamental-research.ru/pdf/2016/2016_3_1.pdf).
  31. Bonne S, Schuerer DJ (2013). Trauma in the older adult: epidemiology and evolving geriatric trauma principles. *Clin Geriatr Med*, 29(1):137-50.
  32. Ministry of Healthcare, Republic of Kazakhstan (2013). Population Health and Health Care System in the Republic of Kazakhstan in 2007. [http://isru.npu.edu.ua/stat/usage\\_201109.html](http://isru.npu.edu.ua/stat/usage_201109.html).
  33. Ministry of Healthcare, The Russian Federation (2013). *The incidence of the population of retirement age*. Moscow.
  34. Centers for Disease Control and Prevention. Nonfatal Injury Reports, 2001 - 2012. <http://webappa.cdc.gov/sasweb/ncipc/nfirates2001.html>.
  35. Injury Prevention Research Unit. National Injury Query System. <http://ipru3.otago.ac.nz/niqs/index.php>.
  36. BC Injury Research and Prevention Unit <http://www.injuryresearch.bc.ca/reports-publications>.
  37. Majori S, Ricci G, Capretta F, Rocca G, Baldovin T, Buonocore F (2009). Epidemiology of domestic injuries. A survey in an emergency department in North-East Italy. *J Prev Med Hyg*, 50(3):164-9.
  38. O'Neill S, Brady RR, Kerssens JJ, Parks RW (2012). Mortality associated with traumatic injuries in the elderly: A population-based study. *Arch Gerontol Geriatr*, 54(3):e426-30.
  39. Alvarez-Nebreda ML, Jiménez AB, Rodríguez P, Serra JA (2008). Epidemiology of hip fracture in the elderly in Spain. *Bone*, 42(2):278-85.
  40. Akkose Aydin S, Bulut M, Fedakar R, Ozgurur A, Ozdemir F (2006). Trauma in



- the elderly patients in Bursa. *Ulus Trauma Acil Cerrahi Derg*, 12(3):230–4.
41. Yegeubaeva SA, Kulzhanov MK, Aubakirova AS, Balabayev TF (2011). Challenges for Injury Prevention Among the Elderly in Kazakhstan. *Asia-Pac J Public Health*, 23(2):237–45.
  42. Wilcke MKT, Hammarberg H, Adolphson PY (2013). Epidemiology and changed surgical treatment methods for fractures of the distal radius: a registry analysis of 42,583 patients in Stockholm County, Sweden, 2004–2010. *Acta Orthop*, 84(3):292-6.
  43. Jagnoor J, Keay L, Ganguli A, Dandona R, Thakur JS, Boufous S, Cumming R, Ivers RQ (2012). Fall-related injuries: A retrospective medical review study in North India. *Injury*, 43(12):1996–2000.
  44. Court-Brown CM, Clement N (2009). Four score years and ten an analysis of the epidemiology of fractures in the very elderly. *Injury*, 40(10):1111–4.
  45. Canadian Institute for Health Information (2006) *Head Injuries in Canada: A Decade of Change (1994-1995 to 2003-2004)*. [https://secure.cihi.ca/free\\_products/ntr\\_head\\_injuries\\_2006\\_e.pdf](https://secure.cihi.ca/free_products/ntr_head_injuries_2006_e.pdf).
  46. Green C, Molony D, Fitzpatrick C, O'Rourke K (2010). Age-specific incidence of hip fracture in the elderly: A healthy decline. *Surgeon*, 8(6):310-3.
  47. Mandavia D, Newton K (1998). Geriatric trauma. *Emerg Med Clin North Am*, 16(1):257–74.
  48. Mondor L, Charland K, Verma A, Buckeridge DL (2015). Weather warnings predict fall-related injuries among older adults. *Age Ageing*, 44(3):403–8.