Review article

Risk factors for fatal traffic accidents: A narrative review

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Abstract

Introduction: Traffic accidents are among the most important causes of death worldwide which are increasing every year. The purpose of this study is to review the risk factors for traffic accidents mortality.

Method: For the present narrative review, we searched databases PubMed, Scopus and Web of Science using keywords “accidents”, “mortality” and “risk factor” to find the related articles.

Findings: After reading the full-texts and final evaluation, totally 13 risk factors were identified. Older age, male gender, low educational level, consumption of alcohol, drugs, drowsiness, not wearing seatbelt, presence of pedestrian/occupant, severe accidents, high speed, adverse weather, rural and wet roads, were considered as the risk factors for fatal traffic accidents, although they can vary somewhat between different regions.

Conclusion: According to the results, it can be stated that control of human risk factors and fails by drivers can decrease risk of accidents mortality. Also, taking measures by the authorities and policy makers, such as better speed management, enforcement of traffic laws, road infrastructure improvement and vehicle standardization, is helpful in this regard.

Key words: Accidents, mortality, risk factor, review article

Introduction:

Trauma (injury) is the leading cause of fatality in the world. Most important cases of trauma are accidents that followed by uncomfortable social, economic and cultural outcomes (1-3). According to WHO report, traffic accidents cause fatality of 1 million and 250 thousand worldwide each year. For this issue accidents are ranked ninth in fatality causes and it is estimated that reaches to seventh until 2030 (4). Over 90% of fatality in accidents are related to middle and low-income countries (5, 6). Meanwhile almost half of accidents fatality is related to pedestrians, bike and motorbike riders (7) therefore recognizing factors affecting traffic accident fatalities and controlling them in order to decrease fatality rates is important. In this review we aim to investigate risk factors of fatality caused by traffic accidents by using different databases and studies.

Methods:

In this narrative review we searched for articles published until July 2018 using "accident", "fatality" and "risk factor" keywords in PubMed, Scopus and Web of Sciences databases. Articles investigated factors related to fatal traffic accidents entered the study.

Findings:

After reading articles full texts and evaluating them, finally 13 factors effective on traffic accidents fatality have been determined (Figure 1) that is explained in the following.

1- Age

Studies expressed inconsistent findings related to association between driver and passenger age with their fatality but mainly pointed their direct relation. A study by Feng et al (8) used Buses Involved in Fatal Accidents (BIFA) database, which includes data of all crashed buses leads to death in America, showed that drivers aged above 55 years has significantly more intense accidents that younger groups. In a study by Mehmandar et al (9) between 2008-2009 conducted national in Iran, it has been expressed that fatality risk in people over 54 years was the highest and 2.5 times less than 25 years age group. In a study in Italy fatality risk in both driver (OR=1.9) and passengers (OR=10.9) was significantly more in people aged 65 years than 30 years (10). In opposite a study in Spain expressed that fatality risk among drivers has negative association with age and a positive association with passengers (11). According to WHO report, 48% of fatality in accidents is related to 15 - 44 years age group (8). Younger drivers, usually drive faster than aged people and their low experience and skills in driving increases accident risk. On the other side aged people faces more sever outcomes of accidents due to limited eye vision, weaker physical structure, slow reflexes and lower flexibility. Based on reports and mentioned reasons it can be expressed that fatality risk caused by accidents is higher in aged people.

2- Gender

Several studies often report that fatality risk on traffic accidents is higher in men than women. A study by Lardelli-Claret et al. (11) in Spain suggests higher risk of fatality in men than women. In a study by Sanaei-Zadeh in Iran (12) had fatality risk was 4 times more in males. In other study in Iran, fatality rate estimated 2.5 more in females than males but it was not significant (9). Reports expresses that rate of non-fatal accidents is higher in women than men but accident leads to death in higher in men (8, 10-12). The reason can be because of functional difference between men and women in driving. In other word women have less attention, experience and skill than men but men are at more risk for more sever accidents because of higher speed and multiplicity of driving at nights.

3- Education

Limited studies are available about the association between education and fatality in traffic accidents. In an investigation by Spoerri et al (13) in Switzerland, it was mentioned that mortality risk in people with elementary education is more than higher

educated people (HR=1.5). This association was more intense in passengers (except driver). In a study in Europe results demonstrated that lower education level increases risk of fatality in men but there was no association in women (14). A study in USA showed that people who had lower education level cared less about fastening seat belt and used more alcoholic drinks while driving than other people (15). In fact it can be said that people who have less education level adhered safety rules less than others while driving.

4- Alcohol

Studies strongly pointed out direction relation of alcohol usage and fatality in traffic accidents. An investigation in 9 European Countries reported that alcohol is the cause 20 to 48 % of traffic accident fatality in these countries (16). A study showed that driving with alcohol drinks usage increases risk of fatality due to accidents to near 3 times (8). It has been reported that risk of accidents caused by alcohol abuse in men and the young is more than women and elderly (17). Alcohol consumption considered as a powerful risk factor for fatality outcome. Evidences shows that people with high level of blood alcohol are at more risk to death than people with lower blood alcohol. Although unfastening seat belt and not having a valid driving license in these - people are some mentioned points (18-20), but unconsciousness and lack of sufficient control are main reasons of accidents.

5- Medications and drugs

Cannabis, stimulus and psychoactive substances are among most important drugs related to traffic accidents and their fatality. Laboratory studies showed that marijuana can strongly weaken driving skill (21). Stimulus reported as fatality factors of traffic accidents because of speeding (OR=2.5) and disturbing driver's attention (OR=1.5) (22). Some results have been in direct relationship with the risk of fatality about amphetamines and it has been expressed that increase was due to effect on speed (OR=2.9) and unfastening seat belt (OR=3.5) but in some studies did reach to significance association (22,23). Benzodiazepines considered as sedations have a direct relationship with fatality risk and increase it between 1.59 to 3.32 times (24).

6- Sleepiness

Driving with sleepiness is highly dangerous and associated with accidents leads to death. Based on data of National Highway Traffic Safety Administration in USA, sleepiness caused 72000 accidents in 2013 that had 800 mortality meanwhile considers this rate of mortality incorrect and estimates that 6000 people dies because of sleepiness annually (25-27). Recent meta-analysis shows that sleepiness can increase risk of accidents between 1.29 and 1.34 times (28). Sleepiness cause decrease in driver attention and make his reactions slower and affect his decision making negatively.

7- Seat belt

According to recent results survival chance of vehicle passengers who had sever traffic accidents with fastened seat belt is less than other passengers (29). In a study mortality chance estimated up to 23 times (10). Other studies pointed this issue out clearly and

expressed fastening seat belt as a preventative factor against fatality (28, 11).

8- Passenger

It is clear that passenger in vehicle can affect driver's function and behavior and his driving outcome. It has been said that this effect depends on car drivers and passenger's age. Previous studies express that passenger presence is considered as fatality risk factor for adolescent and young drivers (specially for male drivers) but it is a protective factor for aged drivers (32,31). Analysis showed that high speed and driving error was more in accidents who had adolescent drivers and these factors increase by increasing number of adolescent passengers (33). Unfastened seat belt mentioned as one of the reasons of more sever harm for adolescent driver\ and passenger (34). Beside of this issue, it has been reported that rear passengers are associated with decrease in fatality in compare with front passengers (RR=0.67) (35). This finding (fatality rate is lower in rear passengers is less than front passengers (children or adults)) has been reported in other studies (37, 37). One on the factors could be that accident usually occurs at the front of the driver.

9- Accident intensity

Traffic accident intensity is one the expected risk factors of fatality because encounter intensity has a direct relationship with input energy. Although it can be said that trauma intensity and its outcomes depend on different factors like driving speed, how accident happened and quality and age of the car but accident intensity expressed as an independent factor for mortality in other studies (38, 11).

10- Speed

As it mentioned high speed could increase accident intensity and risk of fatality. High speed is associated with decrease in driver ability to control the car and increasing his error (8, 20, 39), so driving with safe speed is important in preventing accidents.

11- Time of accident

Based on past results, accidents risk and their fatality can be related to their time (day/night, season) (40-42). Study by Feng et al (8) showed that accidents intensity is more in autumn (OR=1.25) and winter (OR=1.12) than spring. In Iran a study by Mehmandar et al (9) expressed that 60.2% of accidents in autumn and 82.2% of accident in winter led to death. In mentioned study fatality risk in autumn was more than twice and near to 7 times than spring. Different day and night time were associated with accidents intensity and fatality rate was higher during night hours than day. For example, Mehmandar et al (9) mentioned that 78.3% of accidents during 1 to 5 in the morning led to death. Other studies mentioned this time period as very risky (43, 44). This subject could be due to decrease in road vision and driver's exhaustion and sleepiness.

12- Weather

Weather changes like storm, dust, rain, snow and fog can be effective on driving safety and several studies mentioned their direct relationship with accidents (45-47). A study by Lankarani et al in Iran showed that dusty air increased fatality risk more than 9 times

(48). In another investigation fatality risk of accidents in wet roads (snowy or rainy) mentioned almost twice dry roads (8). Decrease in vision and road slipping can be the causes of this issue. It is suggested that more studies procced to investigate uncomfortable weather situations and fatality rate of accidents.

13- Road characteristics

Lankarani et al investigation (48) in Iran showed that fatality risk increases in sharp turns (OR= 6.5), narrowing roads (OR=2.5) and roads without standard guardrails (OR=8.5). Drivers should keep driving more carefully in these situations. Some studies suggest that despite accident rate in urban areas is more than rural areas but accident fatality is more in rural areas (50, 49). Difference of availability to health centers between rural and urban areas could be one the reasons of higher fatality rate in rural areas which mainly being seen in developing countries. Emergency services present later in rural areas and hospitals is more far from villages. This issue cause delay in transportation and hospitalizing injured people.

Discussion:

Several studies investigated traffic accident fatality and factors associating it so far and we investigated 13 effective factors in this narrative review. Some of the factors is related to people like age, gender, education, alcohol consumption, drugs, sleepiness, fastening seat belt and some the other considered as environmental factors like weather, car condition, time and place of accident. There have been different results about age that showed fatality risk exists in all ages and it cannot be clearly said fatality risk is high only in specific ages but based on descriptions itcan be concluded that this risk is higher in older age than younger age specially in male drivers. In continue it has mentioned number of car passengers affects his function and accidents rate and fatality based on drivers age so young drivers should pay attention more to safety points (fastening seat belt and attention to forward) while being with other passengers. People's education level is in a direct relationship with their socioeconomic situation and mentioned as a protective factor against traffic accident fatality. This issue could be because of this reason people with lower education and socioeconomic situation have less ability to buy car or new pieces or care less to safety points (fastening seat belt, no use of alcohol) so it is suggested that related authorities increase people's knowledge about improving health by different ways (social media, schools and educational centers) and improve their socioeconomic situation.

Alcohol consumption is one the most important factors of accidents fatality and driving while lack of full consciousness and high blood alcohol has judicial conviction in several countries. Methods have been suggested for decrease in accidents fatality caused by alcohol consumption. World health organization suggest that blood alcohol level expands. Also suggested that countries that allowed blood alcohol level for driving is 0.5 gr/lit, decrease this amount. It has been suggested that inspection stations for evaluating driver's condition and respiratory test randomly conducts (16). Apart from alcohol, psychedelic drugs

consumption, cannabis, benzodiazepine and stimulus are mentioned risk factors of fatality. There is no standard or allowed dose for amphetamines yet because blood concentration threshold have been different in several reports so it cannot be expressed clearly that what dose increase fatality risk of accidents and its consumption is not allowed (23). As it has been expressed sleepiness and fatigue increase risk of accidents by decreasing driver's attention and slowing their reactions. It is suggested that have enough sleep before driving and prevent hypnotic drugs or alcohol. In the case of fatigue during driving it is better to stop driving for 15 to 20 minutes and take a rest. Past articles in several countries announced that after the mandatory seat-belt closing rule, accidents fatality decreased (51-53). They expressed it as a protective factor against fatal accidents in past analysis, therefore obeying this law by the driver and other occupants of the vehicle help keep their lives. Accidents and irreparable damages of accidents could be prevented by controlling human errors like high speed, sleepiness, using mobile phone, unfastening seat belt, alcohol and drug consumption, inattention in driving, lack of sufficient skill, inappropriate placement of occupants in the car and insufficient awareness of road conditions.

Inappropriate environmental conditions increase risk of traffic accidents and its outcomes. Driving in rainy seasons (autumn, winter), night hours, uncomfortable weather or non-asphalt roads or wet makes it hard for driver so drivers have to be more careful in driving. Some these conditions have to be considered by authorities like construction of direct roads instead of winding roads, the installation of new road signs on the sidewalks, the creation of a special path for cyclists in the streets, standard road pavements, the use of standard carriages and more road lighting can affect Have a significant role in preventing road accidents.

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Figure:

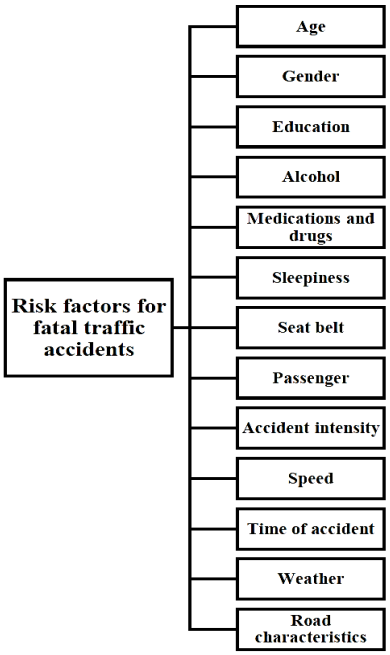

Figure 1: Risk factors for fatal traffic accidents