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Review Article

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Epidemiology of Road Traffic Injuries among Elderly People; A Systematic Review and Meta-Analysis

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ABSTRACT

Objective: To systematically review the epidemiological patterns and interventions for prevention of road traffic injuries (RTIs) among elderly.
Methods: Searching keywords including: accident, trauma, road injury, road traffic injuries, aging, old, elder, strategy, intervention, road traffic crash prevention and traffic accident in databases including, Google scholar, SID, IranMedex, PubMed and Scopus. English and non-Persian articles, articles presented in congresses, articles that considered elderly people to have age under than 60 years were excluded. The reporting quality of articles was assessed by two experts using Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) check list.
Results: RTIs compromised 23.6% of total injuries among elderly. The most frequent injuries were about car accidents (51.4%). Pedestrian injuries composed 48.1% of the RTIs. Head and neck (32.1%) were most injured body parts. There was a significant difference between elderly and non-elderly people in terms of RTIs associated mortality (Odd=2.57 [1.2-5.4 CI 95%]). Overall 25 main domains of intervention and 73 subordinate domains were extracted in five categories (human, road and environment, tools and cars, medical, legal and political issues).
Conclusion: According to the notable prevalence and fatality of RTIs, lack of sufficient studies and valid evidence of the present study can provide an appropriate evidence for better interventions for RTIs prevention among elderly.

Keywords: Road traffic injuries (RTIs); Elderly; Prevention; Interventions; Epidemiology.

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Introduction

Development of human societies has usually been accompanied by increase in the level of life expectancy and increase in number of elderly people [1]. Existing reports suggest that during past 50 years the number of aged people is tripled and it is estimated to be tripled again in upcoming 50 years [2]. In 1950 there were 200 million of elderly all around the world. According to UN investigations in 2000 over 600 million elderly people lived in the world which approximately compromises 10% of global population. This number will be doubled in 2025 [3]. The rate of ageing population growth is 1.9 % that is higher when compared to 1.2% of global population growth [4]. The rate of population aging in middle and lower income countries is more rapid than the developed. It is predicted that up to year 2025 over 80% of global elderly people will come by countries with low and middle income [5]. With the increase in the number of aged people the age related problems also increases. One main concern is elderly injuries [6,7]. First of all, aged population is rapidly increasing and second, having active life style which is more suitable for youngsters, has made aged people face with more serious injuries and finally the harmful consequences of injuries are more serious in elderly people than the young individuals. These consequences make them stay longer in hospitals, extend their hospitalization period and increases medical costs, mortalities and long-term and chronic conditions [8-11]. Almost 28% of all traumas that result in mortalities happen among people over 65 years old. Injuries are ranked as 5th reason of mortalities in this age group [12,13].

Road Traffic Injuries (RTIs) bear high rate of mortalities and injuries for all age groups [14-16]. One of the most important age groups in this regard are old people [17-21]. Many investigations have shown that RTIs are including among important happened injuries for elderly people [22-24]. Due to musculoskeletal problems and slow activities and reactions the elderly people cannot save themselves when a car accident happens. On the other hand, due to chronic diseases like osteoporosis the rate of bone fracture and hospitalization increases which itself augments the risk of mortalities among elderly people [19,25,26].

A comprehensive study on the epidemiological patterns of RTIs in elderly people seems to be a necessary issue. A systematic review of the homogenous studies can provide more accurate and trusted information. By acquiring a systematic awareness of epidemiological patterns of RTIs among elderly people we can prevent them and provide useful info for further planning. The present study aimed at reviewing epidemiological patterns of RTIs and related intervention to cut down these types of injuries among elderly people.

Materials and Methods

The present systematic review was carried out in 2016 and followed orientations of systematic reviews presented by a book called “Systematic Review for Supporting Evidence Based Medicine (EBM)” [27].

Search Strategies

Required data obtained by searching keywords including strategy, intervention, prevent, accident, trauma, road traffic injury, and road traffic accident, old, aging and elder crash in databases including PubMed, Scopus, Google Scholar, SID, and IranMedex. Publishing time span of articles was considered to be 2000 to 2016. In order to have more coverage, we manually searched several prestigious journals later to database search. After the omission of poor and unrelated articles we further searched reference list of each article for assurance. We also contacted the experts in the field of RTIs.

Inclusion and Exclusion Criteria

Reporting at least one epidemiological aspect of RTIs in elderly people, separate epidemiological analysis of RTIs in elderly people (we also included those articles who pointed out all age groups but separately mentioned elderly people) were inclusion criteria. Exclusion criteria were non-English and non-Persian articles, articles presented in congresses, articles that considered elderly people to have age under than 60 years, articles that only studied aged drivers, studies carried out by simulators, studies that only reported death info of aged people and interventional studies.

Quality Assessment

The reporting quality of articles was assessed by two experts using strengthening the Reporting of Observational Studies in Epidemiology (STROBE) check list. The checklist list was selected for its specificity in evaluation of observational studies, its translation and validity in Persian language [28] it included 22 items [29,30]. Here, the articles that did not passed at least half of items were excluded from the study

Data Extraction

To extract data, first of all, the extracted form was manually designed in Microsoft Word that included: author’s name, publication year, country, study design, time span of data collection, data resource, sample size, mean and SD of participants’ age, rate and types of traffic injuries, types of road passengers, anatomical part of injured area, percent of injured people who transferred to hospitals by ambulance, the average time for hospital stay, fatality of traffic injury, severity of traffic injuries, and comparison of mortality rate between aged and other people (in studies with different age groups this comparison was extractable). We first extracted 5 articles data in a pilot

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form to resolve existing problems in designed from.

Data Analysis

To compare the fatality of RTIs among elderly and non-elderly people we utilized meta-analysis with fixed model. CMA: 2 (Comprehensive Meta-Analysis) software was carrying out to meta-analysis. To report obtained results we used Forest Plot charts in which the size of each square represented sample size and drawn lines on square sides represented confidence interval of about 95% for each study. To assess heterogeneity of obtained results we used Q statistics and I^2 index. I^2 index above 50% was considered to be the criterion of heterogeneity of articles. To calculate indexes such as the rate and fatality of RTIs among elderly people we did not used meta-analysis statistical methods due to high heterogeneity of study results. Required data to identify interventions to prevention of RTIs among elderly people were gathered by searching official reports and articles review. To analyze results of interventions we used Content-Analysis which is a method for identification, analysis and reporting existing patterns (themes) inside the text and has wide range of utilization in qualitative data analysis [31,32]. Coding process also done by two researchers in the present study.

Results

Of all 892 extracted articles from databases and other sources, 413 articles were excluded due to duplication. We also excluded 262 cases of abstracts and titles. We also excluded 195 full texts and finally included 17 articles in quantitative section (epidemiology of RTIs among elderly people) and 5 articles in qualitative section (interventions to prevention of RTIs among elderly people) (Figure 1).

Table 1 shows characteristics of included studies in quantitative section.

Of 17 articles, 8 were occurred in countries with high rates of mortalities by RTIs according to World Health Organization (WHO) 2015 report [47] including: Iran, Egypt, China, Brazil, and Saudi Arabia. 9 others belonged to countries with low rate of mortalities by RTIs: The United States, Germany, Sweden, Australia, Singapore, Japan, and Canada. Of studied articles, Biazin and Rodrigues (2009) was a prospective study [40] while others were retrospective. Main sources from for data extraction were patients' medical records, trauma registries and reports by road traffic police.

All 17 studied articles in quantitative section reported RTIs data of 3206809 aged people above 60 years. Mean (SD) of the participants was 71.3±6.2.

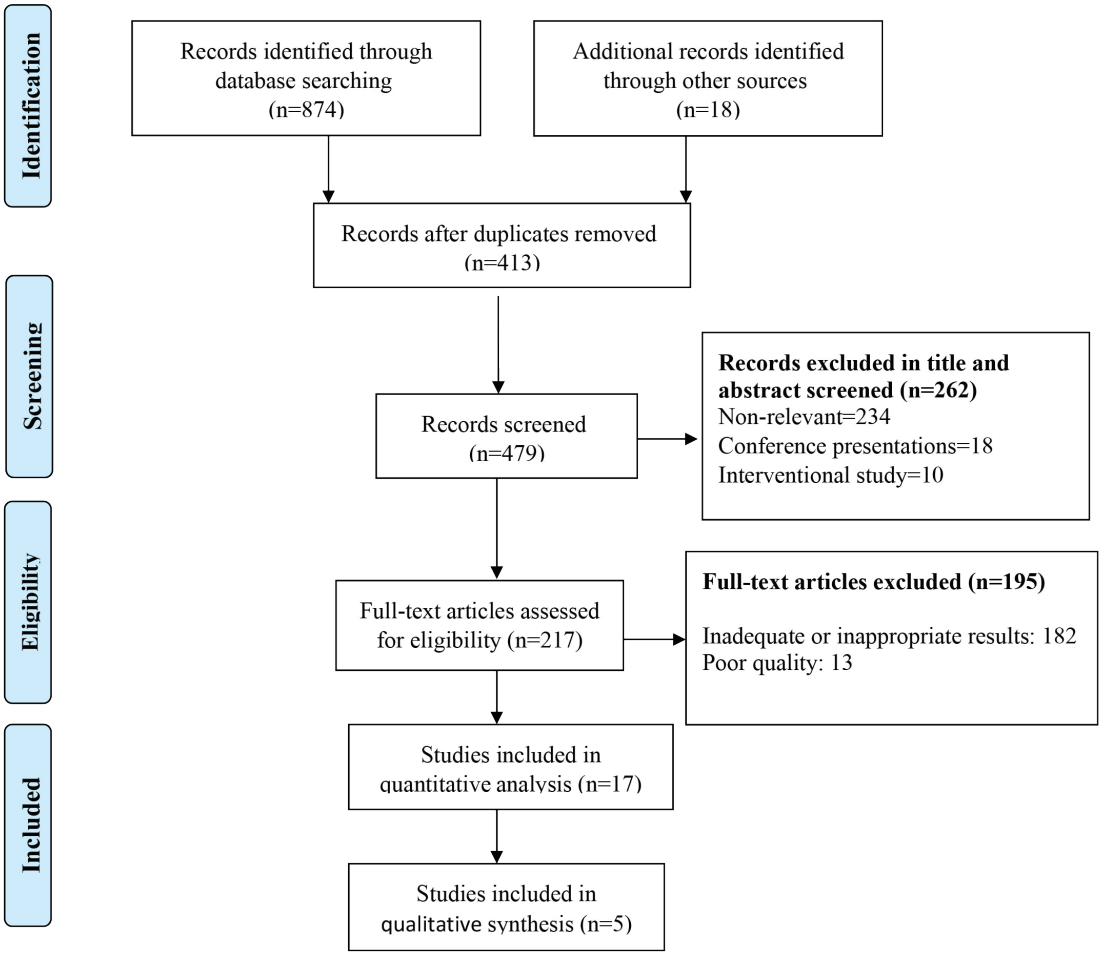

Fig. 1. PRISMA flow diagram of the study.

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Table 1. Characteristics of included studies.

References	country	Study design	Data collection period	Data collection source	sample size (>60 years)	Mean±SD age	RTIs[a] (%) OR Rate per 100000 people	Type of RTIs (%)	Type of road user (%)	Anatomic region	Ambulance Transfer (%)	Length of stay in hospital	Fatality N (%)	ISS[b] OR TRISS[c]	Deference in mortality rate (elderly vs. non elderly)
1. Yeo Y Y C *et al.*, [33]	Singapore	retrospective	6months of 2005	patient hospital profile	720	-	21.2	Pedestrian (39.2), motorcycle (37.2), car accidents (15.7), bicycle (7.8)	-	-	50.1	8.7	3 (0.4)	-	-
2. McElroy *et al.*, [34]	USA	retrospective	2000–2010	trauma registry	177	-	-	-	-	Head and neck (18.1), Abdomen (10.8), Chest (17.3), Extremity (28.1), Face (4.8), External (20.8)	-	11.8 ± 13.1	40 (20.9)	ISS=13 (6–24)	(20.9 VS 11.3)P < 0.001
3. Bhalla K *et al.*, [35]	Iran	retrospective	2005	national death registration system, hospital admissions and outpatient visits	51869	-	-	Car (36), Pedestrian (29), motorcycle (15), Truck (4), Bus (2), other (14)	-	-	-	-	1983 (6.4)	-	-
4. Nagata T *et al.*, [36]	Japan	retrospective	2003-2004	patient hospital profile	197	-	-	Car (38), Pedestrian (21.1), Bicycle (27.2), motorcycle (11.6), other (1.3)	-	Head and neck (44.6), Chest (19.4), Abdomen (8.7), Upper limb (8.7), Lower limb (19.1)	77.6	-	4.4	ISS= 6 (1-34)	(4.4 VS 0.9)P ≤ 0.01
5. Lee K K *et al.*, [37]	Singapore	retrospective	1999-2003	patient hospital profile	130	-	46.2	-	Driver of car (7.8), Passengers of car (5.7), Pedestrian (34.8), Bicyclist (8.6), Motorcyclist (39.3), other (3.7)	-	-	-	-	-	-
6. Etehad H *et al.*, [18]	Iran	retrospective	2011-2012	pre-hospital emergency system reports, hospital and police records	1306	70.9± 6.7	8.7	-	Driver of Car (4.6), Passengers of car (22.1), Pedestrian (40.5), Bicyclist (7.7), Motorcyclist (19.1)	Head and neck (24.9), Chest (9.1), Abdomen& Pelvis (8.6), Upper limb (18.1), Lower limb (20.1), Face (13.4), Spine (5.8)	38.6	3.9±5.7	10.1	-	-

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7. Gowing R *et al*., [38]	Canada	retro-spective	2000-2003	Trauma database, the computerized patient records and the patient charts.	125	77±6	25.6	-	-	-	-	14.6	7(21.8)	ISS= 23 (23–27)	-
8. Shuai AN *et al*., [39]	China	retro-spective	2004–2010	patient hospital profile	1706	median age=71	21.8 per 100 000	Car (88.5), motorcycle (3.5), Bicycle (6.8), other (1.1)	Pedestrians (79.2), Pas-sengers (5.1), Cyclists (14.8), Other (1)	Head and neck (43), Chest (5.7), Abdo-men& Pelvis (1), Upper limb (14.7), Lower limb (34.8), Spine (12.1), other (2.7)	-	-	12 (0.7)	TI[e]: Serious=2.1 Moder-ate=65.5 Slight=32.4	-
9. Biazin DT, Rodri-gues RAP. [40]	Brazil	prospec-tive	2004	Telephone survey	121	67.7±4.4	25.6	-	-	Head and neck (20.7), Chest (4.1), Abdo-men& Pelvis (9.9), Upper limb (22.3), Lower limb (30.6), Spine (6.6), other (5.8)	-	-	-	-	-
10. S Abou-Raya and L Abd ElMe-guid[17]	Egypt	retro-spective	6months	patient hospital profile	258	68.7 ±5.5	-	-	Driver of Car (26), Passengers of car (14), Pedestrian (57), Bicyclist (2.7), Motorcyclist (0.7)	Head and neck (52.3), Chest (34.1), Abdo-men& Pelvis (44.1), Upper limb (20.9), Lower limb (31.7), Spine (16.6)	-	-	-	-	-
11. Yee WY, *et al*., [41]	Aus-tralia	retro-spective	2001-2003	Victorian State Trauma Outcome Registry and Moni-toring Group (VS-TORM)	178	75.8	-	-	Driver of Car (45.1), Pas-sengers of car (20.7), Pedes-trian (29.2), Bi-cyclist (3.3), Mo-torcyclist (0.5), other (0.5)	Head and neck (22.8), Chest (23.4), Abdo-men& Pelvis (8.1), External (18.5), Extrem-ities (21.5), Face (5.3)	-	7.9	47(26.4)	TRISS= 0.88	(26.4 VS 9.4)-p<0.001
12. Hu G, *et al*., [42]	USA	retro-spective	2000-2006	Centers for Disease Control and Prevention's web-based injury statistics query and reporting system online database.	3134935	-	8.4	Car (65.2), Pedestrian (5.7), Bicycle (5), motor-cycle (1.9), other (23.2)	-	-	-	-	6738 (2.5)	-	-

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13. Malik A, *et al.*, [43]	Saudi Arabia	retro-spective	2002-2010	patient hospital profile	149	66.9±6.8	-	Car (74.4), other (25.6)	-	-	-	20.8 ± 7.2	22(14.7)	AIS[d]: minor=17.4 Moderate=67.7 Serious=13.4 Severe=1.3	(14.7 VS 4.6)-p<0.001
14. Richter M, *et al.*, [23]	Germany	retro-spective	1985-1998	Traffic accident reports	1843	74.4	-	Car (57), Pedestrian (22), Bicycle (19), motorcycle (1.3), other (1.9)	-	Head and neck (31), Chest (9), Abdomen& Pelvis (12.3), Upper limb (26.3), Lower limb (57.1)		-	-	ISS= 7.3 (1-75)	p<0.05
15. Saveman BI *et al.*, [44]	Sweden	retro-spective	2006	registered injury events from a well-defined population.	1753	-	13.1	Car (36.6), Pedestrian (5.6), Bicycle (49.2), other (8.4)	-	-	-	-	-	0	-
16. Safizadeh H, *et al.*, [45]	Iran	retro-spective	2006-2009	patient hospital profile	11120	69.5±7.9	25.3	motorcycle (39.9), Car (38.3), Pedestrian (21.8)		-	-	-	48 (1.7)	-	-
17. Norian R, *et al.*, [46]	Iran	retro-spective	2013	patient hospital profile	222	-	38.7	-	-	-	-	-	1 (1.1)	TI: Serious=2.1 Moderate=58 Slight=6	-

[a]RTIs: Road Traffic Injuries; [b]ISS=Injury Severity Score; [c]TRISS= Trauma Score and Injury Severity Score; [d]AIS= Abbreviated Injury Score; [e]TI= Trauma Index

In 10 articles the researchers investigated all types of RTIs while their results showed 23.6 % of total injuries related to the elderly people. Data analysis of RTIs among elderly people showed that most RTIs occurred to the elderly people went back to car crash (51.4%). Results obtained from comparing the patterns of RTIs of countries with high rate of mortalities by RTIs with countries with low rate showed that car, pedestrians and motorcycle accidents were more frequent in countries with high rate of mortalities. While bicycle accidents were more common in countries with lower rate of mortalities (Figure 2).

Results of data analysis by road user type showed that among elderly people the most frequent RTIs went back to pedestrians (48.1%). Results of comparing the patterns of RTIs type between countries with lower and higher rates of mortalities showed that RTIs among pedestrians, drivers and travelers, and bike riders was higher in countries that had higher rates of mortalities from RTIs. In turn, it was true about car drivers and motorbike riders in countries with lower rate of mortalities (Figure 3).

Results analysis showed that in elderly RTIs the most damaged parts of body are respectively head and neck (32.1%) lower limbs (29.4%) and upper limbs (19.7%) (Figure 4). In this figure the sum of distributed averages is not necessarily 100 as some parts of the body are not included in the classification and also in some accidents two or more parts are simultaneously injured.

Only 3 articles pointed out the number of transferred patients by ambulance to hospitals. Yeo YYC *et al.*, [33] in Singapore reported 50.1%, Nagata T *et al.*, [36] in Japan with 77.6% and Etehad H *et al.*, [18] in Iran reported the number to be 38.6%. Mean (SD) of hospitalization time of elderly people was calculated to be 10.6±8.4. To evaluate RTIs severity among elderly people different tools were used. ISS tool was used in 3 articles reporting a range of 6 in Nagata T *et al.*, [36] study in Japan to 23 in Gowing R *et al.*, [38] study in Canada. In Yee WY *et al.*, [41] study in Australia the utilized tool was TRISS upon which the severity was reported to be 0.88. in another two studies by Shuai AN *et al.*, [39] in China and Norian R *et al.*, [46] in Iran they used TI tool that reported severe injuries to be 2.1%, average injuries being 61.7% and mild injuries being 17.4%.

Fatality rate among elderly people was quite different. In a way that in Yeo YYC *et al.*, [33] study in Singapore it was 0.4%, and 26.4%in Yee WY *et al.*, [41] in Australia. In total the average rate of fatality of RTIs was calculated

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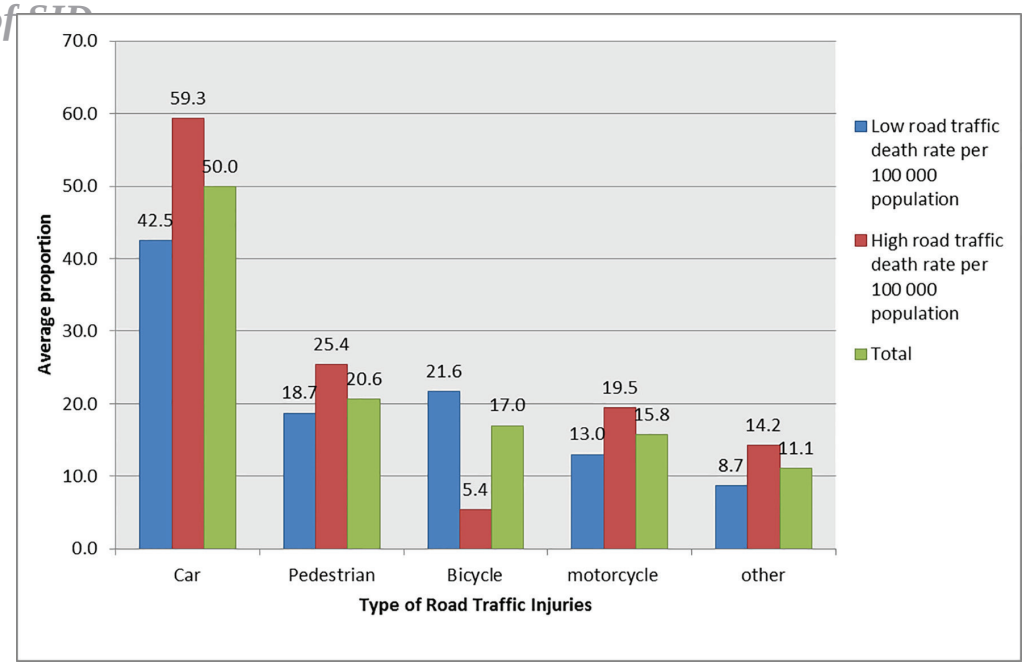

Fig. 2. Type of Road Traffic Injuries among elderly people (≥60 years)

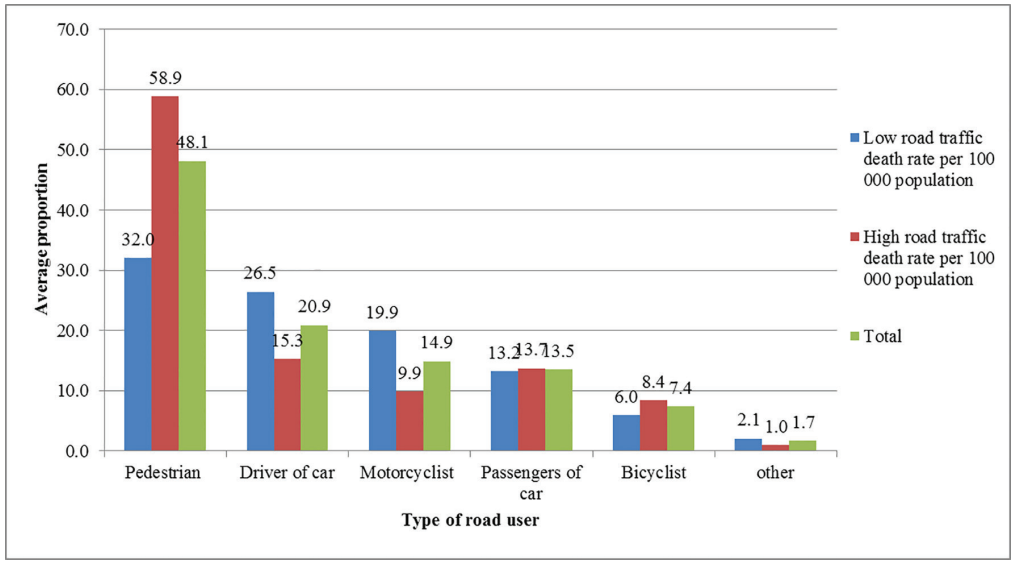

Fig. 3. Road Traffic Injuries among elderly people (≥60 years) based on type of road user

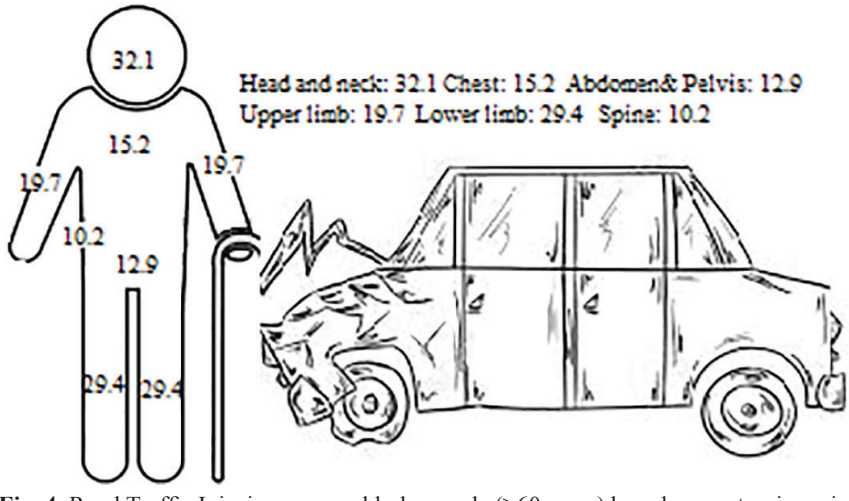

Fig. 4. Road Traffic Injuries among elderly people (≥60 years) based on anatomic region

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to be 9.2%. The fatality issue was investigated in 5 articles. All suggested significant high fatality of RTIs among elderly people when compared with non-elderly individuals. Meta-analysis of 4 articles that mentioned the fatality of RTIs among elderly revealed significant difference between elderly and non-elderly (Figure 5) (Odd=2.57 [1.2-5.4 CI 95%]. Heterogeneity test [Q=0.542 df=3 *p*-value= 0.91 I^2= 0.000]).

Results of literature review on interventions to prevent RTIs among elderly are depicted in Table 2. (For more clearance, intervention/solutions are exactly mentioned according to the references). In total 25 main domains of intervention and 73 subordinate domains were extracted. By utilizing Content-Analysis and according to Figure 6, five main domains included interventions about: humans (elderly), roads and environment, vehicles and equipment, medical cares, and law and policies.

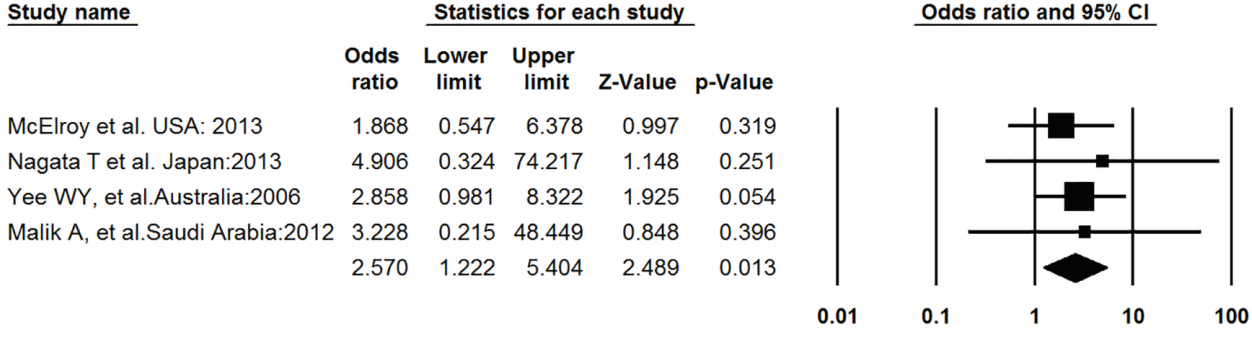

Fig. 5. Road Traffic Injuries fatality rate among elderly people (≥60 years) VS Non-elderly people (<60 years)

Table 2. Strategies/interventions to road traffic injuries prevention in elderly people.

Authors/ institute: year	Aim of document	Main results (risk reduction intervention strategies)
British Columbia Injury Research and Prevention Unit:2007[48]	evaluate the efficacy of various intervention strategies for reducing the risk and rate of motor vehicle crashes (MVC) involving elderly drivers.	*driver-related:* 1. utilization of the Driving Decisions Workbook 2. use of educational programs or home-study 3. courses 4. use of driver re-training programs *vehicle-related:* 1. Advanced Traveler Information Systems (ATIS) 2. head-up displays (HUD) 3. pedestrian detection devices 4. Advanced Transport Telematics (ATT) 5. warning systems 6. Surrogate In-vehicle Information Systems (SIVIS). *road infrastructure-related:* 1. prompts or signage promoting seat belt use 2. symbol signing design for elderly drivers 3. left turn signalization 4. Traffic signal improvements that facilitate driving for the elderly. *clinical-related:* 1. cataract surgery for vision enhancement *legal- and policy-related:* 1. California's Mature Driver Improvement (MDI) Program 2. the National License Assessment Program in Australia 3. the use of practical on-road driving tests 4. mandatory vision or knowledge tests 5. shorter license renewal cycles 6. in-person license renewal to identify higher-risk drivers 7. restricted licensing for medically impaired elderly drivers *screening:* 1. visual impairment 2. visual acuity 3. useful field of view (UFOV) 4. brief field of view (BFOV) 5. automated visual field defect testing 6. perception-reaction time 7. cognitive functioning 8. Mini-Mental State Examination (MMSE).

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Crandall M. *et al*., [49]	Assess the scientific evidence regarding MVC-related injury prevention strategies for elderly drivers and pedestrians.	*car engineering advancements* *environmental or behavioral interventions* *risk screening strategies*
Hanowski RJ. *et al*., [50]	Introduce a taxonomy of safety interventions as a tool for investigating issues specific to the elderly driver population	*Driver Licensing,* *Driver Training/Counseling* *Crashworthiness/Occupant Protection* *Post-Crash Medical Care* *Behavioral Medicine* *Fitness-For-Duty (FFD)* *Environmental Issues* *Cooperative Systems* *Vehicle Design/Crash Avoidance* 1. visibility-related interventions 2. conspicuity-related interventions 3. collision warning systems 4. other crash avoidance countermeasures 5. general in-vehicle display/control issues
Boot WR. *et al*., [51]	Countermeasures to Improve Road-User Safety	*screening:* 1. Vision 2. Hearing and vibration detection 3. Attention 4. Speed of Processing and Responding 5. Disease Processes *environmental or behavioral interventions* 1. Offset Turn Lanes 2. Improving Nighttime Visibility 3. Advanced Street Name Signs 4. Increased Text Size 5. Modifying Perception-Action Time Estimates of Elderly Drivers *Aging Road-User Training* 1. Elderly Driver Education 2. Education plus On-Road Training 3. Perceptual Training 4. Eye Scanning Training 5. Physical Training
Pelderlys E. *et al*., [52]	countermeasures for road traffic of the elderly in Europe	*Infrastructural interventions* 1. Highway design parameters 2. Design and operational aspects of rural and urban road networks 3. Traffic control at intersections 4. Road markings 5. Lighting 6. Route guidance and Signs *Education & Training* 1. Retraining Programs 2. Education and training dedicated to urban road network 3. Promoting specialized clothing 4. Strategies for defensive driving 5. Self-evaluating and improving their skills 6. Rehabilitation *Licensing & Enforcement* 1. Licensing Renewal, Screening and Assessment 2. Enforcement *Vehicle & ITS technologies* 1. Advanced Driver Assistance Systems (ADAS) for Intersection 2. ADAS for headway control 3. ADAS for lateral control 4. ADAS for curve control 5. ADAS for navigation 6. ADAS for parking 7. ADAS for night driving 8. ADAS for driver monitoring 9. Autonomous Vehicle

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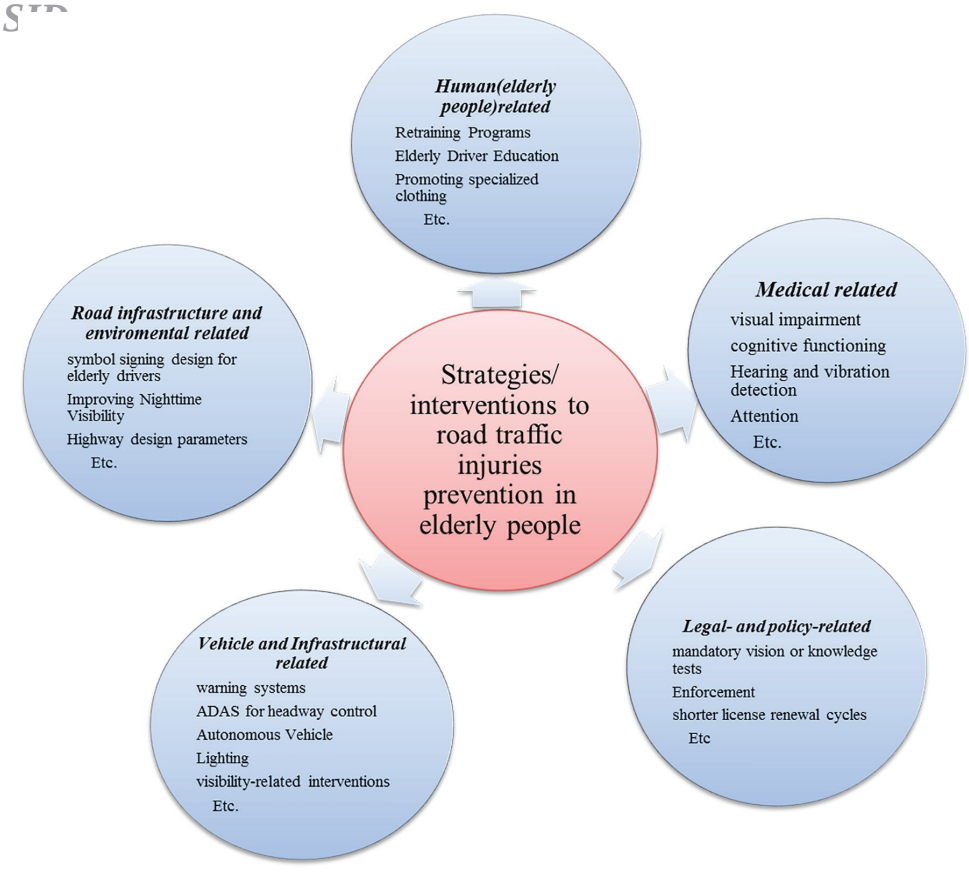

Fig. 6. Content-Analysis of strategies/ interventions to road traffic injuries prevention in elderly people

Discussion

Mean age of the included elderly was 71.3±6.2. RTIs comprised 23.6% of total injuries among elderly while most were car accidents (51.4%). Compared to the countries with low elderly mortalities from RTIs that mostly happened by bike accidents, most injuries in countries with high mortalities were by car crash, passengers and motorbikes. Most RTIs among elderly went back to pedestrians (48.1%) and the most injured parts were respectively head and neck (32.1 %) lower limbs (29.4%) and upper limbs (19.7%). Mean SD for hospitalization among elderly people were 10.6±8.4 days. And in total, the average RTIs fatality estimated to be 9.2%. A significant difference was observed in fatality of RTIs between elderly and non-elderly people [Odd=2.57 1.2-5.4 CI 95%]. Totally, 25 main domains of intervention and 73 interventions as subordinate domains were identified. Through content analysis the extracted interventions were classified under 5 main domains including: human, road / environment, vehicles and equipment, medical care and law/policy interventions.

As the present research revealed, RTIs comprised 23.6% of total injuries among elderly people. Most studies showed these injuries to be the main reason of mortalities and morbidities when compared to the other types [53-58]. According to WHO, RTIs bears the burden of about 24% of accident mortalities by itself [59]. This would be much higher in elderly due to critical physiological conditions and poor quality of roads. Like others, findings of the present study showed that RTIs compromises a great balk of injuries among elderly people. However, it seems that less attention has been paid to these types of injuries in elderly when compared to the other injuries. It needs more special focus and allocation of resources to prevent the high incidence of these types of injuries.

The study also revealed about half of RTIs among elderly people was for car crash. Investigations on non-elderly people reported that motorbike riders were more prone to RTIs [60-65]. This fact goes back to the existing limitations ahead of elderly in using other transportation tools like motorcycles. In countries with lower rates of traffic mortalities like Japan, Germany, Sweden, and the United States, bike accidents are recurrent. The main reason behind is the established culture in utilizing transportation tools in which most citizens –also elderly people- use bicycles more than other countries despite that these countries are clustered inside group of high income countries [66]. Therefore, these injuries are more frequent as elderly people are more exposed to RTIs caused by bicycle riding. So, it is suggested to study the effect of riding bicycles by elderly people on occurrence rate of RTIs in future investigations.

Likewise, about a half of RTIs in elderly people happens among pedestrians. The reports by Organization for Economic Cooperation and Development (OECD) suggested that in most European

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countries about 45% of pedestrians' mortalities are for elderly people while they compromise only 15% of population [67]. Gorgin *et al*., [68] reported that in Iran's Kurdistan province, more than 55% of traffic mortalities occurs to elderly people. Hassani *et al*., [69] in Tehran also concluded that mortality rate caused by RTIs among elderly passengers are higher than the other age group. It seems that inactivity, poor eyesight, miscalculation of vehicles speed and lack of pedestrian bridges for elderly pedestrians are the main reasons behind the issue. So, seemingly it is inevitable to design and renovate city sidewalks to provide elderly people with safety in their walking. There was a significant difference in terms of fatality of RTIs between elderly and non-elderly people. Several studies, all around the world, have confirmed the subject [23,70-73]. The main reason is the physical conditions of elderly people as their physical power is atrophied and mitigated and makes them more vulnerable when they face RTIs. Therefore, interventions and approaches of present study can be useful for authorities and policy makers in preventing RTIs among elderly people.

As mentioned, available interventions found in sources were divided into 5 main domains of: human (elderly people), road/environment, cars and accessories medical care and laws/policies. Most human interventions focused on training. Findings of the most studies have shown that public trainings cannot solely decline mortality rate caused by crashes [74,75]. This made the role of training and education to be blurred. Along with proper administration of rules and regulations, if public training would result in behavioral change, it can leave effective consequences [76]. Most interventions in terms of laws and policies are restricted to elderly driving license renewal. Results of many studies have confirmed the positive effect of driving license renewal on decrease of RTIs among elderly people [77,78]. Most medical interventions and approaches also concentrated on physical health assessment specially eyesight among elderly when issuing driving license. There is insufficient literature in terms of the effect of clinical assessments on prevention of RTIs among elderly people [79-81]. The general focal point when talking about interventions to decrease RTIs among elderly people is that most of them are driver oriented and less focus has been paid to elderly pedestrians.

Few evidence and valid studies are at hand in terms of RTIs among aged people. This issue can be a limitation restricting the generalization of results of the present study. Moreover, in some fields including occurrence rate of RTIs when compared to other types of injuries, fatality rate and dispersion of results limits doing a meta-analysis on the subject matter. Suggesting by the results of the present study, RTIs are highly recurrent and common type of injuries among elderly people. They acquire high prevalence and bring high rate of fatality among this age group, yet there is no clear cut and adequate evidence at hand in this regard while less attention has been paid to its severity and importance. The provided data by this investigation can be utilized in planning and designing interventions to prevent RTIs among elderly especially elderly pedestrians. Further future studies are required about the subject matter as we face lack of valid and clear investigations.

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