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Prevalence and Incidence of Hip Fracture in the World: A Systematic Review

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Abstract

Background: Hip fracture, a serious complication of osteoporosis, is associated with high morbidity and mortality rates. Incidence of hip fractures varies among countries worldwide, particularly in individuals aged 50 years and above. This study was conducted to investigate the prevalence and incidence of hip fractures worldwide systematically.

Materials and Methods: This study systematically reviewed English-language articles published between 2002 and 2022. The articles were sourced from internationally recognized databases, including Proquest, Pubmed, Web of Science, and Scopus. The search strategy employed Mesh terms, specifically "Period Prevalence," "Incidence," and "Hip Fracture." The study encompassed cohort, cross-sectional, and case-control studies that reported the prevalence and incidence of hip fractures in populations aged 18 years and above. A total of 40 articles were selected for analysis.

Results: Based on the studies reviewed, Australia had the highest hip fracture prevalence rate (63%), while the United States had the lowest rate (2.3%). In East Asian countries, Japan had an incidence rate of 1.92 per 1000 persons, and Taiwan had a rate of 649 per 100,000 persons.

Conclusion: Hip fracture incidence changes occur in developed and certain Asian countries. A health strategy is needed to identify key factors for fracture prevention and post-fracture care for better outcomes in older individuals.

Keywords: Prevalence, Incidence, Hip Fractures

Introduction

Hip fracture is one of the most common fractures which are observed in orthopedic trauma teams and is a common public health problem in most countries [1]. The aging of the population, which stems from the increase in life expectancy, is associated with the upward trend in hip fracturen in such a way that 20% of

all fractures occur in people over 50 [2, 3]. Approximately one out of every 3 women and 12 men has a hip fracture during her/his lifetime [4] .The prevalence of hip fracture is expected to increase from 1.26 million in 1990 to 4.5 million by 2050 [1]. The hip fracture rate varies significantly among countries and regions worldwide. The highest rate of hip fracture has been reported in Northern Europe (Norway, Sweden, Iceland, Ireland), Central Europe (Denmark, Belgium, Germany, Switzerland, Austria), Eastern Europe (Czech Republic, Slovakia, Hungary) and the Middle East (Oman, Iran [2]. The age-standardized hip fracture incidence rate varies from 1.95 people per one hundred thousand people in Brazil to 9.315 people in Denmark [5]. In densely populated areas of the world, such as South American or Asian countries, the hip fracture incidence rate has increased [2]. This heterogeneity in incidence can reflect population-based differences, different information sources, and various analytical approaches [5]. The global variation in hip fracture incidence indicates that environmental and genetic factors may contribute to the etiology [1]. Such knowledge will support decision-makers and healthcare professionals in allocating resources according to the population's needs, such as prioritizing interventions for those with the greatest need.

On the other hand,hip fractures can impose significant economic burdens on communities, leading to a decreased quality of life due to long-term care needs and, in some cases, patient mortality. The costs associated with hospitalization—including surgery, laboratory tests, radiology, and length of stay, as well as rehabilitation and nursing home residency, are among the most critical factors. Notably, the average hospital stay varies across countries due to differences in healthcare systems, which can introduce additional costs [6]. Furthermore, studies of this nature can increase researchers' awareness of the risks and prevalence of hip fractures, facilitating improvements in preventive and treatment strategies while highlighting the need for further research.

Consequently, this study was conducted to systematically investigate the prevalence and incidence of hip fractures worldwide to provide consistent information on the subject.

Materials and Methods

Data sources & Search strategy: In this systematic review, all of the English-language studies published in the 2002-2022 period were reviewed. The articles were collected from international databases (Proquest Pubmed, Web of Science, Scopus) using the keywords that matched Mesh, including:

“Period Prevalence" OR "Point Prevalence" OR Prevalence* OR Incidence* OR "Incidence Proportion" OR "Cumulative Incidence" OR "Incidence Rate" OR "Person time Rate" AND hip* OR *trochanteric* OR "neck of femur" OR "lower end of femur" AND break* OR fracture* AND Disability* OR "Disability Evaluation"* OR Frailty* OR "Frailty Syndrome" OR Debility* OR imperfection* OR weakness* OR infirmity

Data Extraction& Risk of Bias Assessment: First, the titles and abstracts of the articles were checked by the researcher (Yarmohammadi. Soudabeh). Second, the researchers checked the articles' complete texts (KalanFarmanFarma & Asgarian Fatemeh Sadat). Finally, the data that involved the author's name, year of publication, age, gender, sample size, and prevalence and incidence of hip fracture were inserted into the Excel software in the researcher-developed checklist.

The Newcastle-Ottawa Scale (NOS) was employed in this systematic review to assess the quality of articles [7]. Scores of 7–9, 4–6, and 4 were classified as having a low, moderate, or high risk of bias, respectively

Selection of studies: All of the cohort, cross-sectional, and case-control studies that reported the prevalence and incidence of hip fracture in the over-18 population were included in the present study. The exclusion criteria involved being a case-report study and being a study that does not have the required information. Lastly, 40 studies were included in this study.

Results

Search results and study characteristics: The identification and selection procedures of the articles are shown in the PRISMA diagram [8] (Fig. 1). After checking the titles of all identified articles, the researchers checked their abstracts in terms of inclusion and exclusion criteria. In the initial review, 918 articles were selected. Nonetheless, after removing the duplicate and unrelated articles, the researchers included 40 articles in this study. NOS risk of bias assessment instrument showed that most of the studies were in the moderate category (Table 1).

In the examined studies, the highest and the lowest prevalence rates of hip fracture were found in Australia and the United States, respectively (63 vs 2.3%). The highest percentage of fracture (80.3%) was related to the Intertrochanteric type, and its lowest percentage (2.6%) was associated with the Subtrochanteric type. There were significant differences between hip fracture incidence rates in East Asian countries (1.92 people per one hundred thousand people in Japan compared to 649 people in Taiwan) (Table 2).

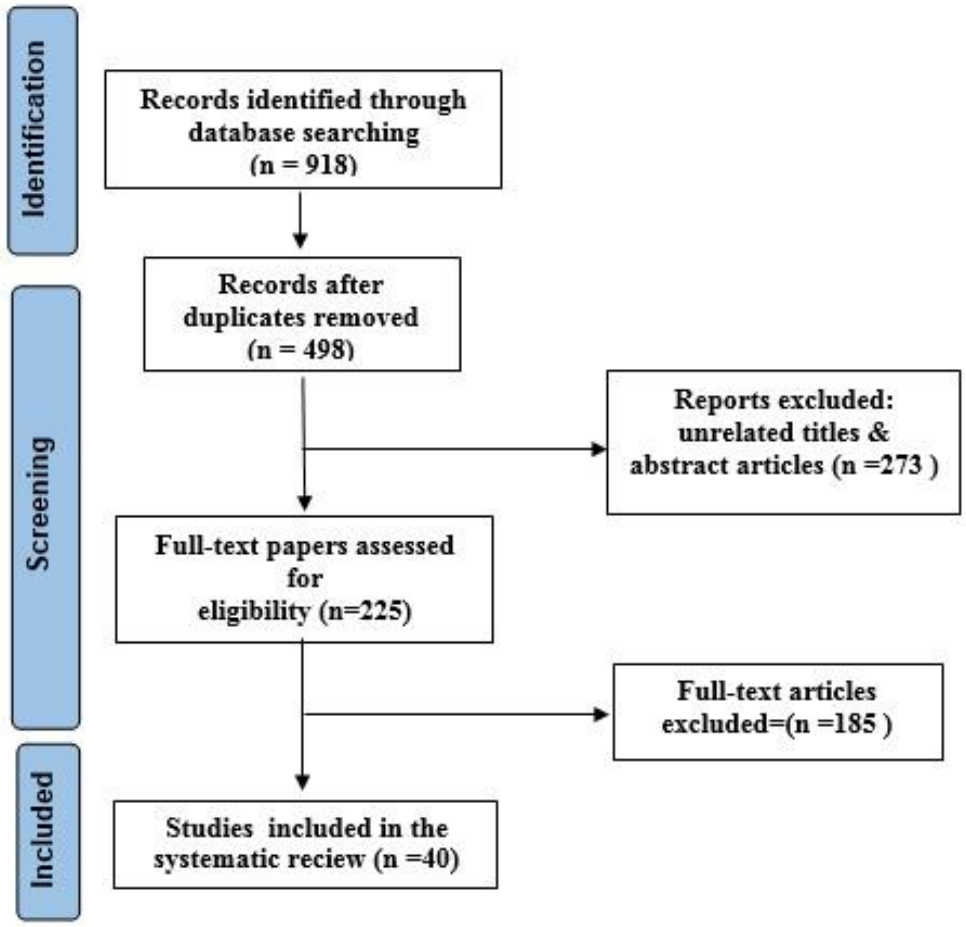

Fig. 1. Flowchart of the literature search.

Table 1. NOS for risk of bias assessment of the included studies

Study	Selection				Comparability	Outcome			Total score
Cohort	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Outcome not present at start		Assessment of outcome	Adequacy of follow up of length	Adequacy of follow up	
DovjakP (2017)[9]	-	*	*	-	-/*	*	*	*	6
Young Y(2011)[11]	-	-	*	*	-/*	-	*	*	5
Palumbo AJ (2015)[12]	-	-	*	*	-/*	-	*	*	5
Badgeley MA (2019)[12]	*	-	*	-	-	-	-	-	2
Holleyman RJ (2022)[14]	-	-	*	-	-/*	*	*	*	5
BowerES (2017)[15]	-	-	*	-	-/*	*	*	*	5
Adunsky A (2012)[16]	-	-		-	-/*	*	*	*	4
Vochteloo AJ (2013)[17]	-	*	*	-	**	*	*	*	7
Trevisan C (2021)[18]	-	*	*	-	-/*	*	*	*	6
Torpilliesi T (2012)[19]	-	-	*	-	-/*	*	*	*	5
Prommik P (2022)[3]	-	-	*	-	-	*	*	*	4
González-Quevedo D (2022)[20]	-	-	*	-	-/*	*	*	*	5
Strøm Rönnquist S (2022)[21]	-	-	*	-	-	*	*	*	4

De Jood SGe (2019)[22]	-	-	*	-	-	*	*	*	**4**
PROBERT N (2020)[23]	*	-	*	-	-/*	*	*	*	**5**
Kjær N(2022)[24]	-	*	*	-	-	*	*	*	**5**
Grundill M(2021)[25]	*	-	*	-	-/*	*	*	*	**6**
Inoue Tatsuro (2019)[26]	-	-	*	-	-/*	*	*	*	**5**
Jérôme V(2020)[27]	-	-	*	-	-	*	*	*	**4**
Van de Ree CL (2019)[28]	-	-	*	-	*/-	*	*	*	**5**
KoYoungji (2019)[30]	-	-	*	-	-	*	*	*	**4**
Beloosesky Y(2011)[31]	*	-	*	-	-	*	*	*	**5**
KimuraA (2019)[32]	-	-	*	-	-	*	*	*	**4**
Zhang C (2020)[33]	*	-	*	*	-/*	*	*	*	**7**
Rey-Rodriguez MM (2020)[34]	*	-	*	-	-/*	*	*	*	**6**
Kim J (2019)[35]	*	*	*	*	-/*	*	*	*	**8**
RappK (2008)[36]	*	*	*	*	*/-	*	*	*	**8**
Glinkowski W(2019)(37]	*	-	*	-	-	*	*	*	**5**
Northuis CA (2020)[38]	-	-	-	-	**	-	*	*	**4**
Zheng JQ (2017)[39]	*	*	*	-	**	*	*	*	**8**
Huang SW (2016)[41]	*	-	*	-	**	*	*	*	**7**
Vala CH (2020)[42]	*	*	*	*	**	*	*	*	**9**
Isaia GC (2011)[43]	-	-	*	*	-	*	*	*	**5**
Furuya T(2013)[44]	*	-	*	-	-	-	*	*	**4**
Chevalley T(2007)[45]	-	-	*	-	-/*	*	*	*	**5**
Videla-Cés M, et al(2017)[46]	*	-	*	-	-	*	*	*	**5**

Cross-sectional	**Selection**				**Compare ability**	**Outcome**		**Total score**
	Representativeness of the sample	**Sample size**	**Non-respondents**	**Ascertainment of the exposure (risk factor)**		**Assessment of the outcome:**	**Statistical test:**	
Da Silva AC (2022)[40]	*	-	-	-	-	**	*	**4**
Monaco M(2006)[10]	*	*	-	**	*	**	*	**8**

Table2. Studies reporting the prevalence & incidence of hip fracture

First author/Year (Reference number)	Type of study	Country	Age(years)	Sex & sample size	Prevalence	N (%)	Incidence rate in 100000	Incidence rate in 1000	Incidence rate in 10000	Incidence (%)	Incidence rate ratio(IRR)	Incidence cumulative
Dovjak P (2017)[9]	cohort	Austria	>50	MF= 238	63							
Monaco M (2006)[10]	cross-sectional	Italy	79.5±7.5	F=200	57							
Young Y (2011)[11]	prospective	USA	65-74	F=383	18							
			75-84	304	26							
			>85	279	55							
Palumbo AJ (2015) [12]	cohort	USA	50-79	F= 80014	2.3			2.0				
Badgeley MA (2019)[13]	cohort	South Australia	50->80	MF= 9024	3							
Holleyman RJ (2022)[14]	cohort	England	>60	MF= 42630		Displaced intracapsular=51.8						
						Undisplaced intracapsular=6.9						
						Intertrochanteric =35.4						
						Subtrochanteric =5.9						
Bower ES (2017)[15]	longitudinal	USA	60≥	MF= 241		Femoral Neck=48.5						
						Intertrochanteric =41.5						
						Subtrochanteric =5.0						
Adunsky A (2012)[16]	retrospective cohort	Israel	65≥	MF =1114		Extracapsular=61						
						Intracapsular=39						
Vochteloo AJ (2013)[17]	cohort	USA	65-89	MF= 1014		Neck of femur fracture=58.1						

			65-89	MF=1014	Inter-) Trochanteric fracture=39.2
			65-89	MF=1014	Subtrochanteric fracture=2.8
			65-89	MF=1014	Non-operative treatment=1.1
			>90	MF=230	Neck of femur fracture=47.4
			>90	MF=230	(Inter-) Trochanteric fracture=48.7
			>90	MF=230	Subtrochanteric fracture=3.9
			>90	MF=230	Non-operative treatment=3.0
Trevisan C (2021)[18]	cohort	Italy	>65	MF(2000-2001years)=192	Medial=60.9
				MF (2000-2001years)=192	Lateral=39.1
				MF (2015-2016years)=323	Medial=43
				MF(2015-2016years)=323	Lateral=57
Torpilliesi T (2012)[19]	retrospective	Italy	>90	MF=76	Femoral neck=19.7
					Intertrochanteric = 80.3
Prommik P (2022) [3]	cohort	Estonian	>50	MF=11541	Femoral neck=51.2
					Pertrochanteric= 43.1
					Subtrochanteric =5.7
González-Quevedo D (2022)[20]	cohort	Spain	>60	MF=357	(Before FLS implementation) Femoral neck=42.3
					Trochanteric=49.6

					Subtrochanteric =8.1	
				MF=744	(After FLS implementation) Femoral neck=39.5	
					Trochanteric=51 .5	
					Subtrochanteric = 9.0	
Strøm Rönnquist S (2022)[21]	cohort	Denmar k and Sweden	18-59y	MF=218	Intracapsularfra cture=58	
					Extracapsular fracture=42	
De Joode SG (2019)[22]	Retrospec tive and cross-sectional study	Netherl ands	65≥	MF=216	Femoral neck=46.8	
					Pertrochanteric= 53.2	
PROBERTN (2020)[23]	cohort	Sweden	>35	MF=78	Femoral neck fracture(in 2008year)=53	
					Subtrochanteric femoral fracture in 2008year) =40	
					pertrochanteric femoral fracture in 2008year)=8	
				MF=76	Femoral neck fracture in 2018year)=49	
					Subtrochanteric femoral fracture in 2018year)=41	
					pertrochanteric femoral fracture in 2018year)=11	
Kjær N(2022)[24]	retrospecti ve	Denmar k	65≥	MF=540	48.4	
Grundill M(2021)[25]	retrospecti ve	South Africa	35≥	MF=253	Neck of femur=45.8	Crude=19.3

					Intertrochanteric =48.6
					Subtrochanteric =5.5
Inoue T (2019)[26]	cohort	Japan	65≥	MF=274	Neck of fracture=50.4
					Trochanteric=42 .2
					Basal=3.3
					Subtrochanteric =4.1
Jérôme V (2020)[27]	Methodol ogical study	Belgiu m	80±12	MF=140	Intracapsular=3 4
					Extracapsular=6 6
Van de Ree CL (2019)[28]	Cohort	Netherl ands	65≥	MF=925	55.5
Scaglione M (2013)[29]	NA	Italy	55≥	MF=1184	Medial=46.2
					Lateral=53.8
Ko Youngji (2019)[30]	Prospectiv e cohort	South Korea	65≥	MF=1841	Intertrochanteric =54
					Neck=39.3
					Subtrochanteric =3.1
					Atypical=3.6
Beloosesky Y (2011)[31]	Cohort	Israel	67-103	MF=155	Intertrochanteric =56.1
					Subcapital=34.8
					Subtrochanteric =9.0
Kimura A (2019)[32]	Retrospec tiv	Japan	60≥	MF=497	Femoral neck=56.7
					Trochanteric=40 .6
					Sub-trochanteric=2.6
Zhang C(2020)[33]	Cohort	China	55≥	MF=190560	Crud (in 2012)=148.75(115.32 -182.19)

						adjusted(in2012)=128.10(88.68-174.79) Crud (in2016)=136.65(109.68-163.62) Adjusted(in2016)=114.46(89.85-142.06)
Rey-Rodriguez MM (2020)[34]	prospective	Spain	50≥	MF=359	Extracapsular in men=50.6 in female=61.1 Intracapsular in men=49.4 in female=38.9	228.0(204.5-251.6)
Kim J (2019)[35]	Cohort	korea	65≥	MF=90012	Limb disability=5.9 Brain disability=6.3 Visual disability=4.8 Auditory impairment=4.7 Mental retardation=5.3 Mental disease=7.5 Renal impairment=5.0	Brain disability =6.3 Mental disability=7.5
Rapp K(2008)[36]	Cohort	Germany	65≥	M=16746 F=52946		Crud in female= 50.8(49.2-52.4) Crud in men=(32.7(30.0-35.4) Adjusted in female=39.3(37.7-40.9) Adjusted in men=26.0(23.3-28.7)

Glinkowski W (2019)[37]	retrospective	Poland	>50	MF=289230	Female=19.4 Men=14.2			
Northuis CA (2020)[38]	prospective	USA	50-79y	F=4640				2.7
Zheng JQ (2017)[39]	Cohort	Taiwan	≥18	MF=68672		Control group= 2.49 Stork patients=4.85	1.95(1.71-2.22)	
Da Silva AC (2022)[40]	Cross-sectional	Brazil	≥60	MF=45645		15.58		
HuangSW (2016)[41]	Cohort	Taiwan	≥51	patients with COPD=16239 patients without COPD=48717	COPD patients=649 Control=369			
Vala CH (2020)[42]	Cohort	Sweden	60-100y	MF=1783035		10.45		
Isaia GC (2011)[43]	longitudinal	Italy	50-85y	MF=4269		3.84		
Furuya T (2013)[44]	Cohort	Japan		MF=9720		1.926		
Chevalley T (2007)[45]	Retrospective	Geneva, Switzerland	≥50	MF=4115	Femal= 455(439-471) Men= 153(143-163)		2.99(2.80-3.18)	
Videla-Cés M (2017)[46]	Retrospective	Spain	>64	MF=2625				1.3 (0.9-1.8)
Di Giovanni Pi (2019)[47]	NA	Italy	81.0±11.7 y	MF=23075	In2006= 175.9 In 2015= 179.3			

Abbreviation: NA, not available, MF, male &female

Discussion

In the present systematic study, hip fracture incidence, and prevalence were very similar. The highest and the lowest prevalence rates were found in the studies conducted in Australia and the United States, respectively. The 14% prevalence of osteoporosis in Australia can partly explain the high prevalence of hip fractures in this country [48]. The widespread prescription of bisphosphonates, reduction in the incidence of smoking, promotion of public health, increase in activity, and healthy lifestyle may be among the possible factors in the reduction in the prevalence of hip fracture in white Americans [49]. In addition, the risk of osteoporosis varies greatly among ethnic groups [50]. Ethnic diversity in the United States can be one of the possible causes of the difference in the risk of hip fracture among Mexican Americans in this country.

According to the studies, intertrochanteric is the most common type of hip fracture in the elderly and constitutes approximately 55% of proximal femoral fractures [51]. The decrease in bone density and the increase in age constitute the causes of fractures in the intertrochanteric region. Therefore, strengthening exercises for the abductor muscles are crucial to return to normal daily activities [52].

In the examined studies, the minimum and the maximum incidence rates of hip fracture were observed in East Asian countries. The secular trend and epidemiological studies of hip fractures in Asia are inadequate compared to those in Western countries, despite the expectation that half of the world's hip fractures will occur in Asia by 2050 [53].

Japan has the largest number of older adults. Nonetheless, most of the drugs that are used to prevent osteoporosis are distributed among the elderly in this country [54] . This issue can justify the contradiction which is observed in Japan. On the other hand, the high incidence of hip fracture in Taiwan may stem from the lack of activity in the Taiwanese elderly due to physiological changes that are associated with age, frailty, sarcopenia, or common diseases [53]. The studies show the upward trend of hip fracture incidence in Asian countries [5, 55]. The increase in osteoporosis is one of the most important known health concerns in East Asia [56].

There are several reasons for the increased risk of hip fractures among the oldest elderly. First, inadequate vitamin D levels and low calcium intake strengthen the risk of fractures. Individuals over 60 years old are particularly vulnerable, often experiencing low vitamin D levels alongside insufficient calcium intake. This combination can lead to a negative calcium balance, increasing bone resorption and a higher risk of osteoporosis and fractures. In addition to deficiencies in vitamin D and calcium, malnutrition is also common among the oldest elderly, often due to age-related anorexia and difficulties with chewing and swallowing. Deficiencies in both macronutrients and micronutrients can result in poor muscle and bone mass, further predisposing these individuals to an increased risk of falls and fractures [53, 57, 58].

It is important to mention that the differences reported among different countries indicate genuine variation in the incidence of hip fracture that stems from racial diversity and different geographical regions [59]. In general, it seems that the people who live in the latitudes that are away from the equator have more fractures. For instance, Northern Europe's inhabitants have the highest hip fracture rate. The changes observed in the epidemiology of hip fracture can reflect population-based differences, heterogeneity in information sources, or different study times [5].

One of the limitations of the present study was its focus on English-language articles in the search methodology, which may partly indicate the regional changes in hip fractures in different countries.

Conclusion

There has been a wide variation in the epidemiology of hip fractures in different countries due to the aging population and the increase in life expectancy. There are important changes in the prevalence and incidence of hip fractures across the world, in developed countries (Australia vs United States) and in some of the Asian countries (Taiwan vs Japan). These findings highlight the importance of conducting more research and implementing preventative measures to address this issue on a global scale.

Conflict of interest

None declared.

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Authors' Contributions

Khadijeh Kalan Farmanfarma: The first draft of the manuscript was written, the study conception and design, Material preparation and data collection, Statistical analysis. Esmaeil Fakharian: The study conception and design, Material preparation and data collection. Soudabeh Yarmohammadi: The study conception and design, Material preparation and data collection. Robbert J Gobben: The study conception and design, Material preparation and data collection. Zahra Batooli: The study conception and design, Material

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