

Epidemiological Characteristics of Traumatic Spinal Cord Injury (TSCI) in the Middle-East and North-Africa (MENA) Region: A Systematic Review and Meta-Analysis

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ABSTRACT

Objective: To systematically search the literature and to summarize current evidence pertaining to the epidemiology of SCI in the MENA region incidence, gender, age, type of the injury and etiology of the injury. **Methods:** Embase, PubMed, Scopus, Web of Science and EBSCOhost were systematically searched from their dates of inception till July 2017 for English and non-English language articles. Also, regional databases were searched. Data were extracted from eligible articles and pooled under the random effect model using *R*. References of the included articles were also screened for potentially relevant studies.

Results: We identified 29 articles from seven countries in the MENA region (Turkey, Iran, Saudi Arabia, Egypt, Jordan, Kuwait and Qatar). The mean age of the cases at time of injury was 31.32 (95% CI: 28.74-33.91). The random pooled annual incidence of TSCI per million was 23.24 (95% CI: 5.64-49.21). Pooled proportion of male gender was 77% (95% CI 73-80%) of the cases. Complete paraplegia was the most common type of injury. Thoracic level injury predominated. Also, the most commonly affected age group was 20-29 then 30-39. Motor vehicle accidents were found to be the leading cause of injury, then falls, gunshot, violence and sports. Further meta-regression analysis showed no association between age and etiology of the injury.

Conclusion: This review shows lack of evidence about SCI in most countries of the MENA region. More epidemiological studies are needed.

Keywords: Spinal cord injury; Epidemiology; Incidence; Middle-east; North-Africa; Etiology; SCI.

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Introduction

C pinal cord injury (SCI) is one of the most devastating events in which lesions to the spinal cord cause motor impairments, sensory deficit, or autonomic nervous system dysfunction [1]. The incidence of traumatic spinal cord injury (TSCI) in the developing countries was 25.5/million/year [2]. People with SCI are 2 to 5 times to die prematurely than people without SCI, depending on the health-care system capacity [3]. Moreover, SCI is associated with various economic, psychological and social impacts. For example, in 2008, the total cost of SCI in Australia was estimated to AUS\$ 2 billion with life-time cost of AUS\$ 5 million per case of paraplegia and AUS\$ 9.5 million per case of tetraplegia [4]. With the limited resources in low-income countries, healthcare cost is one of the main barriers affecting the quality of life of people with SCI [5]. Furthermore, clinical symptoms of depression were seen in 20-30% of people with SCI [6]. Because there is no cure for SCI, primary and secondary prevention strategies are vital [7]. Epidemiological evidence will help to plan and implement future preventive measures. Although more than 436 million live in the Middle-East and North-Africa (MENA) region, epidemiological patterns of SCI in the region are not well characterized [8].

This review aims to summarize current evidence pertaining to SCI in the MENA region regarding the incidence, age, gender, etiology and type of injury.

Materials and Methods

Guidelines

We followed the Meta-analysis of observational studies in epidemiology (MOOSE) Statement in reporting this meta-analysis [9].

Search Strategy

One of the authors (Elshahidi) designed and conducted the search process. The search process was performed using a comprehensive list of keywords (list of keywords and details from each database search can be found in the 'supplementary materials: Search Strategy'). No language nor publication period restrictions were applied.

Data Sources

An electronic search on Embase, PubMed, Scopus, Web of Science and EBSCOhost databases was conducted from their dates of inception till July 2017. In addition, other regional databases including the Index Medicus for the Eastern Mediterranean Region (IMEMR) and African Index Medicus were searched. Also, references of included articles were handsearched for relevant records. Also, some previously published systematic reviews were searched for relevant articles.

Criteria for Selecting Studies

Two authors independently screened retrieved records in two steps: title and abstract screening then full-text reviewing. They applied the inclusion and exclusion criteria to select relevant articles (Table 1). Our definition of the Middle-East and North-Africa (MENA) region is based on The World Bank definition (See 'supplementary materials: Search Strategy' for list of the included countries) [10]. Any conflict was resolved by discussion.

Data Extraction

Two authors independently extracted data using a data collection form prepared by the team. The extracted data included: study reference, sample size, country, duration of the study, male/female ratio, incidence, age, type of the study, type of the injury and etiology of the injury. Any disagreement was resolved by discussion.

Data Analysis

SCI epidemiological characteristics were presented as percentages that were pooled with 95% confidence interval (CI) using the 'meta' package, R 3.4.0 [11]. We used Cochran-Q test to identify heterogeneity, and I-square test was used to quantify its extent. When significant heterogeneity was found (p<0.1), the random-effect model was used [12]. A subgroup group analysis by country was applied. Moreover, a metaregression model was used to assess the association between etiology of injury and male gender and age.

Quality Assessment

A modified version of The Newcastle-Ottawa Scale (NOS) for assessing the quality of non-randomized studies in meta-analyses was used to assess quality of the included studies [13]. Each study could attain a maximum of four points. Studies with \geq 3 points were considered of good quality. Those with \leq 2 points were considered of poor quality. The scale rated the papers according to: 1) inclusion and exclusion

 Table 1. Summary of inclusion and exclusion criteria

Table 1. Summ	ary of inclusion and exclusion criteria	
Criteria	Inclusion	Exclusion
Study	Any study published in any year, language or setting	Reviews, editorial, basic science studies, animal studies,
	about SCI in the MENA region	case studies or studies out of the MENA region
Design	Cross sectional, Retrospective, Prospective	drug trials
Observation	Epidemiological characteristics of spinal cord injury; incidence, age, type of injury, etiology of injury	Specific etiological focus, unrelated specific topics (depression, sleep disorder, pain, pressure ulcer, morbidity or other secondary complications), mixed data without
		independent report of SCI data, spine injuries.

criteria were clearly stated 2) data came from a secure source (register, administrative database or prospectively collected) 3) detailed reporting of analyses results (95% CI or standard error).

Results

Study Selection

Our comprehensive search retrieved 21 557 references. After abstract and full-text reviewing, 29 articles met our inclusion criteria. The included studies were conducted in seven MENA countries (Figure 1). A summary of the included studies was provided in Tables 2, 3 and 4 [14-42]. The number of cases ranged from 1694 [30] to 4 [35].

Mean Age

The mean age ranged from 41.3 in Turkey [28] to 20.6 in Kuwait [38]. The random pooled estimate of mean age was 31.32 (95% CI: 28.74-33.91) (Figure 2).

Male Gender

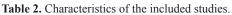
27 studies showed high proportion of males than females. The other two studies showed equal proportion of males to females [25, 35]. The random pooled estimate of male proportion across the included studies was 77% (95% CI: 73-80%) (Figure 3).

Incidence

The incidence of SCI ranged from 7.8/million/year in Kuwait [38] to 72.45/million/year in Iran [16]. The pooled estimate of the annual incidence of SCI across studies was 23.24 per million (Figure 4).

Completeness of the Injury

The random pooled estimate for complete paraplegia was 44% (95% CI: 37-53%) (Figure 5). Whereas, complete tetraplegia pooled estimate was 20% (95% CI: 15-27%) (Figure 5).



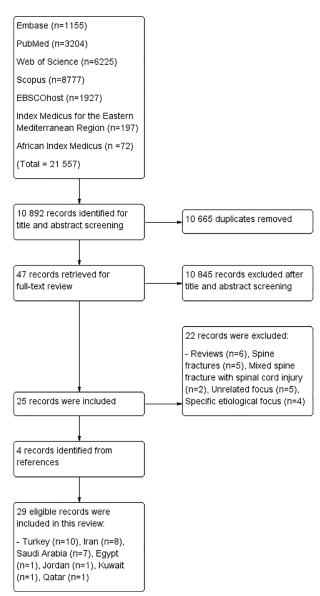


Fig. 1. A flow chart of the search process, performed in July, 2017.

Study ID (Reference)	Duration of the study	Country	Sample size	Mean age(SD)	Male (%)	M/F ratio	Incidence (per million)	Prevalence	Type of the study
Al-Jadid <i>et al.</i> , [14]	January 2005-October 2008	Saudi Arabia	495	34.3 (±0.68)	404 (81.6%)	4.44	-	-	Retrospective review of admission records
Al-Jadid <i>et al.</i> , [15]	August 1982-November 2010	Saudi Arabia	466	29.75 (±0.73)	398 (85.4%)	5.85	-	-	Retrospective review of hospital records
Rahimi-Movaghar <i>et al.</i> , [16]	June 2007-June 2008	Iran	496	-	342 (68.95%)	2.22	72.45	4.4 (per 10 000)	Population-based
Al-Habib <i>et al.</i> , [17]	May 2001-May 2009	Saudi Arabia	23	13.7 (±4.5)	17 (74%)	2.83	-	-	Retrospective study
Tasoglu et al., [18]	June 2013- May 2014	Turkey	262	38.3 (±17.6)	183 (69.8%)	2.32	8–21	-	Retrospective
Derakhshanrad <i>et</i> <i>al.</i> , [19]	September 2011- March 2015	Iran	1137	29.1 (±11.2)	901 (79.2%)	3.82	-	2.36 (per 10 000)	Cross-sectional study

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Gur <i>et al.</i> , [20]	1990-1999	Turkey	539	30.62 (± 13.21)	416 (77.17%)	3.38	12.06	-	Retrospective review of hospital records
Erhan <i>et al.</i> , [21]	January 1992 - December 2002.	Turkey	106	12.67 (± 4.3)	70 (66%)	1.94	-	-	Retrospective study
Erdoğan <i>et al.</i> , [22]	January 2007 - December 2011	Turkey	409	46.82 (±19.05)	253 (61.9%)	1.62	-	-	Descriptive study
Mahmoud <i>et al.</i> , [23]	2009 - 2014	Saudi Arabia	418	31.4	244 (78.2%)	3.59	-	-	Retrospective cohort study
Karamehmetoglul <i>et al.</i> , [24]	January 1992 - 31 December 1992	Turkey	152	32.5	114 (75%)	3.00	21	-	Retrospective study in all hospitals of Istanbul
Alfrayh et al., [25]	August 1982 - November 1983	Saudi Arabia	260	-	130 (50%)	1.00	-	-	Hospital-based study
El Tallawy <i>et al.</i> , [26]	July 2009 - January 2012	Egypt	6	40 (±16)	5 (83.33%)	5.00	-	18 (per 100 000)	Cross-sectional study
Movaghar <i>et al.</i> , [27]	January 2003- January 2008	Iran	-	31 (±7)	-	-	-	4.4 (per 10 000)	Cross-sectional study
Atci <i>et al.</i> , [28]	2010-2013	Turkey	91	41.3	64 (70.4%)	2.37	-	-	Retrospective review of the emergency department records
Karamehmetoglul et al., [29]	January 1994- December 1994	Turkey	75	31.3	64 (85.33%)	5.82	16.9	-	Retrospective study
Dincer <i>et al.</i> , [30]	1974-1985	Turkey	1694	26.8	1282 (75.68%)	3.11	-	-	Retrospective study
Karacan <i>et al.</i> , [31]	January 1992 - December 1992	Turkey	581	35.5 (±15.1)	415 (71.42%)	2.50	12.7	-	Retrospective study
Alshahri <i>et al.</i> , [32]	January 2003 - December 2008	Saudi Arabia	307	29.5	271 (88%)	7.53	-	-	Retrospective study
Cosar <i>et al.</i> , [33]	1996 - 2008	Turkey	127	37.8 (±13.651)	86 (67.7%)	2.10	-	-	Retrospective study
Taghippor <i>et al.</i> , [34]	2002-2003	Iran	85	35 (±12)	68 (80%)	4.00	-	-	Prospective hospital based data collection study
Rahimi-Movaghar et al., [35]	September 2007- January 2008	Iran	4	31(±7)	2 (50%)	1.00	44	4.4 (per 10 000)	Population-based survey study
Chabok <i>et al.</i> , [36]	2005-2006	Iran	44	38.2	-	-	-	-	Retrospective review of hospital database
Otom et al., [37]	January 1988- December 1993	Jordan	151	30	129 (85.4%)	5.86	18	-	Retrospective chart review
Raibulet <i>et al.</i> , [38]	1991-1999	Kuwait	90	20.6	79 (8.7%)	7.18	7.8	-	Retrospective chart review
Alshahri SS <i>et al.</i> , [39]	January 2012- December2015	Saudi Arabia	216	28.94	187 (86.5%)	6.45	-	-	Retrospective chart review
Alhoseini <i>et al.</i> , [40]	March 2010- July 2011	Iran	138	33.2 (±14.3)	117 (84.8%)	5.57	10.5	-	Retrospective hospital based chart review
Fakharian <i>et al.</i> , [41]	1995-1999	Iran	39	39 (±18)	31 (79.4%)	3.88	30	-	Prospective hospital study
Quinones <i>et al.</i> , [42]	1987-1996	Qatar	75	32	67 (89.24%)	8.38	12.5	-	Retrospective hospital study

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Cosar <i>et al.</i> , [33]	Alshahri <i>et al.</i> , [32]	Karacan <i>et al.</i> , [31]	Dincer et al., [30]	Karamehmeto- glul <i>et al.</i> , [29]	Atci <i>et al.</i> , [28]	Movaghar <i>et al.</i> , [27]	El Tallawy <i>et al.</i> , [26]	Alfrayh <i>et al.</i> , [25]	Karamehmeto- glul <i>et al.</i> , [24]	Mahmoud <i>et al.</i> , [23]	Erdoğan <i>et al.</i> , [22]	Erhan <i>et al.</i> , [21]	Gur <i>et al.</i> , [20]	Derakhshanrad <i>et al.</i> , [19]	Tasoglu <i>et al.</i> , [18]	Al-Habib <i>et al.</i> , [17]	Rahimi- Movaghar <i>et al.</i> , [16]	Al-Jadid <i>et al.</i> , [15]	Al-Jadid <i>et al.</i> , [14]	Study ID (Refer-Scale (Fran-Scale A S ence) ke l/ASIA) (%) B
'	ı					I	, ASIA		ı	, ASIA	ASIA	ASIA	I	ASIA	ASIA	ı	1	ı	·	- Scale (Fran- ke l/ASIA)
94 (74%)	ı	ı.		,		ı.	1 (16.7%)	ı.	I	261 (83.7%)	65 (15.9%)	56 (55%)		608 (53.5%)	93 (35.5%)	ı		ı	ı	Scale A (%)
18 (14.3%)	I	,	'	ľ		T	I	I	I	25 (8.01%)	Ó		1	203 (18.7%)	43 (16%)	T	1	T	ı	Scale B (%)
8 (6.2%)	·	ı	1	ı	1	I	1 (16.7%)	T	I	25 26 (8.01%) (8.33%)		45 (45%)	1	200 (17.6%)	56 (21.4%)	I	'	I.	ı	Scale C (%)
8 (6.2%) 7 (5.5%)	ı	1	•	1	1	ı	4 (66.7%)	, i	ı	1			1	109 (9.6%)	69 (26.3%)	ı.	ı	,		Scale D (%)
1	I	,	1	'	1	ı	ı	1	ı		344 (84.1%)			7 (0.6%)	1 (0.04%)	ı	ı	ı	ľ	Scale E (%)
Tetra: 36 (28.3%)	90 (29%)	394 (67.8%)	1442 (85.12%)	44 (58.7%)		1			102 (67%)	239 (76.6%)			243(45.08%)	7 (0.6%) 496 (43.6%)	76 (29%)	ľ	278 (56.04%)			Complete para- plegia (%)
	66 (22%)	187 (32.18%)	82 (4.84%)	31 (41.3%)					50 (33%)	73 (23.4%)			75 (13.91%)	115 (10.1)%	16 (6.1%)		99 (19.9%)			Complete tetra plegia (%)
Para: 76 (59.8%)	56 (18%)		116 (6.85%)			1	ı		ı				148 (27.48%)	308 (27.1%)	117 (44.7%)	1	73 (14.71%)	1		Incomplete paraplegia (%)
Ŭ	95 (31%)		54 (3.19%)			1	·		ı	1			74 (13.72%)	218 (19.2%)	53 (20.2%)	1	39 (7.86%)	1		Incomplete tet- raplegia (%)
I	I	184 (31.7%)	•	I	12(13.1%)	I	3 (50%)	I	50 (33%)	1		50 (47.2%)	cervical:12	358 (31.5%)	69 (26.3%)	9 (39%)		146 (31.33%)	ı	Cervical
T		156 (26.6%)		1	56 (61.53%)	ı	1 (16.7%)	T	ı	1		37 (34.9%)	37 (25.41%),	658 (57.9%)	121 (46.2%)	11 (47.8%)		225 (48.28%)	'	Thoracic
ı	ı	162 (27.8%)			23 (25.27%)		1 (16.7%) 2 (33.3%)		102 (67%)			13 (12.3%)	cervical:137 (25.41%), thoracic:198	121 (10.6%)	72 (27.5%)	109 (43.5%)	I	95 (20.4%)		Lumbar/sac ral

									Lumbar/sac	ral		95 (20.4%)		109 (43.5%)	72 (27.5%)	121 (10.6%)	horacic:198	13 (12.3%)
	1	•	103 (68.2%)		1	·	1	43 (57.3%) 32 (42.66%)	Cervical Thoracic L	ri Li	1	225 9. (48.28%)	1	11 1(47.8%)	121 7. (46.2%)		cervical:137 (25.41%), thoracic:198	37 1. (34 9%)
ı	ı		48 (31.8%)	~ 1			ı	43 (57.3%)			ı	146 (31.33%)	ı	9 (39%)	69 (26.3%)	358 (31.5%)	cervical:1	50 (A7 206)
	ı		ı		47 (21.75%)	(%	1	20 (26.6%)		tetraplegia (%)	1	1	39 (7.86%)		53 (20.2%)	218 (19.2%)	74 (13.72%)	, , 1
ı		29 (65.9%)	ı	ı	53 (24.53%)	Para: 113 (81.9%)		11 (14.7%)	Incomplete	paraplegia (%)	ı	1	73 (14.71%)		117 (44.7%)	308 (27.1%)	148 (27.48%)	1
	ı	11 (25%)	1		36 (16.66%)			23 (30.7%)	Complete	tetra plegia (%)			99 (19.9%)		16 (6.1%)	115 (10.1)%	75 (13.91%)	
ı	1	4 (9.1%)	1		80 (37.03%)	Tetra: 25 (18.1%)		21 (28%)	Complete	paraplegia (%)			278 (56.04%)		76 (29%)	496 (43.6%)	243(45.08%)	
ı	1		ı		ı				Scale E	(%)	I	I	ı	1	1(0.04%)	7 (0.6%)		
			21 (13.9%)	9 (9.9%)		3 (2.2%) 11 (8%)	1	ı		(%)	ı	ı.			69 (26.3%)	109 (9.6%)	т	(9
(0)/	ı.		34 (22.5%)		1					(%)	I	ı.		ı	56 (21.4%)	200) (17.6%)	ı	45 (45%)
51 (60%)	1		15 (10%)) 21 (22.7%	· 1	5 (3.6%)	· 1		dies. Scale	B (%)	I	1	ı	ı	43 (16%)	203 (18.7%)		
28 (32.94%)	1		81 (53.6%)	26 (29%) 21 (22	ı	119 (86.2%)	1		- Scale A	(%)	I	i.	ı		93 (35.5%)	608 (53.5%)	т	56 (55%)
Frankel	I		Frankel	Frankel		ASIA		1	istics of the inc Scale (Fran-	ke l/ASIA)	1	1	ı		ASIA	ASIA	ı	ASIA
Taghippor <i>et al.</i> , [34]	Rahimi- Movaghar <i>et al.</i> , [35]	Chabok <i>et al.</i> , [36]	Otom et al., [37]	Raibulet <i>et al.</i> , [38]	Alshahri SS <i>et</i> al., [39]	Alhoseini <i>et al.</i> , [40]	Fakharian <i>et al.</i> , [41]	Quinones <i>et al.</i> , [42]	Table 3. Characteristics of the included studies.Study IDScale (Fran- Scale A Scale Scale A Scale A Scale A Scale A Scale B	(Reference)	Al-Jadid <i>et al.</i> , [14]	Al-Jadid <i>et al.</i> , [15]	Rahimi- Movaghar <i>et al.</i> , [16]	Al-Habib <i>et al.</i> , [17]	Tasoglu <i>et al.</i> , [18]	Derakhshanrad <i>et al.</i> , [19]	Gur <i>et al.</i> , [20]	T

		102 (67%)		2 (33.3%)		23 (25.27%)			162 (27.8%)											
	ī	102	ı.		ı.		i.	ı		ı	ı	ı.	I	ı	103 (68.2%)	ı	,		i.	32 (42.66%)
	i.	- (0)	,) 1 (16.7%)	i.	56 (61.53%)	i.		156 (26.6%)	ı	ı		ı.	ı		ı	i.		i.	
	ı.	50 (33%)		3 (50%)		12 (13.1%)	1	·	184 (31.7%)	I		ı			48 (31.8%)	ı	·			43 (57.3%)
ı	ı	·	ı	ı			1	54 (3.19%)		95 (31%)	(%	1	ı		ı		47 (21.75%)	6%6		20 (26.6%)
ı	ı	ı	ı	ı			ı	116 (6.85%)	ı	56 (18%)	Para: 76 (59.8%)	•		29 (65.9%)		·	53 (24.53%)	Para: 113 (81.9%)		11 (14.7%)
ı	73 (23.4%)	50 (33%)					31 (41.3%)	82 (4.84%)	187 (32.18%)	66 (22%)	(%	T		11 (25%)		•	36 (16.66%)	(0,		23 (30.7%)
	239 (76.6%)	102 (67%)					44 (58.7%)	1442 (85.12%)	394 (67.8%)	90 (29%)	Tetra: 36 (28.3%)		ı	4 (9.1%)			80 (37.03%)	Tetra: 25 (18.1%)		21 (28%)
344 (84.1%)		ı		'			i.		i.	ı	-	ı.	I.	ī	'	- ()		'		
	ī	I	ı	4 (66.7%)	ı.		T	ı	I.	I	8 (6.2%) 7 (5.5%)		1	ı	21 (13.9%)	9 (9.9%)	ı	3 (2.2%) 11 (8%)	ī	
	26 (8.33%)	ı		1 (16.7%)			1		ı.	ı		()	ı	ı	34 (22.5%)	21 34 (22.7%) (38.3%)	1	3 (2.2%	1	
(0)	25 (8.01%)	I	ı	- -	ī	1	I	ı	I	I) 18 (14.3%)	51 (60%)	1	ī	15 (10%)) 21 (22.7%	· I	5 (3.6%)	ī	
65 (15.9%)	261 (83.7%)	ı		1 (16.7%)			i.		ı.	ı	94 (74%) 18 (14	28 (32.94%)	ı		81 (53.6%)	26 (29%) 21 (22		119 (86.2%)		
ASIA	ASIA	ı		ASIA			1	1	1	ı		Frankel	I		Frankel	Frankel		ASIA	1	
Erdoğan <i>et al.</i> , [22]	Mahmoud <i>et al.</i> , [23]	Karamehmeto- glul <i>et al.</i> , [24]	Alfrayh <i>et al.</i> , [25]	El Tallawy <i>et al.</i> , ASIA [26]	Movaghar <i>et al.</i> , [27]	Atci <i>et al.</i> , [28]	Karamehmeto- glul <i>et al.</i> , [29]	Dincer et al., [30]	Karacan <i>et al.</i> , [31]	Alshahri <i>et al.</i> , [32]	Cosar <i>et al.</i> , [33]	Taghippor et al.,Frankel[34]	Rahimi- Movaghar <i>et al.</i> , [35]	Chabok <i>et al.</i> , [36]	Otom et al., [37]	Raibulet <i>et al.</i> , [38]	Alshahri SS <i>et</i> al., [39]	Alhoseini <i>et al.</i> , [40]	Fakharian <i>et al.</i> , [4]]	Quinones <i>et al.</i> , [42]

I able 4. Characteristics of the included studies. Study ID (Reference) Motor accidet	ncluded studies. Motor accident	Falls	Gunshot	Sport-related	Violence (Others	6-0	10 to 19	20-29	30-39	40-49	50-59	69-09	≥70
Al-Jadid <i>et al.</i> , [14]	1	ı	ı	1	1		1	55 (11.11%)	198 (40%)	98 (19.8%)	60 (12.12%)	31 (6.26%)	42 (8.5%)	11 (2.22%)
Al-Jadid <i>et al.</i> , [15]	377 (80.9%)	51 (10.94%)	30 (6.45)	3 (0.64%)	5 (1.07%)		0-15: 32 (6	6.9%), 16-3	30: 270 (58	%), 31-45:	0-15: 32 (6.9%), 16-30: 270 (58%), 31-45:100 (21.4%), ≥45: 64 (13.7%)	, ≥45: 64 (1:	3.7%)	
Rahimi-Movaghar <i>et al.</i> , [16]	ı	I	ı	1	1	1	3 (0.6%)	33 (6.65%)	133 (26.81%)	118 (23.79%)	104 (20.96%)	≥50: 105 (21.17%)	21.17%)	
Al-Habib et al., [17]	13 (56.5%)	8 (35%)	2 (8.6%)				1		ı	1	1	ı	ı	
Tasoglu <i>et al.</i> , [18]	79 (30.2%)		17 (6.46%)	5 (1.9%)	20 (7.6%) (51 (19.44%)	0-15: 17 (6%), 16-30: 8 (13.1%). ≥76: 4 (1.5%)	5%), 16-30 76: 4 (1.5%	r: 86 (32.5% %)	(), 31-45:68	0-15: 17 (6%), 16-30: 86 (32.5%), 31-45:68 (25.9%), 46-60: 56 (21%), 61-75: 32 (13.1%). ≥ 76 : 4 (1.5%)	6-60: 56 (21	%), 61-75	32
Derakhshanrad <i>et al.</i> , [19]	703 (61.8)%		1	32 (2.8%)		80 (7.1%)		76 (6.7%)	646 (56.8%	316 (27.8%)	86 (7.6%)	13 (1.1%)		
Gur <i>et al.</i> , [20]	200 (37.1%)	172 (32%)	115 (21.33%)			41 (7.6%)	0-14:32 (5. (4.45%)	9%), 15-2	9:261 (48.4	12%), 30-4	0-14:32 (5.9%), 15-29:261 (48.42%), 30-44:158 (29.3%),45-59:64 (11.87%),≥60:24 (4.45%)	(0),45-59:64	(11.87%);	60:24
Erhan <i>et al.</i> , [21]	43 (40.6%)	36 (34%)	10 (9.4%)	11 (10.4%)		6 (5.7%)	1	1	1	1	1	1	T	
Erdoğan <i>et al</i> ., [22]	68 (16.6%)	292 (71.4%)		14 (3.4%)		35 (8.6%)						ı	ı	
Mahmoud <i>et al.</i> , [23]	I	I		I			1		ı	I	ī	ī	ı	
Karamehmetoglul <i>et al.</i> , [24]	62 (41%)	65 (43%)	8 (5%)		3 (2%)	11 (7%)	4 (2.63%)	16 (10.5%)	54 (35.5%)	35 (23.02%)	20 (13.15%)	12 (7.89%)	8 (5.26%)	3 (1.97%)
Alfrayh <i>et al.</i> , [25]														
El Tallawy <i>et al.</i> , [26]	ı		1	I			1		ı			ı		
Movaghar <i>et al.</i> , [27]	ı	1	ı	I			I		1	1		1		
Atci <i>et al.</i> , [28]	34 (37.36%)	54 (59.3%)	1	2 (2.2%)	1 (1.1%) -		1	6 (6.6%)	18 (19.8%)	21 (23.08%)	23 (25.27%)	12 (13.19%)	4 (4.4%) 7 (7.7%)	7 (7.7%)
Karamehmetoglul <i>et al.</i> , [29]	19 (25.3%)	28 (37.3%)	22 (29.3%)	1	1 (1.3%) -	I	2 (2.6%)	5 (6.7%)	29 (38.7%)	17 (22.7%)	15 (20%)	5 (6.7%)	2 (2.7%)	
Dincer et al., [30]	600 (35.41%)	500 (29.51%)	372 (21.95%)	ı	34 (2%)] ((188 (11.1%)	58 (3.42%)	394 (23.26%)	394 548 (23.26%) (32.35%)	360 (21.25%)	196 (11.57%)	110 (6.49%)	28 (1.65%)	
Karacan <i>et al.</i> , [31]	286 (48.8%)	212 (36.5%)	11 (1.9%) 7 (1.2%)	7 (1.2%)	19		9 (1.5%)	57 (9.8%)	180 (30.9%)	127 (21.9%)	87 (15%)	67 (11.8%)	40 (6.9%)	10(1.8%)
Alshahri <i>et al.</i> , [32]	262 (85%)	28 (9%)	14 (5%)	3 (1%)	I	·	(14–15 =8 (3%))	(3%)), (16	5-30=196 (0	64%)),(31–	(14–15 =8 (3%)), (16–30=196 (64%)),(31–45=72 (23%)),(46–60=23 (7%)) ,(61–75=8 (3%))	6)),(46–60=2	23 (7%)), ((61-75=8
Cosar <i>et al.</i> , [33]	70 (55.1%)	43 (33.9%)	10 (7.9%)	4 (3%)					ı	ı			1	
Taghippor <i>et al</i> ., [34]	34 (40%)	32 (37.64%)	ı		2 (2.35%) (1 (1.17%)	2 (2.35%)	10 (11.76%)	10 31 (11.76%) (36.47%)	18 (21.17%)	8 (8.4%)	11 (12.94%)	60+: 5 (5.8%)	(%)
<i>et al.</i> , [35]	3 (75%)	1 (25%)												
Chabok <i>et al.</i> , [36]	ı	ı	ı				1				ı	ı		

Otom <i>et al.</i> , [37]	67 (44.4%)	32 (21.2%)	39 (25.8%)	4 (2.6%)	3 (2%)	6 (4%)	3 (2%) 6 (4%) 0-19: 37 (24.5%) 54 (35.)	() 54 (35.8%)	54 24 (35.8%) (15.9%)	More than 40: 36 (23.8%)	(23.8%)
Raibulet et al., [38]	57 (63.3%)	22 (24.7%)	1	,	2 (2.2%)	2 (2.2%) 8 (8.9%)	•		1	•	1
Alshahri SS <i>et al.</i> , [39]	196 (90.8%)	7 (3.2%)	I	1	13 (6%)	ı	- 14-25 65:8 (65:8 (3.7%), 66+:5 (2.3%) 65:8 (3.7%), 66+:5 (2.3%)	5-35:53 (24.5 2.3%)	5%), 36-45:16 (7.4%	14-25:118 (55%), 26-35:53 (24.5%), 36-45:16 (7.4%), 46-55:16 (7.4%), 56- 65:8 (3.7%), 66+:5 (2.3%)
Alhoseini <i>et al.</i> , [40]	56 (40.57%)	63 (45.65%)	I	ı	I	19 (1376%)	1	·	ı		
Fakharian <i>et al.</i> , [41]	1		1	1	1	1	Less 20: 3 (7.7%), 20-50: 27 (69.2%), more 50: 9 (23.07%)	6), 20-50: 27 (6	(9.2%), more	\$50:9 (23.07%)	
Quinones et al., [42]	54 (72%)	10 (13.3%)	I	,	I	11 (14.7%)			ı		

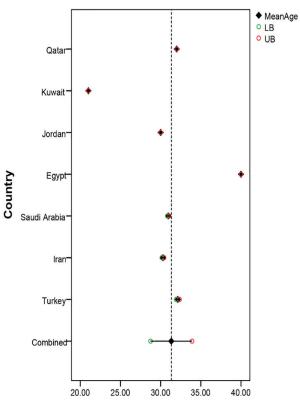


Fig. 2. Random pooled mean age

Study	Events	Total		Proportion	95%-CI	Weight
Country = Egypt El Tallawy et al. 2013 Random effects model Heterogeneity: not applicable	5	6 6			[0.36; 1.00] [0.37; 0.98]	0.7% 0.7%
Country = Iran Rahimi-Movaghar et al. 2010 Derakhshanrad et al. 2016 Taghippor et al. 2015 Rahimi-Movaghar et al. 2009 Alhoseini et al. 2014 Fakharian et al. 2004 Random effects model Heterogeneity: / ² = 82%, r ² = 0.	901 68 2 117 31	1137 85 4 138 39 1899	+==+ +++	0.79 0.80 0.50 0.85 0.79	[0.65; 0.73] [0.77; 0.82] [0.70; 0.88] [0.07; 0.93] [0.78; 0.90] [0.64; 0.91] [0.71; 0.83]	4.5% 4.6% 3.5% 0.8% 3.7% 2.7% 19.9%
Country = Jordan Otom et al. 1997 Random effects model Heterogeneity: not applicable	129	151 151	# ♦		[0.79; 0.91] [0.79; 0.90]	3.8% 3.8%
Country = Kuwait Raibulet et al. 2001 Random effects model Heterogeneity: not applicable	79	90 90	*\$		[0.79; 0.94] [0.79; 0.93]	3.2% 3.2%
Country = Qatar Quinones et al. 2002 Random effects model Heterogeneity: not applicable	67	75 75	* \$		[0.80; 0.95] [0.80; 0.95]	2.9% 2.9%
Country = Saudi Arabia Al-Jadid et al. 2010 Al-Jadid et al. 2010 Al-Habib et al. 2014 Mahmoud et al. 2017 Alshahri at al. 2012 Alshahri at al. 2012 Alshahri SS et al. 2016 Random effects model Heterogeneity: J ² = 97%, r ² = 0.	404 398 17 244 130 271 187 7131, p <	466 23 418 260 307 216 2185	*** ***	0.85 0.74 0.58 0.50 0.88 0.87	[0.78; 0.85] [0.82; 0.88] [0.52; 0.90] [0.53; 0.63] [0.44; 0.56] [0.84; 0.92] [0.81; 0.91] [0.64; 0.87]	4.4% 4.4% 2.3% 4.5% 4.4% 4.1% 4.0% 28.1%
Country = Turkey Tasoglu et al. 2016 Gur et al. 2005 Erdogan et al. 2005 Karamehmetoglul et al. 1995 Atci et al. 2016 Karamehmetoglul et al. 1997 Dincer et al. 1992 Karacan et al. 2000 Cosar et al. 2000 Cosar et al. 2000 Heterogeneity: J ² = 81%, r ² = 0.	415 86	539 106 409 152 91 75 1694 581 127 4036	***********	0.77 0.66 0.62 0.75 0.70 0.85 0.76 0.71 0.68	$\begin{matrix} [0.64; \ 0.75] \\ [0.73; \ 0.81] \\ [0.56; \ 0.75] \\ [0.57; \ 0.67] \\ [0.67; \ 0.82] \\ [0.60; \ 0.79] \\ [0.75; \ 0.92] \\ [0.74; \ 0.78] \\ [0.68; \ 0.76] \\ \hline \begin{matrix} [0.58; \ 0.76] \\ [0.68; \ 0.76] \end{matrix} \end{matrix}$	4.3% 4.5% 3.9% 4.5% 4.1% 3.8% 3.2% 4.6% 4.5% 4.0% 41.4%
Random effects model Heterogeneity: l^2 = 92%, τ^2 = 0.	2179, p <	8442 0.01	0.2 0.4 0.6 0.8	0.77	[0.73; 0.80]	100.0%
Fig 2 A forest m	latak		ng the needed activ	moto of	mala aa	ndar

Fig. 3. A forest plot showing the pooled estimate of male gender.

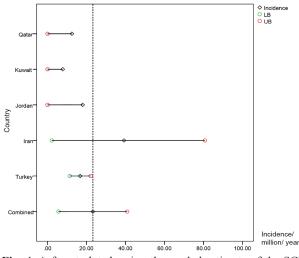


Fig. 4. A forest plot showing the pooled estimate of the SCI incidence/million/year

Incompleteness of the Injury

Incomplete paraplegia injury showed a random pooled estimate of 20% (95% CI: 13-30%) (Figure 5). And, incomplete tetraplegia injury has a random pooled estimate of 15% (95% CI: 9-24%) (Figure 5).

Level of the Injury

Injury at the cervical level was found to have a random pooled estimate of 31% (95% CI: 27-36%) (Figure 6) whereas, the random pooled estimate for thoracic-level injury was 42% (95% CI: 32-53%) (Figure 6) and, the random pooled estimate for lumbar/sacral level injury was 29% (95% CI: 19-42%) (Figure 6).

Etiology of the Injury

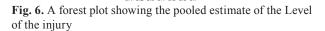
The random pooled estimates for motor vehicle accidents (MVA), falls, gunshots, sports and violence

Complete Paraplegia	Events	Total		Proportion	95%-CI	Weight (fixed)	Weight (random)
Rahimi-Movaghar et al. 2010		496	;		[0.52; 0.60]		
Tasoglu et al. 2016 Derakhshanrad et al. 2016	76 496	262 1137		0.29 0.44			
Gur et al. 2005	243	539		0.44			
Mahmoud et al. 2017	239	418		0.57			
Karamehmetoglul et al. 1995	102	152		- 0.67			8.4%
Karamehmetoglul et al. 1997	44	75	1	0.59			
Karacan et al. 2000	394	581		0.68			
Alshahri at al. 2012 Chabok et al. 2010	90 4	307 44		0.29	0 [0.24; 0.35] 0 [0.03; 0.22]		
Alshahri SS et al. 2016	80	216		0.37			
Quinones et al. 2002	21	75			[0.18; 0.40]		
Fixed effect model		4302	- \$	0.48	[0.47; 0.50]	100.0%	
Random effects model				0.44	[0.37; 0.53]		100.0%
Heterogeneity: $I^2 = 96\%$, $\tau^2 = 0$.	296, $p < 0$.01	0.1 0.2 0.3 0.4 0.5 0.6 0.7				
			0.1 0.2 0.0 0.4 0.0 0.0 0.7			Weight	
Complete Tetraplegia	Events			Proportion			(random)
Rahimi-Movaghar et al. 2010	99	496			[0.17; 0.24]		8.8%
Tasoglu et al. 2016	16	262		0.06			7.7%
Derakhshanrad et al. 2016	115	1137	<u> </u>	0.10			8.9%
Gur et al. 2005	75	539		0.14			8.8%
Mahmoud et al. 2017	73 50	418 152		0.17 0.33			8.7% 8.4%
Karamehmetoglul et al. 1995 Karamehmetoglul et al. 1997	31	75		- 0.41			8.4% 7.9%
Karacan et al. 2000	187	581			[0.30, 0.33]		9.0%
Alshahri at al. 2000	66	307		0.32			8.7%
Chabok et al. 2010	11	44			[0.17; 0.27] [0.13; 0.40]		6.8%
Alshahri SS et al. 2016	36	216			[0.12; 0.22]		8.4%
Quinones et al. 2002	23	75	1; 1;		[0.21; 0.42]		7.8%
Fixed effect model		4302	\$		[0.19; 0.21]		
Random effects model Heterogeneity: $I^2 = 95\%$, $\tau^2 = 0$.	2502 5 -	0.01		0.20	[0.15; 0.27]		100.0%
heterogeneity. 7 = 55 %, t = 6.							
	-		01 02 03 04 05				10/- :
Incomplete Paraplegia	Events		0.1 0.2 0.3 0.4 0.5	Proportion	95%-CI	Weight (fixed)	Weight (random)
		Total	0.1 0.2 0.3 0.4 0.5	-		(fixed)	(random)
Rahimi–Movaghar et al. 2010	73	Fotal 496	0.1 0.2 0.3 0.4 0.5	0.15	[0.12; 0.18]	(fixed) 9.4%	(random) 12.7%
Rahimi−Movaghar et al. 2010 Tasoglu et al. 2016	73 117	Fotal 496 262	0.1 0.2 0.3 0.4 0.5	0.15 0.45	[0.12; 0.18] [0.39; 0.51]	(fixed) 9.4% 9.8%	(random) 12.7% 12.7%
Rahimi−Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016	73 117 308	Fotal 496 262 1137	0.1 0.2 0.3 0.4 0.5	0.15 0.45 0.27	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30]	(fixed) 9.4% 9.8% 33.9%	(random) 12.7% 12.7% 12.9%
Rahimi–Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005	73 117 308 148	Fotal 496 262 1137 539		0.15 0.45 0.27 0.27	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31]	(fixed) 9.4% 9.8% 33.9% 16.2%	(random) 12.7% 12.7% 12.9% 12.8%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992	73 117 308 148 116	Fotal 496 262 1137 539 1694 +		0.15 0.45 0.27 0.27 0.07	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.06; 0.08]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3%	(random) 12.7% 12.7% 12.9% 12.8% 12.8%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012	73 117 308 148 116 56	Fotal 496 262 1137 539 1694 307		0.15 0.45 0.27 0.27 0.07 0.18	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.06; 0.08] [0.14; 0.23]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9%	(random) 12.7% 12.9% 12.8% 12.8% 12.8% 12.6%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016	73 117 308 148 116 56 53	Fotal 496 262 1137 539 1694 307 216		0.15 0.45 0.27 0.27 0.07 0.07 0.18 0.25	$\begin{matrix} [0.12; \ 0.18] \\ [0.39; \ 0.51] \\ [0.25; \ 0.30] \\ [0.24; \ 0.31] \\ [0.06; \ 0.08] \\ [0.14; \ 0.23] \\ [0.19; \ 0.31] \end{matrix}$	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0%	(random) 12.7% 12.9% 12.8% 12.8% 12.8% 12.6% 12.5%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012	73 117 308 148 116 56	Fotal 496 262 1137 539 1694 307		0.15 0.45 0.27 0.27 0.07 0.07 0.18 0.25	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.06; 0.08] [0.14; 0.23]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9%	(random) 12.7% 12.9% 12.8% 12.8% 12.8% 12.6%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016	73 117 308 148 116 56 53 11	Fotal 496 262 1137 539 1694 307 216		0.15 0.45 0.27 0.27 0.07 0.18 0.25 0.15	$\begin{matrix} [0.12; \ 0.18] \\ [0.39; \ 0.51] \\ [0.25; \ 0.30] \\ [0.24; \ 0.31] \\ [0.06; \ 0.08] \\ [0.14; \ 0.23] \\ [0.19; \ 0.31] \end{matrix}$	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4%	(random) 12.7% 12.9% 12.8% 12.8% 12.8% 12.6% 12.5%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model	73 117 308 148 116 56 53 11	Fotal 496 262 1137 539 1694 307 216 75 4726		0.15 0.45 0.27 0.27 0.07 0.18 0.25 0.15 0.21	$\begin{matrix} [0.12; \ 0.18] \\ [0.39; \ 0.51] \\ [0.25; \ 0.30] \\ [0.24; \ 0.31] \\ [0.06; \ 0.08] \\ [0.14; \ 0.23] \\ [0.19; \ 0.31] \\ [0.08; \ 0.25] \end{matrix}$	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4%	(random) 12.7% 12.9% 12.8% 12.8% 12.8% 12.6% 12.5%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model	73 117 308 148 116 56 53 11	Fotal 496 262 1137 539 1694 307 216 75 4726		0.15 0.45 0.27 0.27 0.7 0.18 0.25 0.15 0.21 0.20	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.16; 0.08] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.6% 12.5% 11.0%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model	73 117 308 148 116 56 53 11	Fotal 496 262 1137 539 1694 307 216 75 4726		0.15 0.45 0.27 0.27 0.7 0.18 0.25 0.15 0.21 0.21	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.13; 0.30]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4%	(random) 12.7% 12.7% 12.8% 12.8% 12.6% 12.6% 12.5% 11.0%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $\tau^2 = 0.5$	73 117 308 148 116 56 53 11	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01		0.15 0.45 0.27 0.27 0.7 0.18 0.25 0.15 0.21 0.20	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.13; 0.30]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4% 100.0% Weight	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $\tau^2 = 0.5$	73 117 308 148 116 53 11 741, p < 0	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01		0.15 0.45 0.27 0.27 0.18 0.25 0.15 0.21 0.20	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.13; 0.30]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4% 100.0% Weight	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 2092 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $f^2 = 98\%$, $\tau^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016	73 117 308 148 56 53 11 741, <i>p</i> < 0 Events 1 39 53	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01 •otal 496 262		0.15 0.45 0.27 0.27 0.7 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.14; 0.23] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.13; 0.30] 95%-CI [0.06; 0.11] [0.16; 0.26]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4% 100.0% Weight (fixed) 7.4% 8.7%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0% Weight (random) 12.4% 12.5%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $\tau^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016	73 117 308 148 116 53 11 741, <i>p</i> < 0 Events 1 39 53 218	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01 • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • • 		0.15 0.45 0.27 0.27 0.7 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.13; 0.30] 95%-CI [0.06; 0.11]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.2% 6.9% 6.0% 1.4% 100.0% (fixed) 7.4% 8.7% 36.1%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0% Weight (random) 12.4% 12.5% 12.5% 12.9%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $\tau^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005	73 117 308 148 116 56 53 11 741, <i>p</i> < 0 Events 1 39 53 218 74	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01 •otal 496 262 1137 539		0.15 0.45 0.27 0.27 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20 0.19 0.14	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.06; 0.08] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.13; 0.30] 95%-Cl [0.06; 0.11] [0.16; 0.26] [0.17; 0.22] [0.11; 0.17]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4% 100.0% 	(random) 12.7% 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $f^2 = 98\%$, $\tau^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992	73 117 308 148 16 56 53 11 741, <i>p</i> < 0 Events 1 39 53 218 74 74 54	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01 Fotal 496 262 137 539 1694 ■		0.15 0.45 0.27 0.27 0.7 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20 0.19 0.14 0.03	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.06; 0.08] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.20; 0.23] [0.20; 0.23] [0.06; 0.11] [0.16; 0.26] [0.17; 0.22] [0.11; 0.17] [0.02; 0.04]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4% 100.0% Weight (fixed) 7.4% 8.7% 36.1% 13.1% 10.7%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0% Weight (random) 12.4% 12.5% 12.9% 12.9% 12.6%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $\tau^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012	73 117 308 148 16 56 53 11 741, p < 0 Events 1 39 53 218 74 74 54 95	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01 496 262 137 539 694 307		0.15 0.45 0.27 0.27 0.7 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20 0.19 0.14 0.03 0.31	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.06; 0.08] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.20; 0.23] [0.13; 0.30] 95%-CI [0.16; 0.26] [0.17; 0.22] [0.11; 0.17] [0.02; 0.04] [0.26; 0.36]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.2% 6.9% 6.9% 6.0% 1.4% 100.0% 7.4% 8.7% 36.1% 13.1% 10.7% 13.5%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0% Weight (random) 12.4% 12.5% 12.9% 12.7%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $\tau^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012	73 117 308 148 16 56 53 11 741, $p < 0$ Events 7 39 53 218 74 74 54 74	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01 694 137 539 1694 307 216		0.15 0.45 0.27 0.27 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20 0.19 0.14 0.31 0.22	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.06; 0.08] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.13; 0.30] 95%-Cl [0.06; 0.11] [0.16; 0.26] [0.17; 0.22] [0.11; 0.17] [0.26; 0.36] [0.26; 0.28]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 1.4% 100.0% Uveight (fixed) 7.4% 8.7% 8.7% 36.1% 13.1% 10.7% 13.5% 7.5%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $\tau^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012	73 117 308 148 16 56 53 11 741, p < 0 Events 1 39 53 218 74 74 54 95	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01 496 262 137 539 694 307		0.15 0.45 0.27 0.27 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20 0.19 0.14 0.31 0.22	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.06; 0.08] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.20; 0.23] [0.13; 0.30] 95%-CI [0.16; 0.26] [0.17; 0.22] [0.11; 0.17] [0.02; 0.04] [0.26; 0.36]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.2% 6.9% 6.9% 6.0% 1.4% 100.0% 7.4% 8.7% 36.1% 13.1% 10.7% 13.5%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0% Weight (random) 12.4% 12.5% 12.9% 12.7%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $\tau^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002	73 117 308 148 56 53 11 741, $p < 0$ Events 1 39 53 218 74 53 218 74 54 95 47 20	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01 539 496 262 137 539 694 307 216 75 307 216 75		0.15 0.45 0.27 0.27 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20 0.19 0.14 0.03 0.31 0.22 0.27	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.06; 0.08] [0.14; 0.23] [0.19; 0.31] [0.20; 0.23] [0.20; 0.23] [0.20; 0.23] [0.13; 0.30] 95%-CI [0.16; 0.26] [0.17; 0.22] [0.16; 0.28] [0.16; 0.28] [0.17; 0.38]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4% 100.0% Weight (fixed) 7.4% 8.7% 36.1% 10.7% 13.5% 7.5% 3.0%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $\tau^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 1992 Alshahri at al. 2012 Alshahri at al. 2012 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model	73 117 308 148 56 53 11 741, $p < 0$ Events 1 39 53 218 74 53 218 74 54 95 47 20	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01 694 137 539 1694 307 216		0.15 0.45 0.27 0.27 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20 0.19 0.14 0.03 0.31 0.22 0.27 0.16	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.14; 0.23] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.13; 0.30] 95%-CI [0.16; 0.26] [0.17; 0.22] [0.11; 0.17] [0.26; 0.36] [0.16; 0.28] [0.16; 0.28] [0.17; 0.38]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4% 100.0% Weight (fixed) 7.4% 8.7% 36.1% 10.7% 13.5% 7.5% 3.0%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0% Weight (random) 12.4% 12.5% 12.9% 12.7% 12.6% 12.7% 12.6% 12.7% 12.5% 11.7%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $r^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model	73 117 308 148 16 56 53 11 741, p < 0 Events 1 39 53 218 74 54 747 20	Fotal 496 262 1137 539 1694 = 307 216 75 4726 0.01 496 262 137 216 307 216 75 9 694 = 307 216 75 1726		0.15 0.45 0.27 0.27 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20 0.19 0.14 0.03 0.31 0.22 0.27 0.16	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.06; 0.08] [0.14; 0.23] [0.19; 0.31] [0.20; 0.23] [0.20; 0.23] [0.20; 0.23] [0.13; 0.30] 95%-CI [0.16; 0.26] [0.17; 0.22] [0.16; 0.28] [0.16; 0.28] [0.17; 0.38]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4% 100.0% Weight (fixed) 7.4% 8.7% 36.1% 10.7% 13.5% 7.5% 3.0%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0%
Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 2005 Dincer et al. 1992 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: $I^2 = 98\%$, $\tau^2 = 0.5$ Incomplete Tetraplegia Rahimi-Movaghar et al. 2010 Tasoglu et al. 2016 Derakhshanrad et al. 2016 Gur et al. 1992 Alshahri at al. 2012 Alshahri at al. 2012 Alshahri at al. 2012 Alshahri SS et al. 2016 Quinones et al. 2002 Fixed effect model	73 117 308 148 16 56 53 11 741, p < 0 Events 1 39 53 218 74 54 747 20	Fotal 496 262 1137 539 1694 307 216 75 4726 0.01 496 262 137 539 307 216 694 307 216 75 307 216 694 307 216 694 307 216 694 307 216 .01		0.15 0.45 0.27 0.27 0.18 0.25 0.15 0.21 0.20 Proportion 0.08 0.20 0.19 0.14 0.03 0.31 0.22 0.27 0.16	[0.12; 0.18] [0.39; 0.51] [0.25; 0.30] [0.24; 0.31] [0.14; 0.23] [0.14; 0.23] [0.19; 0.31] [0.08; 0.25] [0.20; 0.23] [0.13; 0.30] 95%-CI [0.16; 0.26] [0.17; 0.22] [0.11; 0.17] [0.26; 0.36] [0.16; 0.28] [0.16; 0.28] [0.17; 0.38]	(fixed) 9.4% 9.8% 33.9% 16.2% 16.3% 6.9% 6.0% 1.4% 100.0% Weight (fixed) 7.4% 8.7% 36.1% 10.7% 13.5% 7.5% 3.0%	(random) 12.7% 12.9% 12.8% 12.8% 12.6% 12.5% 11.0% Weight (random) 12.4% 12.5% 12.9% 12.7% 12.6% 12.7% 12.6% 12.7% 12.5% 11.7%

0.05 0.1 0.15 0.2 0.25 0.3 0.35

Fig. 5. A forest plot showing the pooled estimate of the type of injury

Level: Cervical	Events	Total		Proportion	95%-CI	Weight (fixed)	Weight (random)
Country = Egypt El Tallavy et al. 2013 Fixed effect model Random effects model Heterogeneity: not applicable	3	6 6		0.50 0.50 0.50	[0.12; 0.88] [0.17; 0.83] [0.17; 0.83]	0.2% 0.2%	1.4%
Country = Iran Derakhshanrad et al. 2016 Fixed effect model Random effects model Heterogeneity: not applicable	358	1137 1137	\$ \$ \$	0.31 0.31 0.31	[0.29; 0.34] [0.29; 0.34] [0.29; 0.34]	30.0% 30.0% 	10.3%
Country = Jordan Otom et al. 1997 Fixed effect model Random effects model Heterogeneity: not applicable	48	151 151		0.32 0.32 0.32	[0.24; 0.40] [0.25; 0.40] [0.25; 0.40]	4.0% 4.0%	8.2%
Country = Qatar Quinones et al. 2002 Fixed effect model Random effects model Heterogeneity: not applicable	43	75 75		0.57 0.57 0.57	[0.45; 0.69] [0.46; 0.68] [0.46; 0.68]	2.2% 2.2%	7.0%
	146 9 0 = 0.43	466 23 489	····+	0.31 0.39 0.32 0.32	[0.27; 0.36] [0.20; 0.61] [0.28; 0.36] [0.28; 0.36]	12.3% 0.7% 13.0% 	9.7% 3.9% 13.6%
Country = Turkey Tasogiu et al. 2016 Education et al. 2016 Erdogan et al. 2013 Karamehmetoglut et al. 1995 Atci et al. 2016 Karacan et al. 2010 Fixed effect model Random effects model Heterogeneity. / ² = 88%, t ² = 0.	69 137 50 79 50 12 184	262 539 106 409 152 91 581 2140	∽₽≈₽≈₽≈₽≈₽	0.26 0.25 0.47 0.19 0.33 0.13 0.32 0.28 0.27	[0.21; 0.32] [0.22; 0.29] [0.37; 0.57] [0.16; 0.23] [0.25; 0.41] [0.07; 0.22] [0.28; 0.36] [0.26; 0.30] [0.22; 0.34]	6.2% 12.5% 3.2% 4.1% 1.3% 15.4% 50.6%	9.0% 9.7% 7.8% 9.3% 8.3% 5.5% 5.5%
Fixed effect model Random effects model Heterogeneity: $l^2 = 86\%$, $\tau^2 = 0$.			÷ *	0.30 0.31	[0.29; 0.32] [0.27; 0.36]	100.0% 	 100.0%
	vents Te		0.2 0.4 0.6 0.8	Proportion	95%-CI	Weight (fixed)	Weight (random)
ountry = Egypt El Tallawy et al. 2013 ixed effect model andom effects model eterogeneity: not applicable	1	6		0.17 0.17 0.17	[0.00; 0.64] [0.02; 0.63] [0.02; 0.63]	0.1% 0.1% 	3.0% 3.0%
ountry = Iran erakhshanrad et al. 2016 ixed effect model andom effects model eterogeneity: not applicable	658 1 1	137 137	*	0.58	[0.55; 0.61] [0.65; 0.61] [0.55; 0.61]	39.1% 39.1% 	13.1% 13.1%
ountry = Saudi Arabia I-Jadid et al. 2013 I-Habib et al. 2014 ixed effect model andom effects model eterogeneity: / ² = 0%, τ ² = 0, <i>p</i>	11	466 23 489		0.48	[0.44; 0.53] [0.27; 0.69] [0.44; 0.53] [0.44; 0.53]	16.4% 0.8% 17.2% 	12.9% 8.9% 21.8%
iountry = Turkey asoglu et al. 2016 irdogan et al. 2013 tci et al. 2013 tci et al. 2013 tci et al. 2016 iracaan et al. 2000 ixed effect model andom effects model tetrogeneity: /² = 94%, r² = 0.7	37 120 56 156	262 106 409 91 581 449	*	0.35 0.29 0.62 0.27 0.34	[0.40; 0.52] [0.26; 0.45] [0.25; 0.34] [0.51; 0.72] [0.23; 0.31] [0.32; 0.37] [0.29; 0.50]	9.2% 3.4% 11.9% 3.0% 16.1% 43.6%	12.7% 11.9% 12.8% 11.7% 12.9%
leterogeneity: $l^2 = 94\%$, $\tau^2 = 0.1$ fixed effect model Random effects model leterogeneity: $l^2 = 96\%$, $\tau^2 = 0.3$	3	081	*	0.46 0.42	[0.44; 0.47] [0.32; 0.53]	100.0%	 100.0%
leterogeneity: / ² = 96%, τ ² = 0.3 _evel: Lumbar/sacral	3591, <i>p</i> ≺ Events		0.1 0.2 0.3 0.4 0.5 0.6 0.7	Proportio	n 95%-0	Weigh	nt Weigh d) (random
Country = Egypt El Tallawy et al. 2013 Tixed effect model Random effects model leterogeneity: not applicable	2	6 6		- 0.3 0.3 0.3	3 [0.04; 0.7 3 [0.08; 0.7 3 [0.08; 0.7	3] 0.3 3] 0.3	
country = Iran Derakhshanrad et al. 2016 Iixed effect model tandom effects model leterogeneity: not applicable	121	1137 1137	•	0.1 0.1 0.1	1 [0.09; 0.13 1 [0.09; 0.13 1 [0.09; 0.13		% 10.9 %
ountry = Saudi Arabia I-Jadid et al. 2013 I-Habib et al. 2014 ixed effect model andom effects model eterogeneity: $J^2 = 84\%$, $\tau^2 = 0$.	95 10	466 23 489	*	0.2 0.4 0.2 0.2	0 [0.17; 0.2 3 [0.23; 0.6 2 [0.18; 0.2 9 [0.12; 0.5	4] 14.49 3] 1.19 5] 15.59 5] -	% 9.09
country = Turkey asoglu et al. 2016 rhan et al. 2005 rdogan et al. 2013 aramehmetoglul et al. 1995 tei et al. 2010 aracan et al. 2000 ixed effect model andom effects model eterogeneity: $l^2 = 96\%$, $r^2 = 0$.			→ 	0.2 0.1 0.4 0.6 0.2 0.2 0.3 0.3	7 [0.59; 0.79 5 [0.17; 0.39 8 [0.24; 0.33 6 [0.34: 0.39	3] 10.09 0] 2.29 3] 19.59 5] 6.49 5] 3.39 2] 22.39 9] 63.69 7] -	% 9.99 % 10.99 % 10.79 % 10.39 % 10.39
	5096 p =		11				

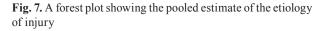


were found to be 51% (95% CI: 42-60%), 29% (95% CI: 23-36%), 10% (95% CI: 6-15%), 2% (95% CI: 1-4%) and 3% (95% CI: 2-4%) respectively (Figure 7). In addition, the pooled estimate for etiology by country showed that MVA were the leading cause of injury and then falls, except in Turkey were falls were the leading etiology (Figure 8). Moreover, based on a meta-regression model to investigate possible association between male gender and mean age, male gender was found to have no association with any cause of the injury. However, mean age was found to have association between MVA (p<0.0004), falls (p<0.0001) and sports (p<0.041).

Age Groups

The random pooled estimates for the age groups

						Weight	Weight
Etiology: MVA Country = Iran	Events		1: _	Proportion		(fixed) (r	
Derakhshanrad et al. 2016 Taghippor et al. 2015	703 34	1137 85	; =		[0.59; 0.65] [0.30; 0.51]	18.8% 1.4%	5.2% 4.8%
Rahimi-Movaghar et al. 2009 Alhoseini et al. 2014	3 56	4 138		- 0.75	[0.19; 0.99] [0.32; 0.49]	0.1%	1.7% 5.0%
Fixed effect model Random effects model Heterogeneity: $I^2 = 91\%$, $\tau^2 = 0.3$		1364	*	0.58	[0.32; 0.49] [0.56; 0.61] [0.34; 0.66]	22.6%	16.7%
Country = Jordan	67	151		0.44	10 20: 0 521	2.6%	5.0%
Otom et al. 1997 Fixed effect model Random effects model	67	151	-00	0.44	[0.36; 0.53] [0.37; 0.52] [0.37; 0.52]	2.6%	5.0%
Heterogeneity: not applicable Country = Kuwait							
Raibulet et al. 2001 Fixed effect model	57	90 90		0.63	[0.53; 0.73] [0.53; 0.73]	1.5% 1.5%	4.8%
Random effects model Heterogeneity: not applicable				0.63	[0.53; 0.73]		4.8%
Country = Qatar Quinones et al. 2002 Fixed effect model	54	75			[0.60; 0.82]	1.1% 1.1%	4.7%
Random effects model Heterogeneity: not applicable			\$	0.72	[0.61; 0.81]		4.7%
Country = Saudi Arabia Al-Jadid et al. 2013	377	466	-	0.81	[0.77; 0.84]	5.0%	5.1%
Al-Habib et al. 2014 Alshahri at al. 2012	13 262	23 307			[0.34; 0.77] [0.81; 0.89]	0.4% 2.7%	4.1% 5.0%
Alshahri SS et al. 2016	196	216 1012	÷	0.91	[0.86; 0.94]	1.3% 9.4%	4.8%
Fixed effect model Random effects model Heterogeneity: / ² = 86%, τ ² = 0.2	2238, p <		Å	0.82	[0.81; 0.85] [0.73; 0.89]	J.4 70	18.9%
Country = Turkey Tasoglu et al. 2016	79	262			[0.25; 0.36]	3.9%	5.0%
Gur et al. 2015 Erhan et al. 2005	200 43	539 106	* : 	0.41	[0.33; 0.41] [0.31; 0.51]	8.8% 1.8%	5.1% 4.9%
Erdogan et al. 2013 Karamehmetoglul et al. 1995	68 62	409 152	* <u> </u>		[0.13; 0.21] [0.33; 0.49]	4.0% 2.6%	5.1% 5.0%
Atci et al. 2016 Karamehmetoglul et al. 1997	34 19	91 75		0.37		1.5% 1.0%	4.8% 4.7%
Dincer et al. 1992	600	1694		0.35	[0.33; 0.38]	27.1%	5.2%
Karacan et al. 2000 Cosar et al. 2010	286 70	581 127	*		[0.45; 0.53] [0.46; 0.64]	10.2% 2.2%	5.1% 4.9%
Fixed effect model Random effects model Heterogeneity: / ² = 93%, τ ² = 0.1	815. p <	4036 0.01	\$		[0.35; 0.38] [0.30; 0.43]	62.9%	49.9%
Fixed effect model Random effects model		6728	*		[0.46; 0.49] [0.42; 0.60]	100.0%	
Heterogeneity: $l^2 = 98\%$, $\tau^2 = 0.6$	616, p <	0.01	0.2 0.4 0.6 0.8	0.01	[0.42, 0.00]	Weigh	
Etiology: Falls	Events	Total		Proportio	on 95%-	Cl (fixed) (random
Country = Iran Derakhshanrad et al. 2016		1137	₩]		25 [0.22; 0.2		
Taghippor et al. 2015 Rahimi-Movaghar et al. 2009	32 1	85 4	 		38 [0.27; 0.4 25 [0.01; 0.8		
Alhoseini et al. 2014	63		ji	0.4	46 [0.37; 0.5	4] 2.7%	5.1%
Fixed effect model Random effects model Heterogeneity: $I^2 = 90\%$, $\tau^2 = 0.3$	013. <i>p</i> <	1364 0.01	* -		28 [0.25; 0.3 34 [0.22; 0.5		- 16.7%
Country = Jordan							
Otom et al. 1997 Fixed effect model	32	151 151			21 [0.15; 0.2 21 [0.15; 0.2		
Random effects model Heterogeneity: not applicable		101	\$		21 [0.15; 0.2		- 5.0%
Country = Kuwait Raibulet et al. 2001	22	90		0.5	24 [0.16; 0.3	5] 1.3%	4.8%
Fixed effect model	~~	90		0.1	24 [0.17; 0.3	4] 1.3%	
Random effects model Heterogeneity: not applicable			0	0.3	24 [0.17; 0.3	4]	- 4.8%
Country = Qatar Quinones et al. 2002	10	75	į	0.1	13 [0.07; 0.2	3] 0.7%	4.3%
Fixed effect model		75		0.1	13 [0.07; 0.2	3] 0.7%	
Heterogeneity: not applicable			✓	0.1	13 [0.07; 0.2	~1	4.3%
Country = Saudi Arabia Al-Jadid et al. 2013	51		+ ¦	0.1	11 [0.08; 0.1	4] 3.6%	
Al-Habib et al. 2014 Alshahri at al. 2012	8 28		+	0.3	35 [0.16; 0.5 09 [0.06; 0.1	7] 0.4%	
Alshahri SS et al. 2016	28	216	+ 1	0.0	03 [0.01; 0.0	7] 0.5%	6 4.1%
Fixed effect model Random effects model Heterogeneity: $l^2 = 87\%$, $\tau^2 = 0.4$	111 n -	1012	\$	0.1	10 [0.08; 0.1 11 [0.06; 0.1	2] 6.5%	- 18.0%
Country = Turkey			2 2 2				
Tasoglu et al. 2016 Gur et al. 2015	90 172	262 539	<u>년</u>		34 [0.29; 0.4 32 [0.28; 0.3		
Erhan et al. 2005	36	106		0.3	34 [0.25; 0.4	4] 1.9%	4.9%
Erdogan et al. 2013 Karamehmetoglul et al. 1995	292 65	409 152	· · · · ·		71 [0.67; 0.7 13 [0.35; 0.5		
Atci et al. 2016	54	91	<u> </u>	0.5	59 [0.49; 0.7	0] 1.7%	4.9%
Karamehmetoglul et al. 1997 Dincer et al. 1992	28 500	75 1694			37 [0.26; 0.4 30 [0.27; 0.3	2] 27.7%	5.4%
Karacan et al. 2000 Cosar et al. 2010	212 43			0.3	36 [0.33; 0.4	1] 10.6%	5.3%
Fixed effect model	43	4036	•	0.3	34 [0.26; 0.4 37 [0.35; 0.3	8] 68.7%	
Random effects model			\sim	0.4	1 [0.32; 0.5	01	- 51.2%
Heterogeneity: $I^2 = 96\%$, $\tau^2 = 0.3$	1435, p <	0.01	1			- 4	
Heterogeneity: $I^2 = 96\%$, $\tau^2 = 0.3$ Fixed effect model	1435, p <	0.01 6728	*	0.3	32 [0.30; 0.3	3] 100.0%	
Heterogeneity: $I^2 = 96\%$, $\tau^2 = 0.3$		6728	0.2 0.4 0.6	0.3		3] 100.0%	



0-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69 and \geq 70 were found to be 2% (95% CI: 1-4%), 10% (95% CI: 6-15%), 35% (95% CI: 28-43%), 22% (95% CI: 20-25%), 14% (95% CI: 11-18%), 7% (95% CI: 4-11%), 4% (95% CI: 2-8%) and 3% (95% CI: 1-5%) respectively (Figure 9).

Etiology: Sports	Events Total		Proportion	95%-CI	Weight (fixed) (Weight random)
Country = Iran Derakhshanrad et al. 2016 Fixed effect model Random effects model Heterogeneity: not applicable	1137		0.03	[0.02; 0.04] [0.02; 0.04] [0.02; 0.04]	37.9% 37.9% 	13.7% 13.7%
Country = Jordan Dom et al. 1997 Fixed effect model Random effects model Heterogeneity: not applicable	4 151 - 151 -		0.03	[0.01; 0.07] [0.01; 0.07] [0.01; 0.07]	4.8% 4.8%	9.1% 9.1%
Country = Saudi Arabia J–Jadid et al. 2013 Jshahri at al. 2012 Vixed effect model Random effects model leterogeneity: $l^2 = 0\%$, $\tau^2 = 0$	3 466 + 3 307 + 773 ¢		0.01	[0.00; 0.02] [0.00; 0.03] [0.00; 0.02] [0.00; 0.02]	3.6% 3.6% 7.3% 	8.1% 8.1% 16.3%
Country = Turkey Fasoglu et al. 2016 Erhan et al. 2005 Erdogan et al. 2013 Atci et al. 2016 Garacan et al. 2010 Fixed effect model Random effects model Iderogeneity. /* 2 = 75%, r ² =	5 262 - 11 106 14 409 2 91 - 7 581 → 4 127 - 1576	· · · · · · · · · · · · · · · · · · ·	- 0.10 0.03 0.02 0.01 0.03 0.03	[0.01; 0.04] [0.05; 0.18] [0.02; 0.06] [0.00; 0.08] [0.00; 0.02] [0.01; 0.08] [0.03; 0.05] [0.02; 0.06]	6.0% 12.0% 16.5% 2.4% 8.4% 4.7% 50.1% 	9.9% 11.9% 12.5% 6.6% 10.9% 9.1% 60.9%
Fixed effect model Random effects model Heterogeneity: $I^2 = 75\%$, $\tau^2 =$	3637	\$ •		[0.02; 0.03] [0.01; 0.04]	100.0%	 100.0%
Etiology: Violence	Events Total	0.05 0.1 0.15	Proportio	n 95%-C	Weight I (fixed)	Weigh (random)
Country = Iran Derakhshanrad et al. 2016 Taghippor et al. 2015 Fixed effect model Random effects model Heterogeneity: $l^2 = 0\%$, $\tau^2 = 0$	2 85 1222	φφ	0.0	4 [0.03; 0.05 2 [0.00; 0.08 4 [0.03; 0.05 4 [0.03; 0.05	1.3% 28.6%	12.5% 4.4% 16.9%
Country = Jordan Dtom et al. 1997 Fixed effect model Random effects model Heterogeneity: not applicable	3 151 151		0.0	2 [0.00; 0.06 2 [0.01; 0.06 2 [0.01; 0.06	1.9%	5.7%
Country = Kuwait Raibulet et al. 2001 Fixed effect model Random effects model leterogeneity: not applicable	2 90 90		0.0	2 [0.00; 0.08 2 [0.01; 0.08 2 [0.01; 0.08	1.3%	4.49
Country = Saudi Arabia Al-Jadid et al. 2013 Alshahri SS et al. 2016 Fixed effect model Random effects model Heterogeneity: / ² = 91%, r ² =	5 466 13 216 682 1.435 , p < 0.01		0.0	1 [0.00; 0.02 6 [0.03; 0.10 4 [0.02; 0.06 3 [0.00; 0.13	8.1% 3 11.3%	7.49 10.29 17.79
Country = Turkey Tasoglu et al. 2016 Sure tal. 2005 Karamehmetoglui et al. 19: Aci et al. 2016 Karamehmetoglui et al. 19: Dincer et al. 1992 Karacan et al. 2000 Fixed effect model Random effects model Idetrogeneity: //2 = 78%, r ² =	1 91 97 1 75 34 1694 19 581 3394	\	0.0 0.0 0.0 0.0 0.0 0.0 0.0	2 [0.00; 0.06 1 [0.00; 0.06		11.2% 9.9% 5.7% 2.6% 12.2% 12.2%
Fixed effect model Random effects model Heterogeneity: $l^2 = 71\%$, $\tau^2 =$	5539 0.2384, <i>p</i> < 0.01	.:. ♦ 	0.0	3 [0.03; 0.04 3 [0.02; 0.04		100.0%
Etiology: Gunshots	Events Total	0.02 0.04 0.06 0.08 0.1	Proportio	n 95%-0	Weight (fixed)	
Country = Jordan Otom et al. 1997 Fixed effect model Random effects model Heterogeneity: not applicab	39 151 151		0.2	6 [0.19; 0.34 6 [0.19; 0.33 6 [0.19; 0.33	5.6%	9.0% 9.0%
Country = Saudi Arabia Al-Jadid et al. 2013 Al-Habib et al. 2014 Alshahri at al. 2012 Fixed effect model Random effects model Heterogeneity: $l^2 = 0\%$, $\tau^2 =$	30 466 2 23 14 307 796	+ + + + + + + + + + + + + + + + + + + +	0.0 0.0 0.0	6 [0.04; 0.09 9 [0.01; 0.29 5 [0.03; 0.08 6 [0.04; 0.08 6 [0.04; 0.08	8] 0.4% 8] 2.6% 8] 8.3%	9.0% 5.0% 8.5% 22.5%
Country = Turkey Tasoglu et al. 2016 Gur et al. 2005 Erhan et al. 2005 Karamehmetoglul et al. 1 Dincer et al. 1992 Karacan et al. 2000	17 262 115 539 10 106 995 8 152 997 22 75 372 1694 11 581	+ + + + +	0.2 0.0 0.2 0.2 0.0	6 [0.04; 0.10 1 [0.18; 0.25 9 [0.05; 0.17 5 [0.02; 0.10 9 [0.19; 0.47 2 [0.20; 0.24 2 [0.01; 0.03 8 [0.04; 0.14	5] 17.4% 7] 1.7% 0] 1.5% 1] 3.0% 4] 55.7% 8] 2.1%	8.69 9.49 8.19 7.89 8.69 9.59 8.39 8.19
Cosar et al. 2010 Fixed effect model Random effects model Heterogeneity: $l^2 = 95\%, \tau^2$	10 127 3536	*	0.1	9 [0.18; 0.20 0 [0.06; 0.17] 86.1%	68.4%

Fig. 7. A forest plot showing the pooled estimate of the etiology of injury (continued)

Quality of the Included Studies

Sixteen studies were of good quality; six studies have score of 3, and ten studies have a score of 4. The remaining thirteen studies were of poor quality; having score ≤ 2 . Most studies achieved low score in both the clear definition of inclusion

and exclusion criteria and the qualifications of the person responsible for data collection. Also, many studies received low score in the category of security of the data repositories. Many studies either did not mention the form of the data source or did not mention the appropriateness of these data repositories.

Discussion

Spinal cord injury (SCI) negatively affect the patient's physical, social and psychological well-beings. Besides its paramount economic costs, SCI places profound burden on healthcare systems. In addition to the importance of epidemiological evidence to help in implementing effective prevention strategies, it will help physicians in managing cases with SCI. Because of lack of resources and limited number of rehabilitation centers across the MENA region, this knowledge is crucial [43, 44].

Based on this comprehensive meta-analysis, the annual incidence of SCI in the MENA region was found to be 23.24/million. 77% of SCI cases were estimated to be males. Mean age of all cases was estimated to be 31.32. The most affected age group was those aging 20-29 then those aging 30-39. Thoracic spinal region was the most affected. Complete paraplegia was the most common type of injury. Furthermore, MVA and falls were the leading causes of SCI. However, it is difficult to compares countries upon causes of SCI because of lack of standardization in defining the etiology of SCI. For example, different studies have different definition of MVA. Some studies consider hitting pedestrians as MVA whereas other studies considered them as different category. The same issue was found in defining sports, whether it include diving.

In addition, there is lack of evidence about SCI in most countries. Only seven countries out of the twenty-one MENA countries have published reports about the epidemiology of SCI. This may restrict the generalizability of this meta-analysis results across the region.

Also, most studies used a retrospective chart review of their records. In most studies, it is unclear whether the records came from a register or paper records.

Finally, this review, up to our knowledge, is the most comprehensive systematic review of published studies about the epidemiological patterns of SCI in the Middle-East and North-Africa region.

Conclusion

This review summarized evidence pertaining to the pattern of traumatic spinal cord injuries in the MENA region. It will help in implementing preventive measures and will help in managing patients with SCI. It will help healthcare systems

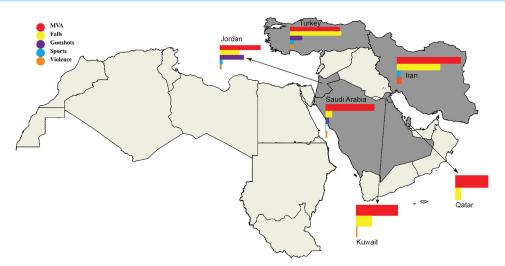


Fig. 8. Etiology of the spinal cord injury by country.

Age: 0-9 Years	Events	Total		Proportion	\ 95%-CI	Veight V (fixed) (ra	Veight
Country = Iran			: 1				
Rahimi-Movaghar et al. 2010 Taghippor et al. 2015 Fixed effect model Random effects model Heterogeneity: I ² = 55%, r ² = 0.5	3 2 5233, p = 0	496 - 85 581			[0.00; 0.02] [0.00; 0.08] [0.00; 0.02] [0.00; 0.04]	3.9% 2.6% 6.5%	13.3% 10.2% 23.4%
Country = Turkey	5255, p - 0	.15					
Karamehmetodul et al. 1995	4	152 75		0.03	[0.01; 0.07]	5.1% 2.6%	15.4% 10.1%
Karamehmetoglul et al. 1997 Dincer et al. 1992 Karacan et al. 2000	58 9	1694 581		0.03	[0.00; 0.09] [0.03; 0.04] [0.01; 0.03]	74.0% 11.7%	29.5% 21.6%
	9	2502	\$	0.02	[0.02; 0.04] [0.02; 0.04]	93.5%	76.6%
Random effects model Heterogeneity: $I^2 = 42\%$, $\tau^2 = 0.0$	0873, p = 0	0.16		0.03	[0.02; 0.04]		76.6%
Fixed effect model Random effects model Heterogeneity: $l^2 = 61\%$, $\tau^2 = 0.2$	2425. p = 0	3083	- ¢	0.03 0.02	[0.02; 0.04] 1 [0.01; 0.04]		00.0%
	Events		0.02 0.04 0.06 0.08	Proportion	95%-CI	Weight (fixed) (r	Weight andom)
Country = Iran Rahimi-Movaghar et al. 2010	33	496		0.07	[0.05; 0.09]	5.7%	11.7%
Derakhshanrad et al. 2016 Taghippor et al. 2015	76	1137		0.07	[0.05: 0.08]	13.2%	12.1%
	10	85 1718	<u>ه</u>	0.12	[0.06; 0.08]	1.6% 20.6%	10.3%
Random effects model Heterogeneity: $I^2 = 37\%$, $\tau^2 = 0.0$	0206, p = 0	0.21	۵	0.07	[0.06; 0.09]		34.2%
Country = Saudi Arabia							
Al-Jadid et al. 2010 Fixed effect model	55	495 495	~	0.11	[0.08; 0.14] [0.09: 0.14]	9.1% 9.1%	12.0%
Fixed effect model Random effects model Heterogeneity: not applicable			\diamond	0.11	[0.09; 0.14] [0.09; 0.14]		12.0%
Country = Turkov							
Karamehmetoglul et al. 1995 Atci et al. 2016 Karamehmetoglul et al. 1997 Dincer et al. 1992	16 6	152 91 75		0.11	[0.06; 0.17] [0.02; 0.14] [0.02; 0.15] [0.21; 0.25] [0.08; 0.13]	2.7% 1.0% 0.9%	11.0% 9.4% 9.0%
Karamehmetoglul et al. 1997 Dincer et al. 1992	5	75 1694		0.07	[0.02; 0.15]	0.9% 56.2%	9.0%
Karacan et al. 2000				- 0.23	[0.08; 0.13]	9.6% 70.4%	12.0%
Karacan et al. 2000 Fixed effect model Random effects model Heterogeneity: $I^2 = 94\%$, $\tau^2 = 0.5$		2593		0.20	[0.18; 0.21] [0.06; 0.19]	70.4%	53.8%
Heterogeneity: <i>I</i> [*] = 94%, τ [*] = 0.5 Fixed effect model		4806			[0.14; 0.16]		
Fixed effect model Random effects model Heterogeneity: $l^2 = 96\%$, $\tau^2 = 0.5$		4806	<u> </u>	0.15	[0.14; 0.16] [0.06; 0.15]	100.0%	100.0%
Heterogeneity: /* = 96%, τ* = 0.5 Age: 20-29 Years	5554, p < 0			25	n 95%-C	Weight	Weight (random)
			1.1	Proportio			
Rahimi-Movaghar et al. 2010 Derakhshanrad et al. 2016) 133 646	496 1137		0.2 - 0.5	7 [0.23; 0.31] 8.8%] 25.1%	10.5% 10.8%
Taghippor et al. 2015	31	85		0.3	IG 10 26 0 48	1 1 8%	9.2%
Country = Iran Rahimi-Movaghar et al. 2010 Derakhshanrad et al. 2016 Taghippor et al. 2015 Fixed effect model Random effects model Heterogeneity: I ² = 98%, v ² = 0.	6908. p <	0.01		0.4	18 [0.46; 0.50 10 [0.20; 0.63]	30.5%
Country = Jordan							
Otom at al. 1997	54	151 151			6 [0.28; 0.44		9.9%
Fixed effect model Random effects model Heterogeneity: not applicable			-	0.3	6 [0.29; 0.44 6 [0.29; 0.44	i	9.9%
Country = Saudi Arabia							
Al-Jadid et al. 2010 Fixed effect model	198	495 495		0.4	0 [0.36; 0.44	10.7%	10.6%
Random effects model Heterogeneity: not applicable			\diamond	0.4	10 [0.36; 0.44 10 [0.36; 0.44	1	10.6%
Country = Turkey							
Karamehmetoglul et al. 1995 Atci et al. 2016 Karamehmetoglul et al. 1997	54 18	152		0.3	6 [0.28; 0.44 0 [0.12; 0.29 9 [0.28; 0.51 2 [0.30; 0.35 31 [0.27; 0.35] 3.1%] 1.3%] 1.6%	9.9% 8.6%
Karamehmetoglul et al. 1997 Dincer et al. 1992	29 548	91 75 1694		0.2	9 [0.28; 0.51	1 1.6%	8.6% 9.0% 10.8%
Karacan et al. 2000	180	581	-	0.3	1 [0.27; 0.35	111.2%	10.6%
Fixed effect model Random effects model Heterogeneity: $I^2 = 54\%$, $\tau^2 = 0$.	0407	2593	Š	0.3	2 [0.30; 0.34 2 [0.28; 0.36		49.0%
Fixed effect model	0167, p =	4957	\$		9 10 27: 0 40	1 100 0%	
Random effects model Heterogeneity: $I^2 = 96\%$, $\tau^2 = 0$.	2588, p <	0.01		0.3	88 [0.37; 0.40 5 [0.28; 0.43	1	100.0%
Age: 30-39	Events		0.2 0.3 0.4 0.5	Proporti	on 95%-	Weight Cl (fixed)	Weight (random)
Country = Iran	0 118	496	3	-	24 10 20:0 2	81 10.3%	13.0%
Rahimi-Movaghar et al. 2010 Derakhshanrad et al. 2016 Taghippor et al. 2015	0 118 316	1137		0.	24 [0.20; 0.2 28 [0.25; 0.3 21 [0.13; 0.3	B] 10.3% 0] 26.2%	13.0% 16.1% 4.8%
Taghippor et al. 2015 Fixed effect model	18	85 1718	~	0 .			
Fixed effect model Random effects model Heterogeneity: $I^2 = 51\%$, $\tau^2 = 0$.	.0136, p =	0.13	~	0.	25 [0.22; 0.2	9]	34.0%
Country = Jordan							
Otom et al. 1997 Fixed effect model	24	151 151		0.	16 [0.10; 0.2 16 [0.11; 0.2	3] 2.3% 3] 2.3%	6.2%
Random effects model Heterogeneity: not applicable				0.	16 [0.11; 0.2 16 [0.11; 0.2	3]	6.2%
Country = Raudi Arabia							
Al-Jadid et al. 2010 Fixed effect model Random effects model	98	495 495		0.	20 [0.16; 0.2	4] 9.0%	12.4%
Random effects model Heterogeneity: not applicable		+40		0.	20 [0.17; 0.2 20 [0.17; 0.2	4]	12.4%
Country = Turkey							
	35	152 91		0.	23 [0.17; 0.3 23 [0.15; 0.3 23 [0.14; 0.3 21 [0.19; 0.2 22 [0.19; 0.2	1] 3.1%	7.5%
Karamehmetoglul et al. 1997	21 17	75		- 0.	23 [0.15; 0.3 23 [0.14; 0.3	3] 1.9% 4] 1.5%	5.3% 4.6%
Atci et al. 2016 Karamehmetoglul et al. 1997 Dincer et al. 1992 Karacan et al. 2000	360 127	1694 581		0.	21 [0.19; 0.2 22 [0.19; 0.2	3] 32.6% 5] 11.4%	16.6% 13.4%
Fixed effect model Random effects model		2593	10	0.	22 [0.20; 0.2 22 [0.20; 0.2	3] 50.5%	47.4%
Heterogeneity: $I^2 = 0\%$, $\tau^2 = 0$, j	p = 0.97		<u></u>	0.		-4	r== 70
Fixed effect model		4957	- \$	0.	23 [0.22; 0.2 22 [0.20; 0.2	4] 100.0%	100.0%
Random effects model Heterogeneity: $I^2 = 65\%$, $\tau^2 = 0$.	.0239, p <	0.01		0.	∠∠ [U.20; 0.2	ol	100.0%

 $\begin{array}{c|c} & & & \text{Readom effects model} \\ & & & \text{Heterogeneity}, f^2 = 65\%, t^2 = 0.0230, p < 0.01 \\ & & & \text{Intersection} \end{array} \end{array} \xrightarrow[0.15]{0.22} \begin{array}{c} 0.22 & [0.26]{0.25} & - & 100.0\% \\ \hline 0.15 & 0.2 & 0.25 & 0.3 \end{array}$

Country = Iran Rahim-Moxphar et al. 2010 Derakhsharrad et al. 2016 Derakhsharrad et al. 2016 Takiper et al. 2015 Fixed effect model Random effects model Random effects model Random effects model Karamehmetoglul et al. 1995 Karamehmetoglul et al. 1995 Karamehmetoglul et al. 1997 Mano et al. 2006 Random effects model Heterogenehr / I ⁺ = 10%, I ⁺ = 0.0 Fixed effect model	60 20 23 15 196 87	495 495 152 91 75 1694 581 2593	* * *	0.08 0.09 0.13 0.12 0.12 0.12 0.12 0.12 0.12 0.13 0.25 0.20 0.12	(0.17; 0.25) (0.06; 0.09) (0.04; 0.18) (0.04; 0.18) (0.05; 0.25) (0.09; 0.15) (0.09; 0.15) (0.10; 0.15) (0.10; 0.15) (0.10; 0.15) (0.12; 0.31) (0.12; 0.31)	15.9% 15.4% 1.4% 32.8% 10.2% 3.4% 3.3% 2.3%	12.7% 12.7% 7.4% 32.8% 12.2% 12.2%
Taghippor et al. 2015 Fixed effect model Random effects model Alemogenety, <i>P</i> = 0.80, <i>R</i> = 0.6 Country = Saudi Arabia A-bade et al. 2010 Fixed effect model Heterogenety, <i>P</i> et applicable Country = Turkey Karanehmetogial et al. 1995 Karanehmetogial et al. 1997 Karaneh et al. 2000 Tunor et al. 1992 Karaceh et abel Random effects model Random effects model Random effects model Fixed effect model	8 0008, p < 60 20 23 15 196 87	85 1718 0.01 495 495 152 91 75 1694 581 2593	* + + + + + + + + + + + + + + + + + + +	0.09 0.13 [0.12] 0.12] 0.12] 0.13] 0.13] 0.25] 0.20] 0.12]	(0.04; 0.18] 0.11; 0.15] 0.05; 0.25] (0.09; 0.15] 0.10; 0.15] 0.10; 0.15] (0.08; 0.20] (0.17; 0.35] (0.12; 0.31]	1.4% 32.8% 10.2% 10.2% 3.4% 3.3%	7.4% 32.8% 12.2% 12.2%
Fixed effect model Random effects model Heterogenety, <i>P</i> = 05%, <i>e</i> = 0.6 (country = 58udi Arabia Ar-Jadd et al. 2010 Random effects model Heterogenetiy: rot applicable Country = Turkey Karametmetoglui et al. 1997 Dinoer et al. 1992 Karde effects model Random effects model Random effects model Random effects model Random effects model Random effects model Random effects model	2008, p < 60 20 23 15 196 87	1718 0.01 495 495 152 91 75 1694 581 2593	• • •	0.13 [0.12] 0.12] 0.12 [0.12] 0.12] 0.13] 0.25] 0.20] 0.12]	0.11; 0.15] 0.05; 0.25] [0.09; 0.15] 0.10; 0.15] 0.10; 0.15] [0.08; 0.20] [0.17; 0.35] [0.12; 0.31]	32.8% 10.2% 10.2% 3.4% 3.3%	
Random effects model Henrogeneki, Presolo, Henrogeneki, Presolo Country = Sandi Arabita Ar-Jadid et al. 2008. Di Rest effects model Henrogeneki, not applicable Country = Turkey Karanetmetogial et al. 1995 Alor et al. 2019. Dinorer et al. 1992 Karacen et al. 2009. Enced effect model Random effects model Random effects model Random effects model	60 20 23 15 196 87	0.01 495 495 152 91 75 1694 581 2593		0.12 0.12 0.12 0.12 0.13 0.25 0.20 0.12	0.05; 0.25] [0.09; 0.15] 0.10; 0.15] 0.10; 0.15] [0.08; 0.20] [0.17; 0.35] [0.12; 0.31]	 10.2% 3.4% 3.3%	12.2% 12.2%
Country = Saudi Arabia Al-Jadid et al. 2010 Fixed effect model Random effects model Hetergomerky: net applicable Country = Turkey Karamehmetoglul et al. 1995 Nato et al. 2010 Dioner et al. 1992 Karada effect model Fixed effect model Fixed effect model Fixed effects model	60 20 23 15 196 87	495 495 152 91 75 1694 581 2593	•	0.12 [0.12] 0.13 0.25 0.20 0.12	0.10; 0.15] 0.10; 0.15] [0.08; 0.20] [0.17; 0.35] [0.12; 0.31]	10.2% 3.4% 3.3%	12.2%
Fixed effect model Random effects model Heterogeneity: not applicable Country = Turkey Karamehmetogul et al. 1995 Atci et al. 2016 Karamehmetogul et al. 1997 Dincer et al. 1992 Karacan et al. 2000 Fixed effect model Heterogeneity: <i>I</i> ² = 79%, r ² = 0.0 Fixed effects model Random effects model	20 23 15 196 87	495 152 91 75 1694 581 2593	++++++++++++++++++++++++++++++++++++++	0.12 [0.12] 0.13 0.25 0.20 0.12	0.10; 0.15] 0.10; 0.15] [0.08; 0.20] [0.17; 0.35] [0.12; 0.31]	10.2% 3.4% 3.3%	12.2%
Random effects model Heterogeneity: not applicable Country = Turkey Karamehmetoglul et al. 1995 Akia et al. 2016 Dincer et al. 1992 Karacan et al. 2000 Fixed effect model Random effects model Fixed offect model Fixed offect model	23 15 196 87	91 75 1694 581 2593		0.12 [0.13 0.25 0.20 0.12	0.10; 0.15] [0.08; 0.20] [0.17; 0.35] [0.12; 0.31]	3.3%	10.1%
Karamehmetoglui et al. 1995 Atoi et al. 2016 Karamehmetoglui et al. 1997 Dincer et al. 1992 Karacan et al. 2000 Fixed effect model Random effects model Heterogeneity: <i>I</i> ² = 79%, v ² = 0.0 Fixed effect model	23 15 196 87	91 75 1694 581 2593		0.20	[0.12; 0.31]	3.3%	
Atci et al. 2016 Karamehmetoglul et al. 1997 Dincer et al. 1992 Karacan et al. 2000 Fixed effect model Random effects model Heterogenety. <i>I</i> ² = 70%, τ ² = 0.0 Fixed effect model	23 15 196 87	91 75 1694 581 2593		0.20	[0.12; 0.31]	3.3%	
Dincer et al. 1992 Karacan et al. 2000 Fixed effect model Random effects model Heterogeneity: $l^2 = 79\%$, $\tau^2 = 0.0^\circ$ Fixed effect model Random effects model	196 87	1694 581 2593		0.20	[0.12; 0.31]	2 3%	
Karacan et al. 2000 Fixed effect model Random effects model Heterogeneity: $l^2 = 79%$, $\tau^2 = 0.0^{\circ}$ Fixed effect model Random effects model	87	581 2593				33.6%	9.1% 13.2%
Fixed effect model Random effects model Heterogeneity: $l^2 = 79\%$, $\tau^2 = 0.0^{\circ}$ Fixed effect model Random effects model	903, p <		6		[0.10; 0.13] [0.12; 0.18]	33.6%	13.2%
Heterogeneity: $l^2 = 79\%$, $\tau^2 = 0.0^\circ$ Fixed effect model Random effects model	903, p <		-	0.13 [0.12; 0.15] 0.12; 0.20]	57.0%	
Random effects model		0.01		0.10 [0.12, 0.20]		00.070
rundom enects model		4806		0.13	0.12; 0.14] 0.11; 0.18]	100.0%	
Heterogeneity: $l^2 = 90\%$, $\tau^2 = 0.1$	663, p <	0.01	05 0.1 0.15 0.2 0.25 0.3 0.3		0.11, 0.10]	Weight	Weight
	Events	Total		Proportion	95%-CI	(fixed) (I	
Country = Iran Derakhshanrad et al. 2016		1137 -	-		[0.01; 0.02]	5.4%	12.4%
Taghippor et al. 2015	11	85 1222	~	0.13	[0.07; 0.22] [0.02; 0.05]	4.0% 9.4%	11.7%
Fixed effect model Random effects model		-	~	0.03	[0.02; 0.05] [0. 80; 0.33]	9.4%	24.1%
Heterogeneity: $I^2 = 97\%$, $\tau^2 = 3.10$	69 , p <	0.01					
Country = Saudi Arabia Al-Jadid et al. 2010	31	495		0.06	[0.04: 0.09]	12.1%	13.7%
Fixed effect model	01	495	0	0.06	[0.04; 0.09]	12.1%	
Random effects model Heterogeneity: not applicable			4	0.06	[0.04; 0.09]		13.7%
Country = Turkey Karamehmetoqlul et al. 1995	12	152		0.09	[0.04; 0.13]	4.6%	12.0%
Atci et al. 2016	12	91		0.13	[0.07; 0.22]	4.3%	11.9%
Karamehmetoglul et al. 1997	5	75	<u> </u>	0.07	[0.02; 0.15]	1.9%	9.5%
Dincer et al. 1992 Karacan et al. 2000	110 67	1694 581			[0.05; 0.08]	42.9% 24.7%	14.5% 14.3%
Fixed effect model		2593	0	0.08	[0.07; 0.09]	78.5%	62.3%
Random effects model Heterogeneity: $I^2 = 78\%$, $\tau^2 = 0.1$:	265, p <	0.01		0.09	[0.06; 0.13]		62.3%
Fixed effect model Random effects model		4310		0.07 0.07	[0.07; 0.08] [0.04; 0.11]	100.0%	 100.0%
Heterogeneity: $I^2 = 90\%$, $\tau^2 = 0.3$	778, p <	0.01	0.05 0.1 0.15 0.2			Weight	Weight
Age: 60-69 Years	Events	Total	0.03 0.1 0.13 0.2	Proportion	n 95%-		(random)
Country = Saudi Arabia Al−Jadid et al. 2010	42	495		- 0.0	B [0.06; 0.1	11 33.0%	19.6%
Fixed effect model	72	495	\sim	0.0	B [0.06; 0.1	1] 33.0%	
Random effects model Heterogeneity: not applicable			\sim	0.0	8 [0.06; 0.1	1]	19.6%
Country = Turkey Karamehmetoglul et al. 1995	8	152		0.0	5 [0.02; 0.1	01 6.5%	16.7%
Atci et al. 2016	4	91		0.0	4 [0.01; 0.1	1] 3.3%	14.1%
Karamehmetoglul et al. 1997	2	75		0.0	3 [0.00: 0.0	9] 1.7%	10.8%
Dincer et al. 1992 Karacan et al. 2000	28	1694 581		0.0	2 [0.01; 0.0 7 [0.05; 0.0	2] 23.6% 9] 32.0%	
Fixed effect model		2593	\Leftrightarrow	0.0	4 [0.03; 0.0	5] 67.0%	
				0.0	4 [0.02; 0.0	8]	80.4%
Random effects model Heterogeneity: $I^2 = 89\%$, $\tau^2 = 0.6$	642, p <	0.01	1.1				
Random effects model -leterogeneity: J ² = 89%, τ ² = 0.6 Fixed effect model		3088	\$	0.0	5 [0.04; 0.0	6] 100.0%	
Random effects model -leterogeneity: $t^2 = 89\%$, $\tau^2 = 0.6$		3088		0.0	5 [0.04; 0.0 4 [0.02; 0.0	8]	100.0%
Random effects model leterogeneity: $I^2 = 89\%$, $\tau^2 = 0.6$ Fixed effect model Random effects model leterogeneity: $I^2 = 91\%$, $\tau^2 = 0.5$		3088 0.01	0.02 0.04 0.06 0.08 0.1	0.0 0.0 Proportio	4 [0.02; 0.0	8] Weigh	100.0%
Random effects model Heterogeneity: $I^2 = 85\%$, $\tau^2 = 0.6$ Fixed effect model Random effects model Heterogeneity: $I^2 = 91\%$, $\tau^2 = 0.5$ Age: 70 or more	5706, p < Events	3088 0.01 Total		0.0 Proportio	4 [0.02; 0.0 n 95%–	8] Weigh Cl (fixed	100.0% t Weight) (random)
Random effects model Heterogeneity: i ² = 89%, i ² = 0.6 Fixed effect model Random effects model Heterogeneity: i ² = 91%, i ² = 0.5 Age: 70 or more Country = Saudi Arabia N-Jadid et al. 2010 Fixed effect model	5706, p <	3088 0.01		0.0 Proportio 0.0 0.0	4 [0.02; 0.0 n 95%- 2 [0.01; 0.0 2 [0.01; 0.0	8] Weigh Cl (fixed 14] 35.9%	100.0% t Weight) (random) 28.5%
Random effects model Heterogeneity: $l^2 = 69\%$, $t^2 = 0.6$ Fixed effect model Random effects model Heterogeneity: $l^2 = 91\%$, $t^2 = 0.5$ Age: 70 or more Country = Saudi Arabia V-Jadid et al. 2010	5706, p < Events	3088 0.01 Total 495		0.0 Proportio 0.0 0.0	4 [0.02; 0.0 n 95%- 2 [0.01; 0.0	8] Weigh Cl (fixed 14] 35.9%	100.0% t Weight) (random) 28.5%
Random effects model leterogeneity, $I^2 = 89\%$, $\tau^2 = 0.8$ Random effects model Random effects model leterogeneity , $I^2 = 91\%$, $\tau^2 = 0.5$ Agge: 70 or more U Lounty = Saudi Arabia V -Jadid et al. 2010 Lounty = Lound Random effects model Random effects model Random effects model Random effects model Leterogeneity , not applicable Lounty = Turkey	5706, p < Events 11	3088 0.01 Total 495 495		0.0 Proportio 0.0 0.0	4 [0.02; 0.0 n 95%- 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.01; 0.0	8] Weigh CI (fixed (4] 35.9% (4] 35.9% (4]	100.0% t Weight) (random) 5 28.5% - 28.5%
Random effects model deterogeneity, r ² = 80%, r ² = 0.6 Kede effect model Random effects model Random effects model Random effects model Age: 70 or more Country : 9 audit Arabia Audit et al. 2010 House the model House the model	5706, p < Events 11	3088 0.01 Total 495 495		0.0 Proportio 0.0 0.0 0.0	4 [0.02; 0.0 n 95%- 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.00; 0.0	8] Weigh CI (fixed (4] 35.9% (4] 35.9% (4] (6] 9.8%	100.0% t Weight) (random) 5 28.5% - 28.5%
Random effects model leterogeneity, $l^2 = 0.8\%$, $t^2 = 0.8\%$ Random effects model leterogeneity, $l^2 = 01\%$, $t^2 = 0.1\%$ leterogeneity, $l^2 = 01\%$, $t^2 = 0.1\%$ leterogeneity, $l^2 = 01\%$, $t^2 = 0.1\%$ county = 5 audi Arabia V-Jadid et al. 2010 Leterogeneity, not applicable county = Turker model leterogeneity, not applicable County = Turker (1, 1995) Via et al. 2016	5706, p < Events 11	3088 0.01 Total 495 495		0.0 Proportio 0.0 0.0 0.0 0.0	4 [0.02; 0.0 n 95%- 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.00; 0.0 8 [0.03; 0.1	 8] Weigh CI (fixed 14] 35.99 4] 35.99 4] 35.99 4] 16] 9.89 5] 21.59 	100.0% t Weight) (random) 5 28.5% - 28.5% 5 18.4% 5 25.1%
Random effects model eleterogeneity: I ² = 89%, r ² = 0.8 Random effects model Random effects model eleterogeneity: I ² = 91%, r ² = 0.5 Age: 70 or more U Sounty = Studi Arabia V-Jadid et al. 2010 County = Studi Arabia V-adid et al. 2010 County = Studie County = Studie County = Studie County = Studie County = Studie State al. 2010 County = Studie State al. 2000 County = State al. 2000	5706, p < Events 11 3 7 10	3088 0.01 Total 495 495 495 152 91 581 824		0.0 Proportio 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	4 [0.02; 0.0 n 95%- 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.00; 0.0 8 [0.03; 0.1 2 [0.03; 0.1 3 [0.02; 0.0	B] Weigh (fixed (4] 35.9% (4] 35.9% (4] (6] 9.8% (5] 21.5% (5] 22.8% (5) 64.1%	100.0% t Weight (random) 28.5% - 28.5% 18.4% 25.1% 28.0%
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Random effects model deterogeneity, i ² = 60%, i ² = 0.6 Kade offect model Random effects model deterogeneity, i ² = 05 Age: 70 or more Country = Saudi Arabia N-Jadid et al. 2010 Kraed effect model Handom effects model Kamehmengului et al. 1995 Noi et al. 2010 Gramehmengului et al. 1995 Noi et al. 2010 Gramehmengului et al. 1995 Noi et al. 2010 Kraena et al. 2000 Viked effects model leterogeneity, i ² = 80%, i ² = 0.8	5706, p < Events 11 3 7 10	3088 0.01 Total 495 495 495 152 91 581 824		0.0. Proportio 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	4 [0.02; 0.0 n 95%- 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.00; 0.0 8 [0.03; 0.1 2 [0.01; 0.0 3 [0.02; 0.0 3 [0.01; 0.0	 B] Weigh Cl (fixed (4] 35.99 (4] 35.99 (4] 35.99 (4] (4] 35.99 (4] (4] 35.99 <li< td=""><td>100.0% t Weight (random) 5 28.5% 5 18.4% 5 18.4% 5 25.1% 5 28.5% 5 18.4% 5 71.5%</td></li<>	100.0% t Weight (random) 5 28.5% 5 18.4% 5 18.4% 5 25.1% 5 28.5% 5 18.4% 5 71.5%
Random effects model eleterogeneity: I ² = 89%, r ² = 0.8 Random effects model Random effects model eleterogeneity: I ² = 91%, r ² = 0.5 Age: 70 or more U Sounty = Studi Arabia V-Jadid et al. 2010 County = Studi Arabia V-adid et al. 2010 County = Studie County = Studie County = Studie County = Studie County = Studie State al. 2010 County = Studie State al. 2000 County = State al. 2000	3706, p < Events 11 3 7 10 3955, p <	3088 0.01 Total 495 495 152 91 581 824 0.01 1319		0.0. Proportio 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	4 [0.02; 0.0 n 95%- 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.01; 0.0 2 [0.00; 0.0 8 [0.03; 0.1 2 [0.03; 0.1 3 [0.02; 0.0	 B] Weigh (fixed (fixed) 4] 35.99 4] 35.99 4] 4] 6] 9.89 5] 21.59 3] 32.89 5] 64.19 8] 4] 100.09 	100.0% t Weight (random) 5 28.5% 5 18.4% 5 18.4% 5 25.1% 5 28.5% 5 18.4% 5 71.5%

Fig. 9. A forest plot showing the pooled estimate of proportion of SCI cases by the age group. (continued)

in the MENA region in properly allocating resources to improve the care of patients with SCI.

Limitation

Lack of full data reporting and the limited number of available articles restrict the generalizability of the analysis results. Also, there is discrepancy in defining etiology of SCI. So, the data of this metaanalysis should be interpreted carefully.

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Recommendations

More studies in this field, especially from countries not included in this review, are needed. Large scale national studies are encouraged to ensure representativeness of the sample. Moreover, using more standardized definitions in reporting SCI epidemiological studies will help to solve discrepancy in the literature [45, 46].

Conflicts of Interest: None declared.

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