Meta-synthesis of qualitative evidence in road traffic injury prevention: a scoping review of qualitative studies (2000 to 2019)

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Abstract

Background: A considerable number of qualitative studies have been published in recent years on the issues that the quantitative studies have limitations on. This study aimed at performing a meta-synthesis on qualitative studies on Road Traffic Injuries (RTIs) with a scoping review approach.

Methods: This meta-synthesis study was conducted as a scoping review in 2019. The Arksey and O'Malley framework was applied which has six steps of identifying the research question, identifying the relevant studies, selecting the studies, charting the data, data analysis and reporting the results, and consultation exercise. The required data were gathered by searching the relevant keywords in databases of PubMed, web of knowledge, Scopus, Cochrane Library, Science Direct, Google scholar, Sid, IranMedex. Extracted data were analyzed by the Content-Analysis method.

Results: Finally, 30 studies were included. Extracted data summarized in five main themes and 17 sub-themes. The main themes were: consequences (individual, family, social, financial), the needs of survivors (social support and healthcare), risk factors (general risk factors, risk factors for motorcyclists, risk factors for children and adolescents), barriers of prevention (general barriers, pre-hospital barriers, emergency, and hospital barriers), and prevention solutions (increasing safety, rules and regulations, education, increasing equipment, scientific solutions) of RTIs.

Conclusion: This study combined the methods of the scoping review and the meta-synthesis to mapping all qualitative studies on the RTIs, with this approach, this study provides extensive and practical information for policymakers, managers, practitioners, and researchers in the field of RTIs. Also, by applying this approach, the gaps in the existing knowledge and areas in need of further research are identified.

Keywords: Meta-synthesis, Scoping review, Qualitative study, Road traffic injuries
**Background**

Road Traffic Injuries (RTIs) are the main cause of morbidity and mortality in the world nowadays [1]. The biggest proportion of hospital emergency department admissions is comprised of those affected by the RTIs and these admissions result in an enormous amount of direct and indirect costs for both people and the government. So it consumes a considerable share of the country’s annual budget [2]. It is estimated that globally 1.35 million people lose their lives due to RTIs every year and 50 million people get injured [3]. Moreover, it is estimated that these numbers will increase by 65% in the future 20 years [4]. The estimations also show that for each death due to the RTIs, there are 16 cases of hospitalizations and 400 cases of outpatient visits or transient activity limitations [5].

Quantitative studies have been published on various aspects of the RTIs. Although the quantitative studies were brilliant in this area and have helped the prevention of the RTIs, they are faced with some limitations in some aspects. So the researchers used the qualitative methods besides the quantitative ones [6]. The qualitative studies have been the focus of researchers in the field of health sciences in recent years [7, 8]. Despite the successes of the quantitative researches in measurement, analysis, and use of knowledge, they have some limitations in measuring the subjects such as perception, attitude, experience, and feelings of the people. Thus the use of qualitative studies has been grown in fields such as social sciences and health service management [9].

Considering the characteristics of the qualitative studies, in recent years a significant number of these studies have been performed on some aspects of the RTIs that the quantitative studies were faced with serious limitations on those aspects [10, 11]. Summarization of the findings of these qualitative studies may produce some useful information for macro-level policymaking on the RTIs. Thus this study is performed with the aim of meta-synthesis of the qualitative studies on RTIs with the scoping review approach.

**Methods**

This was a meta-synthesis study performed as a scoping review in 2019 with the aim of the analysis of published qualitative studies on RTIs. The framework by Arksey and O’Malley was used which is the first methodological framework to manage the scoping review studies. The framework is published in 2005 and includes six steps: identification of the research question, identification of the relevant studies, selection of the studies, data charting, data analysis and reporting the results, and consultation exercise [12].

Step one: Identification of the research question

The research question was what are the characteristics and results of the qualitative studies on RTIs. The question is specifically divided into the following:

- What are the main approaches of the qualitative studies on RTIs?
- What are the main methods of data collection in qualitative studies on RTIs?
- What are the most important aspects of RTIs studied in qualitative studies and what are the results?

Inclusion and exclusion criteria: All qualitative studies on the RTIs from January 2000 to March 2019 were eligible to include in the analysis. The language was limited to English and Persian. Those studies on injuries of accidents other than road traffic accidents (such as sailing, aviation, railway), those studies that assessed the RTIs and other injuries at the same time, short communications, and conference abstracts were excluded.

Step two: Identification of the relevant studies

The required data were gathered by searching the keywords of road traffic injury, road traffic accidents, road traffic crashes, motorcycle accident, motorcycle crash, motorcycle injury, motor vehicle injury, motor vehicle crash, motor vehicle accident, qualitative, interview, phenomenology, focus group discussion, grounded theory at the databases of PubMed, web of knowledge, Scopus, Cochrane Library, Science Direct, Google scholar, Sid, IranMedex (Additional file 1: complete search strategy for PubMed databases). To assure the maximum coverage of the study identified these actions were made: some key journals were hand searched, after removing the irrelevant records the remaining papers were reference checked, they were also citation checked by using the Google Scholar citation, some experts were contacted, and the gray literature was searched through the European Association for Grey Literature Exploitation (EAGLE), the Health Care Management Information Consortium (HMIC), and the System for information on Grey Literature in Europe (SIGLE).

Step three: Study selection/screening

All works of the selection and screening of the papers were performed independently by two members of the research team. Cases of inconsistency between the two were resolved by discussion. Over 80% agreement was the cut of the agreement for the selection and screening of articles between the two researchers. Firstly, the titles
of all papers were assessed and those irrelevant to the study purpose were removed. Then the abstracts and full-texts were assessed for eligibility according to inclusion and exclusion criteria. EndNote X5 software was used to handle these works and also to identify the duplications. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram [13] was used to report the findings (Fig. 1).

**Reporting quality assessment**

After screening, the reporting quality of the studies was assessed by two researchers using the Critical Appraisal Skills Program (CASP) checklist. The checklist includes 10 items. The first two items are screening questions. The appraisal of the study would continue only if the answer to at least one of these two questions was yes. For the next eight questions the three options of Yes, Can’t tell, No were marked for which the scores of three, two, one were assigned respectively [14]. So the maximum score of each paper was 24 and the minimum was eight. The inconsistencies were resolved by discussion.

Step four: Categorization of the data

To extract the data, the data extraction form was developed in MS Word 2010. Data for three papers were extracted as a pilot. Then the form was revised. The intended data included: author(s), year, country, study purpose, participants, the approach of the study, data collection method, study findings (themes and sub-themes).

Step five: Conclusion, summarization, and reporting the results

The gathered data were analyzed by the content analysis method. Content-Analysis is a widespread method for the analysis of qualitative data through the identification, analysis, and reporting of the patterns (themes) within a text [15–18]. Coding the text was performed by two researchers independently. Steps of the analysis were: getting familiarized with data, identifying primary areas, putting the paper in the areas, reviewing the papers of each area to complete the findings, assuring the reliability of the work by comparing the results by the two coders.

Step six: Providing practical recommendations

![PRISMA chart, screening process of qualitative studies on Road Traffic Injuries (RTIs) published between 2000 to 2019](image-url)
After extracting and reporting the study results, based on the study findings and the opinions of the research team, practical recommendations were made in terms of research methodology and also for the policymakers and managers.

**Results**

Of the 4623 retrieved records, 1825 were duplicates. At the title and abstract screening, 2752 records were removed. The full-text review also resulted in the removal of 16 papers so finally, 30 papers were included in the synthesis (Fig. 1).

The characteristics of the included studies are shown in Table 1. They are conducted in 12 countries most of which (nine countries) are low-and-middle-income countries (LMICs). The total number of the participants of the included studies was 906 people. The interview was used in 25 studies, FGD in eight studies, and the nominal group in one study (four studies had used more than one method) as a data collection method. The approach of the study was not mentioned in 12 studies. Seven studies have used content analysis, six phenomenologies, and five grounded theory.

Extracted data were summarized into five main themes and 17 sub-themes by the content-analysis (Fig. 2).

**Consequences**

The consequences of the RTIs were divided into four categories of individual, family, social, and financial consequences.

**Individual consequences**

One main individual consequence of the RTIs was the physical so that even if the individual survives at the accident, he/she will suffer from morbidity. Long-term pains, movement problems, and sleep problems were major examples of physical problems. Beyond the mortality and the morbidity, some mental problems also occur as a result of the RTIs such as feeling ashamed, being an encumbrance, and fear of the future.

**Family consequences**

Further to the individual consequences, the RTIs also have consequences on families. The major problems in this category were problems of caring for the injured people (skills, costs, the stamina of caring), change in roles of the family members such as the breadwinner role of the mother of children due to injury of the father), and cut or reduction of family income.

**Social consequences**

One main social consequence of the RTIs that was highly mentioned was the limitations of the social relations of the injured people. Moreover, the accidents due to the low safety of the vehicles and roads can result in distrust of the people in government actions.

**Financial consequences**

One of the most obvious consequences of RTIs is financial consequences. It includes damages to the vehicle, damages to road facilities, treatment and care costs of the injured people, costs of losing the productivity of the people in the society, paying the blood money, and other costs.

**Needs of survivors**

Every RTIs due to the mentioned consequences creates some needs in the injured individual and his/her family. One of these needs is the social needs of the injured people which include social support by the government, charities, family, and friends in terms of financial, mental, spiritual, and legal supports. Another need after an RTI is the need for healthcare which includes emergency care right after the accident, specialist and quality care at the hospital, rehabilitation care, and mental care.

**Risk factors**

The other main theme was the risk factors of the RTIs which had three sub-themes of general risk factors (five items), risk factors for motorcyclists (five items), risk factors for children and adolescents (four items). Table 2 shows the risk factors of the RTIs.

**Barriers to prevention**

The barriers to the prevention of the RTIs were in three categories of general barriers (five main and 13 sub-main), pre-hospital barriers (three main and 10 sub-main), emergency, and hospital barriers (two main and five sub-main). Table 3 shows the themes and sub-themes of the barriers to the prevention of the RTIs.

**Solutions of prevention**

Solutions for prevention of the RTIs and reduction of their consequences were categorized in five dimensions including increasing safety (three items), rules and regulations (four items), education (two items), increasing equipment (five items), and scientific solutions (two items). Table 4 shows these solutions.

Results of the quality appraisal of the included qualitative studies showed that the average quality score of them was 21.6 in the 8–24 range. One issue that did not receive sufficient attention in the studies was the ethical issues (Additional file 2).
| Author, year          | Country | Aim of study                                                                 | Participants (number)                                                                 | Approach | Data collection | Results | Main Categories                                                                 | Subcategories                                                                 |
|-----------------------|---------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------|----------------|---------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Doohan and Saveman, 2014 | Sweden  | nonphysical consequences of a multifatality bus crash and the subsequent effect on the surviving passengers' lives | survivors of a major bus crash (56)                                                 | NM       | IDIs           | Reacting to the crash | Feeling, thinking and helping others                                    |
|                       |         |                                                                              |                                                                                      |          |                |          | Reacting to the emergency care                                                  |
|                       |         |                                                                              |                                                                                      |          |                |          | Encountering the Media                                                         |
|                       |         |                                                                              |                                                                                      |          |                |          | Receiving formal support                                                       |
|                       |         |                                                                              |                                                                                      |          |                |          | Processing the crash                                                           |
|                       |         |                                                                              |                                                                                      |          |                |          | Healing with social Support                                                     |
|                       |         |                                                                              |                                                                                      |          |                |          | Difficulties when sleeping                                                     |
|                       |         |                                                                              |                                                                                      |          |                |          | Everyday travelling                                                            |
|                       |         |                                                                              |                                                                                      |          |                |          | Seeking closure                                                                |
| Pashaei Sabet et al., 2016 | Iran    | experiences of encountering with physical trauma resulting from traffic accidents | participants had a record of upper and or lower extremity injuries caused by traffic accidents (NM) | CA       | IDIs           | experiencing some limitations | 1. Limitations in daily activities                |
|                       |         |                                                                              |                                                                                      |          |                |          | 2. Dependency                                                                  |
|                       |         |                                                                              |                                                                                      |          |                |          | disturbances in performing professional duties                                |
|                       |         |                                                                              |                                                                                      |          |                |          | family problems caused by trauma                                               |
|                       |         |                                                                              |                                                                                      |          |                |          | –                                                                             |
| Yadav and Shrestha, 2017 | Nepal   | experience of oral and maxillofacial trauma patients due to road traffic accident right from immediate after the accident till the end of definitive treatment | oral and maxillofacial trauma patients due to road traffic accident (20) | Phenomenology | IDIs           | unreal experiences | emotional responses                                                           |
|                       |         |                                                                              |                                                                                      |          |                |          | need to inform and need for information                                        |
|                       |         |                                                                              |                                                                                      |          |                |          | need for assistance                                                            |
|                       |         |                                                                              |                                                                                      |          |                |          | perception toward the maxillofacial injury                                      |
|                       |         |                                                                              |                                                                                      |          |                |          | experience on treatment                                                         |
|                       |         |                                                                              |                                                                                      |          |                |          | staff-patient interaction                                                        |
| Franzen et al., 2006 | Sweden  | experiences of pre-hospital and hospital care and subsequent rehabilitation | people injured in a traffic environment (9)                                         | NM       | IDIs           | Facing commotion | Feeling uncomfortable due to memory loss                                      |
|                       |         |                                                                              |                                                                                      |          |                |          | Feeling embarrassed                                                            |
|                       |         |                                                                              |                                                                                      |          |                |          | Experiencing trust and security                                                 |
|                       |         |                                                                              |                                                                                      |          |                |          | Being the centre of attention                                                   |
|                       |         |                                                                              |                                                                                      |          |                |          | Having confidence in caregivers and relatives                                  |
|                       |         |                                                                              |                                                                                      |          |                |          | Lacking security and support                                                    |
|                       |         |                                                                              |                                                                                      |          |                |          | Feeling worried and uncertain                                                   |
|                       |         |                                                                              |                                                                                      |          |                |          | Feeling neglected and disrespected                                              |
|                       |         |                                                                              |                                                                                      |          |                |          | Feeling hindered                                                                |
|                       |         |                                                                              |                                                                                      |          |                |          | 1. Longing for daily routines                                                   |
|                       |         |                                                                              |                                                                                      |          |                |          | 2. Doubting the will                                                            |
| Author, year          | Country | Aim of study                                               | Participants (number)                                                                 | Approach | Data collection | Results | Subcategories |
|----------------------|---------|------------------------------------------------------------|--------------------------------------------------------------------------------------|----------|----------------|---------|---------------|
| Pashaei Sabet et al., 2014 [23] | Iran    | understand the rehabilitation needs of patients with physical disabilities from road traffic accidents to return to the community | both genders and age ranged between 18 and 45 years old with at least 3 months physical disability in upper and lower limbs or spinal cord injury (12) | CA       | IDIs           | the need to be under the umbrella of support | to become healthy | 3. Finding ways to cope with pain  |
|                      |         |                                                            |                                                                                      |          |                |         | Need for support by the care team       | The need for social support | Tendency to spirituality | liberation in society | Caring knowledge search |
|                      |         |                                                            |                                                                                      |          |                |         | achieving independence | motorcycle as entertainment tool | alcohol and drug abuse | racing | showing |
| Ghorashi et al., 2012 [24] | Iran    | reasons of motorcycle accidents                            | motorcycle drivers in streets, injured motorcycle drivers in hospital and their families, old car drivers, traffic wardens and nurses (17) | CA       | IDIs           | environmental and technical factors | economic and cultural factors | ill-favored climate | Impaired motorcycle | neglecting motorcycles | |
|                      |         |                                                            |                                                                                      |          |                |         | 1. not adhere to laws | 2. challenge with police | 3. escaping of helmet | 4. purchasing power | |
| Batool et al., 2012 [25] | Pakistan | road safety issues                                         | government officials, academics and the general driving population (31)              | NM       | IDIs           | Institutional Issues | Execution Issues | Low valuation of road safety | Institutional Weaknesses | Lack of human resources | Lack of timely implementation | Increasing motorization and urbanization | Traffic mix on roads | Non-standardized driving practices | Poor public transport system | On-road encroachments and |
| Author, year | Country | Aim of study | Participants (number) | Approach | Data collection | Results | Subcategories |
|--------------|---------|--------------|-----------------------|----------|----------------|---------|---------------|
| Christie et al., 2007 [26] | UK | children’s exposure to road traffic injury risk in low socioeconomic areas | Parents of children aged 9–14 years living in low socioeconomic areas (86) | NM | FGDs | hazards caused by drivers and riders, insufficient parental responsibility, risk-taking by children, lack of activities and facilities, parents’ views on solutions |
| Sanusi and Emmelin, 2015 [27] | Nigeria | risk and road safety as well as of protective measures | commercial motorcycle driver’s (10) | NM | IDIs | risk-taking as generally acceptable, inadequate training and licensing, poor law enforcement, risk-saturated environment, profit based on overriding rules, assumptions of safety, unavoidable accidents, constant exposure, risk-taking as a way to make ends meet, a fight to feed and survive, family responsibilities |
| Author, year                | Country | Aim of study                                                                 | Participants (number)                                                                 | Approach       | Data collection | Results Main Categories                                                                 | Subcategories                                                                 |
|----------------------------|---------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------|----------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Tetali et al., 2013 [28]   | India   | perceptions of stakeholders on road safety                                    | government officials, subject experts, and road traffic injury victims, trauma surgeons, medical interns, nurses, and taxi drivers (37) | NM             | IDIs and FGDs   | Status of road safety                                                                   | Unaffordable safety measures                                                                                   |
|                            |         |                                                                               |                                                                                      |                |                | 1. Unsafe roads                                                                         | 1. Ineffective enforcement                                                                                  |
|                            |         |                                                                               |                                                                                      |                |                | 2. Unequal enforcement                                                                   | 2. Unequal enforcement                                                                                 |
|                            |         |                                                                               |                                                                                      |                |                | 3. Lack of political-will                                                                  | 3. Lack of political-will                                                                               |
|                            |         |                                                                               |                                                                                      |                |                | 4. Fines are not a deterrent                                                                | 4. Fines are not a deterrent                                                                       |
|                            |         |                                                                               |                                                                                      |                |                | 5. Corruption                                                                            | 5. Corruption                                                                                               |
|                            |         |                                                                               |                                                                                      |                |                | 6. Low compliance                                                                        | 6. Low compliance                                                                                          |
|                            |         |                                                                               |                                                                                      |                |                | 7. Disregard of rules                                                                     | 7. Disregard of rules                                                                                     |
|                            |         |                                                                               |                                                                                      |                |                | Road engineering                                                                        |                                                                                                             |
|                            |         |                                                                               |                                                                                      |                |                | 1. Poor roads                                                                            | 1. Poor roads                                                                                               |
|                            |         |                                                                               |                                                                                      |                |                | 2. Poor infrastructure                                                                    | 2. Poor infrastructure                                                                                   |
|                            |         |                                                                               |                                                                                      |                |                | 3. Poor road-use                                                                          | 3. Poor road-use                                                                                          |
| Hashemiparast et al., 2017a| Iran    | Explore the reasons for risky road crossing behaviors among young people.     | males and females who had a car-accident (12)                                         | CA             | IDIs           | Conformity with the masses                                                               | 1. conformity with peers                                                                                   |
|                            |         |                                                                               |                                                                                      |                |                | 2. conformity with the public space of society                                           | 2. conformity with the public space of society                                                          |
| Shams et al., 2010 [30]    | Iran    | views of taxi drivers about risky driving behaviors                           | taxi drivers (42)                                                                    | NM             | FGDs           | the role of taxi drivers in current driving situation                                    | Non-Behaviorian                                                                                           |
|                            |         |                                                                               |                                                                                      |                |                | drivers’ reasons for committing risky driving                                            |                                                                                                             |
Table 1: Characteristic and results of qualitative studies on Road Traffic Injuries (RTIs) published between 2000 to 2019 (N = 30) (Continued)

| Author, year       | Country | Aim of study                                      | Participants (number) | Approach | Data collection | Results Main Categories | Subcategories                                                                 |
|--------------------|---------|---------------------------------------------------|-----------------------|----------|-----------------|-------------------------|--------------------------------------------------------------------------------|
| Zamani-Alavijeh et al., 2010 [31] | Iran | explore risk behaviors among Iranian motorcyclists | Motorcyclists (32)    | GT       | IDIs and FGDs   | behaviors               | reasons                                                                 |
|                    |         |                                                   |                       |          |                 | actions for modifying risky driving behaviors | Suitable education                                                                 |
|                    |         |                                                   |                       |          |                 |                         | Monitoring for roles                                                            |
|                    |         |                                                   |                       |          |                 |                         | Correcting the streets                                                          |
|                    |         |                                                   |                       |          |                 |                         | Providing suitable facilities for driving                                        |
|                    |         |                                                   |                       |          |                 |                         | Resolving Community Structural Problems                                           |
|                    |         |                                                   |                       |          |                 |                         | Carry out hazardous driving behaviors modification interventions                  |
|                    |         |                                                   |                       |          |                 | suitable places for implementing the recommended interventions                 |
|                    |         |                                                   |                       |          |                 | Drivers' gathering places                                                      |
|                    |         |                                                   |                       |          |                 | Interior Space and Taxi Body                                                   |
|                    |         |                                                   |                       |          |                 | Taxi Drivers' Routes                                                          |
|                    |         |                                                   |                       |          |                 | best channels for communicating and persuading taxi drivers                   |
|                    |         |                                                   |                       |          |                 | Mass media                                                                    |
|                    |         |                                                   |                       |          |                 | Writing media                                                                 |
|                    |         |                                                   |                       |          |                 | Effective people on the behavior of taxi drivers                             |
|                    |         |                                                   |                       |          |                 | Individual features                                                           |
|                    |         |                                                   |                       |          |                 | Physical and mental health and balance                                         |
|                    |         |                                                   |                       |          |                 | Knowledge and skill                                                           |
|                    |         |                                                   |                       |          |                 | Motivation to use motorcycleThe reaction of the individual to previous experiences and behaviors |
|                    |         |                                                   |                       |          |                 | Social factors                                                                |
|                    |         |                                                   |                       |          |                 | Police performance                                                             |
|                    |         |                                                   |                       |          |                 | low cost and easy availability of motorcycles                                 |
|                    |         |                                                   |                       |          |                 | motorcycle defects and land ownership laws                                    |
|                    |         |                                                   |                       |          |                 | traffic laws                                                                   |
|                    |         |                                                   |                       |          |                 | traffic culture                                                                |
|                    |         |                                                   |                       |          |                 | vehicle related factors                                                       |
|                    |         |                                                   |                       |          |                 | Type of motorcycle                                                             |
|                    |         |                                                   |                       |          |                 | Motorcycle breakdown                                                           |
|                    |         |                                                   |                       |          |                 | abuse of safe equipment's                                                      |
|                    |         |                                                   |                       |          |                 | 1. Motorcycle Safety Equipment                                                 |
|                    |         |                                                   |                       |          |                 | 2. Motorcyclist Safety Equipment                                               |
| Author, year            | Country       | Aim of study                                                                 | Participants (number)                                                                 | Approach | Data collection | Main Categories                                      | Subcategories                                                                 |
|------------------------|---------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------|----------------|---------------------------------------------------|----------------------------------------------------------------------------|
| Khorasani-Zavareh et al, 2009 [32] | Iran          | barriers effective post-crash management                                       | medical services personnel, police officers, members of Red Crescent, firefighters, public-health professionals, road administrators; some road users and traffic injury victims (36) | GT IDIs  | IDIs           | environmental factors                             | Type and structure of roads                                                |
|                        |               |                                                                               |                                                                                       |          |                | lack of special motorcycle route                  |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | road safety                                        |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | air condition                                      |                                                                             |
| Haghparast-Bidgoli et al, 2013 [33] | Iran          | influencing an effective trauma care delivery at emergency departments (EDs)   | health professionals (15) and injured patients (20)                                   | GT IDIs  | IDIs           | involvement of laypeople                           | 1. Cultural background                                                      |
|                        |               |                                                                               |                                                                                       |          |                | 2. limitations in knowledge                       |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | 3. late arrival of the emergency services          |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | lack of coordination                               | different ambulance dispatch site locations                                 |
|                        |               |                                                                               |                                                                                       |          |                | existence of parallel organizations with the same activity |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | substandard telecommunication equipment           |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | undeveloped satellite navigation                 |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | inadequate pre-hospital services                  | low number of ambulance dispatch sites                                   |
|                        |               |                                                                               |                                                                                       |          |                | inadequate human resources                       |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | insufficient physical resources                   |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | lack of police officers                           |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | lack of crash scene management skills             |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | shortcomings in infrastructure                   | 1. poor urban infrastructure                                              |
|                        |               |                                                                               |                                                                                       |          |                | 2. no satellite navigation                        |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | Teaching hospitals                                |                                                                             |
|                        |               |                                                                               |                                                                                       |          |                | Inappropriate structure of hospitals              | Inappropriate layout and planning of ED premises                            |
|                        |               |                                                                               |                                                                                       |          |                | Unsupportive environment                          | Absence of established ways and inappropriate facilities for communication |
|                        |               |                                                                               |                                                                                       |          |                |                                                     | An environment of mistrust                                                  |
| Author, year          | Country        | Aim of study                                      | Participants (number) | Approach | Data collection | Results                                                                 |
|----------------------|----------------|--------------------------------------------------|-----------------------|----------|-----------------|-------------------------------------------------------------------------|
| Haghparast-Bidgoli et al., 2010 [34] | Iran           | explore prehospital trauma care process for RTI victims | pre-hospital trauma care professionals (15) | GT IDIs administration and organization | Inappropriate management  
Absence of an established trauma system  
Unclear national policies  
Lack of continuity between prehospital and hospital trauma care processes  
Poor organization of care at the ED  
1. Absence of established trauma teams  
2. Lack of protocols and guidelines for trauma care  
3. Inappropriate human resource planning  
Inappropriate training plans  
Out of date, unpractical and inadequate training courses  
Deficiency of resources  
misdistribution of resources  
inappropriate communication system  
Ineffective medical direction and referral system  
Poor coordination and cooperation between organizations  
Insufficient knowledge and skills regarding the rescue of victims  
Insufficient knowledge and skills regarding managing the crash  
Providing Laypeople |
| Author, year          | Country  | Aim of study                                      | Participants (number)                                                                 | Approach | Data collection | Results                                                                 |
|-----------------------|----------|---------------------------------------------------|---------------------------------------------------------------------------------------|----------|----------------|-------------------------------------------------------------------------|
| Alinia et al., 2015   | Iran     | explore the barriers of pre-hospital care in traffic injuries | Peoples with at least 2 years’ experience in the field of pre-hospital services (18) | CA       | IDIs people    | incomplete or wrong information, emotional reactions, conflicts with the EMS personnel, infrastructure lack of GPS system, sub-standard road infrastructures, lack of infrastructures for helicopter ambulances in the big cities, an inadequate telecommunication system, Metropolitan infrastructure traffic accessibility to streets and alleys, naming of alleys, profession professional autonomy, work-related issues, 1. Inadequate telecommunication technology, 2. Inadequate human resources, 3. Inappropriate workload related privilege, 4. Lack of organizational coordination |
| Razzaghi et al., 2017 | Iran     | explore the obstacles relating to the elderly pedestrians | elderly pedestrians age equal or more than 60 years old (23)                          | CA       | IDIs           | Problems related to environment, social respect to elderly physical health |
| Hashemiparast et al., 2017b | Iran   | explore the young pedestrians risky road crossing behaviors reasons | young individuals who had the experience of vehicle-collision accident (12)           | CA       | IDIs           | conformity with the masses/crowds, bypassing the law/law evasion, lack of social cohesion and sense of belonging in social relations’ |
| Author, year          | Country  | Aim of study                                                                 | Participants (number)                                                                 | Approach          | Data collection | Results                                                                 |
|----------------------|----------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------|----------------|------------------------------------------------------------------------|
| Perez-Nunez et al., 2012 [38] | Mexico   | consequences of fatal and non-fatal road traffic injuries                      | injured and relatives of people who died (24)                                       | Phenomenology: IDIs |                | Health Consequences depend on others to perform the activities of daily life |
|                      |          |                                                                                |                                                                                      |                  |                | Changes in family members health during the care of injured people   |
|                      |          |                                                                                |                                                                                      |                  |                | mental health                                                       |
|                      |          |                                                                                |                                                                                      |                  |                | feelings of sadness and pain                                        |
| Noori Hekmat et al., 2015 [39] | Iran     | explore the challenges and complexities related to health care financing for traffic victims | managers at the Ministry of Health, Medical Sciences Universities, trauma specialized hospitals and basic insurances (36) | Phenomenology: IDIs |                | financial integration Lack of timely payment of contributions to the Ministry of Health |
|                      |          |                                                                                |                                                                                      |                  |                | Injustice in aggregating financial resources                         |
|                      |          |                                                                                |                                                                                      |                  |                | The complex process of aggregating financial resources              |
|                      |          |                                                                                |                                                                                      |                  |                | Lack of fair distribution of financial resources                   |
|                      |          |                                                                                |                                                                                      |                  |                | The complex and                                                       |
Table 1 Characteristic and results of qualitative studies on Road Traffic Injuries (RTIs) published between 2000 to 2019 (N = 30) (Continued)

| Author, year | Country | Aim of study | Participants (number) | Approach | Data collection | Results |
|--------------|---------|--------------|-----------------------|----------|----------------|---------|
| Bazeli et al., 2017 [40] | Iran | explore the challenges and facilitators in management of mass casualty traffic incidents | experienced managers, paramedics and staff of aid organizations (14) | GT | IDIs | Multiplicity of relief agencies |
|              |         |              |                       |          |                | timeliness of process of allocating and distributing financial resources |
|              |         |              |                       |          |                | Challenge and tension over deductions |
|              |         |              |                       |          |                | Non-transparency of the criteria for identifying the injured |
|              |         |              |                       |          |                | Lack of Comprehensive Coverage for Service Article 92 |
|              |         |              |                       |          |                | Defective service coverage |
|              |         |              |                       |          |                | Therapeutic Services Package |
|              |         |              |                       |          |                | Lack of number of trauma services providers |
|              |         |              |                       |          |                | General challenges |
|              |         |              |                       |          |                | Buy service |
|              |         |              |                       |          |                | Several organizations are involved in managing these events. |
|              |         |              |                       |          |                | The accident scene is managed by several organizations. |
|              |         |              |                       |          |                | In most accidents involve at least three or four of emergency agencies |
|              |         |              |                       |          |                | Lack of clear roles |
|              |         |              |                       |          |                | Limit set of organizational tasks is not defined. |
|              |         |              |                       |          |                | There is no clear description of personnel's job |
|              |         |              |                       |          |                | There is no a certain Commander |
|              |         |              |                       |          |                | Currently we do not have a unified command |
|              |         |              |                       |          |                | Cultural factors |
|              |         |              |                       |          |                | Citizens do not adhere traffic rules |
|              |         |              |                       |          |                | traditional management culture |
Table 1 Characteristic and results of qualitative studies on Road Traffic Injuries (RTIs) published between 2000 to 2019 (N = 30) (Continued)

| Author, year | Country | Aim of study | Participants (number) | Approach | Data collection | Main Categories | Subcategories |
|--------------|---------|--------------|-----------------------|----------|----------------|----------------|---------------|
| Huicho et al., 2012 [41] | Peru | assess current interventions implemented to reduce RTIs | policymakers and technical officers involved (19) | NM | IDIs | Lack of clear and sustained political and budgetary support |  |
| | | | | | | Ineffective coordination between the different sectors involved |  |
| | | | | | Insufficient community participation |  |
| | | | | | Lack a reliable and fully functional information system |  |
| Ramos et al., 2008 [42] | Spain | Young people’s perceptions of traffic injury risks, prevention and enforcement measures: Informants (43) and Young people (98) | | NM | IDIs & FGDs | Determinants of traffic injuries | personal |
| | | | | | | drug use |  |
| | | | | | | false sense of security which comes from well equipped cars |  |
| | | | | | | enjoyment of the sensation of speed |  |
| | | | | | | distractions (using cell-phones, reading the newspaper or arguing while driving) |  |
| | | | | | | fatigue |  |
| | | | | | | night driving |  |
| | | | | | | being male |  |
| | | | | | | low educational level |  |
| | | | | | | social |  |
| | | | | | | 1. rebelliousness of youth against norms |  |
| | | | | | | 2. permissiveness of Mediterranean culture about drug use |  |
| | | | | | | 3. having parents who break rules as a model |  |
| | | | | | | 4. the social value attributed to vehicles as symbols of freedom |  |
| | | | | | | 5. the early age at which moped driving is allowed |  |
| | | | | | | 6. job-pressure on professional drivers |  |
| | | | | | | 7. the lack of public transport |  |
| | | | | | structural | unsuitable design of roads |  |
| | | | | | | siting of clubs far away from towns |  |
| Author, year | Country | Aim of study | Participants (number) | Approach | Data collection | Results |
|-------------|---------|--------------|-----------------------|----------|-----------------|---------|
| Soori et al., 2015 [43] | Iran | Opportunities and barriers to enacting mandatory child car restraint laws in Iran | road safety stakeholders (28) | Phenomenology | FGDs | Rising traffic densities, Important problem, Leading cause of death, Complex problem to tackle, RTIs injuries and deaths are avoidable, Traffic injuries are declining, Driving while under the influence of psychoactive substances, Assessment of interventions which are carried out, Intervention proposals, On improving public transport, Sanctions and incentives, Measures to reduce adverse effects of drugs on driving, Design cities more suited for pedestrians, Generate social debate, Barriers and threats, Lack of propaganda by mass media, Lack of related laws, Lack of parents’ awareness, Lack of a positive attitude among households, It is not a priority for the children’s needs, Lack of accessibility, It is too expensive to purchase for everyone, It is hard to find it in the market, Policy-makers do not know about its benefits, Children dislike to use it |
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Table 1 Characteristic and results of qualitative studies on Road Traffic Injuries (RTIs) published between 2000 to 2019 (N = 30) (Continued)
| Author, year       | Country   | Aim of study                                | Participants (number) | Approach       | Data collection | Results                                                                 |
|-------------------|-----------|---------------------------------------------|-----------------------|----------------|----------------|--------------------------------------------------------------------------|
| Trevino-Siller et al., 2011 [44] | Mexico   | prioritise road traffic injury (RTI) interventions | road users and social groups (48) | NM FGDs, NGs | FGDs, NGs | 1. Massive educational campaign                                            |
|                   |           |                                             |                       |                |                | 2. Vital education programmes in schools                                  |
|                   |           |                                             |                       |                |                | 3. Increase and improve streets and avenues                                |
|                   |           |                                             |                       |                |                | 4. Urban planning policies to locate schools and parking lots             |
|                   |           |                                             |                       |                |                | 5. Obligatory programmes for bars                                         |
|                   |           |                                             |                       |                |                | 6. Special paths for pedestrian crossings in risk zones                   |
|                   |           |                                             |                       |                |                | 7. Clear signalization for pedestrians and bus stops                       |
|                   |           |                                             |                       |                |                | 8. Obligatory exam to obtain drivers license and increase minimum age for drivers |
|                   |           |                                             |                       |                |                | 9. Implementation of punitive law system                                   |
|                   |           |                                             |                       |                |                | 10. Permanent program for selection and training of policemen and salaries improvement |
| Ainy et al., 2011 [45] | Iran     | Presenting a practical model for governmental political mapping on road traffic injuries | experts from governmental and non-governmental organizations (26) | Phenomenology FGDs | suggested organization to be the leading agency in prevention of RTIs | Traffic police |
|                   |           |                                             |                       |                |                | Presidential institution                                                  |
|                   |           |                                             |                       |                |                | Ministry of interior                                                      |
|                   |           |                                             |                       |                |                | Parliament                                                               |
|                   |           |                                             |                       |                |                | Cabinet                                                                  |
|                   |           |                                             |                       |                |                | Ministry of roads and transport                                            |
|                   |           |                                             |                       |                |                | Judiciary                                                                 |
|                   |           |                                             |                       |                |                | Correction related laws and determine the duties                          |
|                   |           |                                             |                       |                |                | Credit allocation necessary                                               |
|                   |           |                                             |                       |                |                | Careful planning and coherent                                             |
|                   |           |                                             |                       |                |                | Sensitive authorities                                                     |
| Author, year | Country | Aim of study | Participants (number) | Approach | Data collection | Results |
|-------------|---------|--------------|-----------------------|----------|----------------|---------|
| Salari et al., 2017 [46] | Iran | explore strategies to control RTIs | Mainly representatives from the police, Ministry of Road, Municipal, emergency services and Ministry of Health (30) | NM | IDIs | Accident scene management |
| | | | | | | Integration |
| | | | | | The use of a single Relay phone Number |
| | | | | | Scientific examination of causes of accident |
| | | | | | Governance and Leadership |
| | | | | | Establishing a leading agency responsible for RTIs |
| | | | | | Improving Accident database |
| | | | | | Integrated Database |
| | | | | | Education |
| | | | | | public education, and creation of awareness |
| | | | | | Ensuring safe driving by Enforcement |
| | | | | | random testing of the use of alcohol and drugs |
| | | | | | Increasing fines for traffic violations |
| | | | | | Increasing the number of speed cameras |
| | | | | | Ensuring safe driving by restriction |
| | | | | | Instituting Psychological examination as part of the tests to acquire driver's license |
| | | | | | Restricting teens from driving at night |
| | | | | | Ensuring the safety of Pedestrians |
| | | | | | Construction of pedestrian bridges/ overpass |
| Patel et al.: 2017 [47] | Brazil | causes of delays in pre-hospital transport of RTIs patients | health care providers employed at prehospital or hospital settings (11) | Phenomenology | IDIs | Traffic related issues |
| | | | | | | High traffic volume |
| | | | | | | Wrong navigation information |
| | | | | | | Lack of public education |
| | | | | | | 1. Lack of traffic education |
| | | | | | | 2. Lack of public education to respond to trauma |
| | | | | | | 3. Lack of drivers awareness of |
| Author, year | Country | Aim of study | Participants (number) | Approach | Data collection | Results |
|--------------|---------|--------------|-----------------------|----------|----------------|---------|
| Teye-Kwadjo et al. 2017 [48] | Ghana | risk factors for road transport-related injury among pedestrians | Pedestrians (26) | NM | IDIs | Behavioral factors |
|              |         |              |                       |          |                | Insufficient personnel |
|              |         |              |                       |          |                | Lack of personnel |
|              |         |              |                       |          |                | Poor location |
|              |         |              |                       |          |                | Stations distance from crashes sites |
|              |         |              |                       |          |                | Stations located far from important places of the city |
|              |         |              |                       |          |                | Insufficient ambulances |
|              |         |              |                       |          |                | Lack of equipment in the ambulances |
|              |         |              |                       |          |                | Not enough ambulances |
|              |         |              |                       |          |                | Bureaucracy |
|              |         |              |                       |          |                | 1. Long time to receive notification within the pre-hospital care system |
|              |         |              |                       |          |                | 2. Difficulty with patient admission |
|              |         |              |                       |          |                | 3. Walking with face turned against traffic |
|              |         |              |                       |          |                | 4. Cell phone use while walking |
|              |         |              |                       |          |                | 5. Drivers not yielding of right-of-way |
|              |         |              |                       |          |                | 6. Speeding |
|              |         |              |                       |          |                | 7. Repeated honking |
|              |         |              |                       |          |                | 8. Distracted driving (driver chatting with front |
|              |         |              |                       |          |                | 9. seat vehicle occupants |
|              |         |              |                       |          |                | 10. Roadside trading/trading in motorised traffic |
|              |         |              |                       |          |                | Personal factors |
|              |         |              |                       |          |                | Low pedestrian crash risk perception |
|              |         |              |                       |          |                | Pedestrian and driver attitudes to right-of-way laws |
|              |         |              |                       |          |                | Inaccurate vehicle speed estimation |
Of the 4623 retrieved papers, finally, 30 included in the study. The synthesis of the qualitative data resulted in five main themes and 17 sub-themes. The themes were consequences of the RTIs (individual, family, social, financial), needs (social support, healthcare), risk factors of the RTIs (five general risk factors, five risk factors of motorcyclists, four risk factors of children and adolescents), barriers of prevention of the RTIs (five general barriers, three pre-hospital barriers, two hospitals, and emergency barriers), and solutions of prevention of the RTIs (three items on increasing safety, four items on regulation, two items on education, five items on increasing equipment, and two items of scientific solutions).

**Consequences of the RTIs**

The RTIs not only cause physical and financial problems, but also cause some mental problems due to losing family members, feeling guilty, feeling ashamed, being an encumbrance, and fear of the future. The physical problems usually get better by healthcare or the person becomes adapted to the problems. But the mental problems such as long-term depressions bring more suffering for the person and have more severe consequences [49]. A meta-analysis by Wanli Lin and colleagues (2018) showed that the prevalence of Post-Traumatic Stress Disorder (PTSD) among 6804 victims of the RTIs was 22.2% [50]. Another meta-analysis by Dai et al. (2018) on 1532 children and adolescents injured in RTIs showed the prevalence of PTSD as 19.9% [51]. The study by Asuquo et al. in Nigeria (2017) showed that 63% of the victims of the RTIs became depressed [52]. Some other studies also indicated the high prevalence of mental problems among injured people in the RTIs [53–57]. Thus the mental problems of these people should be considered to provide appropriate care.

Another consequence of RTIs is financial issues. The high social and economic costs of the RTIs have challenged the policymakers of the countries [38, 58]. The economic costs of the RTIs include all costs of the RTIs and costs due to the RTIs [59]. It is estimated that the global costs of the RTIs be US $ 518 billion of which the US $ 65 billion is at the LMICs. It is also estimated that the costs of the RTIs at the low-income, middle-income, and high-income countries to be 1, 1.5, and 2% of the Gross Domestic Product (GDP) of that country, respectively [4]. According to the study by Eyni et al. (2014) which applied the willingness to pay (WTP) method found that the costs of the RTIs equal to 6.46% of the GDP of Iran [60]. A glance at the literature shows that several methods have been used to estimate the costs of the RTIs in recent years such as life insurance approach, court award, compensation method, implicit public sector valuation, gross output, Human Capital (HC), Willingness To Pay (WTP) [58, 61–65]. The systematic review by Azami-aghdash et al. (2018) showed that the HC method is more frequently used for this purpose [66].
**Needs of survivors**

One of the main needs of the victims of the RTIs is the need for social support because they cause the victims to be socially isolated [67, 68]. Numerous studies have shown that good social support to the survivors of the RTIs helps them to get better quickly and to overcome mental problems [69–72]. Family, friends, and some peer groups in the society can provide good social support for these people [73, 74]. The important point to consider in this regard is that to get the most possible impact, the support should be according to the conditions of the injured one and his/her injury.

**Risk factors**

One of the most important categories of the risk factors identified in this study is the risk factors of the motorcyclists. According to the National Highway Traffic Safety Administration (NHTSA), the risk of death of the motorcyclists is 34 times more than other vehicles. This number is eight times for severe injuries [75]. Most of the studies in this review also indicated a higher risk of injury to the motorcyclists [76–80]. It seems that the prevalence of using motorcycles has been grown so fast that the culture of its proper use has been lagged. So that people are not familiar with the culture of right and safe use of motorcycles [81]. Another reason for the higher rate of injuries of the motorcyclists might be its lower safety equipment compared to other vehicles [82, 83]. Moreover, compared to the other vehicles, most of the users of the motorcycles are the youth and peoples at this age due to the nature of the age and the more tendencies for excitement are at the higher risk of accident [84]. So, safer design of the motorcycles and more preventive laws along with the more measures to promote helmet seem necessary. Six risk factors were identified for the motorcyclists in this study. Quantitative studies have identified numerous risk factors for the motorcyclists [85–89]. Since in this study the risk factors are identified from qualitative studies, merging the findings of the qualitative and quantitative studies may provide a broader view on the issue.

As it is mentioned, the risk factors identified from qualitative papers in this study were general risk factors, specifically for motorcyclists and children and adolescents. Yet quantitative studies have identified specific risk factors for other groups of people such as the elderly, pedestrians, and bike riders. The literature shows that these groups are also vulnerable to RTIs [90–96] and should be investigated by qualitative studies.

**Barriers to prevention**

The study by Khorasani Zavareh et al. (2009) showed that there are several barriers to the prevention of the RTIs in Iran. The main theme of the study was the lack of a systemic approach to the prevention of the RTIs and the sub-themes were human resources, transportation systems, and organizational coordination [97]. A report by Hyder et al. (2013) assessed the barriers to prevention of the RTIs including knowledge, attitude, participation, management, capacity building, and
infrastructure in five dimensions of government, health sector, academics, and private sector [98]. Alinia and colleagues (2015) studied the barriers of providing pre-hospital EMS care for the RTI victims and found 13 barriers in 4 main areas of barriers related to people, barriers related to the structure of the metropolises, barriers related to professions, and managerial barriers [35]. This study found few barriers in hospital and hospital emergency departments which might be mainly due to a limited number of studies in this regard. But other studies have shown that the hospital emergency medical care has a significant role in reducing the mortality and morbidity due to the RTIs [99, 100]. Thus it is suggested that more qualitative studies be conducted on the barriers to providing quality care for the RTI victims at the hospital emergency departments.

**Solutions of prevention**

The existence of a leading organization with sufficient authority and tools is one of the most important solutions for the prevention of the RTIs. Several organizations are involved in RTIs and their prevention, of which the main ones are the ministry of transportation, ministry of industry, ministry of health, traffic Police, forensic medicine organization, Central insurance organization, ministry of Justice, ministry of interior, the red crescent organization, and the EMS. At the countries that are successful in reducing the burden of the RTIs, usually, there is a leading organization that has the stewardship of the activities around the RTIs [101, 102]. For example, in Canada, the federal and provincial governments are the pioneer of road safety. The federal government has a commanding role in the transportation system and participates in the transportation system development by data collection and research. The police have the administrative role and develop safety plans with the help of the judiciary [103]. The study by Soori et al. (2009) proposed the Traffic Police or the president as the steward leader in the prevention of the RTIs in Iran [104].

Another important solution that was emphasized in several studies is establishing an on-time and effective registration and reporting system. The experiences of the countries indicate that the health sector can play an effective role in designing and implementing the recording and reporting system of the RTIs [105–108]. In India, for example, the project named “Road Traffic Injury Surveillance Project” The project implemented in 2007 by the Indian Council of Medical Research Association (ICMRA), World Health Organization (WHO), ministry of health and family welfare after the many problems of the health sector data system. The main purpose of the project was to establish a care system in 25 major hospitals of India which then achieved considerable successes [109]. The system then merged with the Integrated Disease Surveillance Project (IDSP) by the government [110]. The other example is the case of Pakistan in which the health system of the country developed and implemented the RTIs’ care system in 2006. The goal of the system was to estimate the burden of the RTIs, to study the RTIs’ victims admitted to the hospital,
Table 3 Barriers to prevent the Road Traffic Injuries (RTIs) and reduce their consequences according to qualitative studies published between 2000 to 2019

| Dimension                  | Main barriers                                                                 | Secondary barriers                                                                                   |
|----------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| **General barriers**       | Organizational 1. Low priority of the RTIs in government agenda                | 2. Weaknesses in organizing 3. Lack of sufficient support and political commitment for the prevention of the RTIs |
|                            | Administrative 1. Shortages of manpower                                         | 2. Poor road safety standards                                                                        |
|                            | Socio-cultural 1. Social inequity                                               | 2. Behavioral and believe problems 3. Underdefined and little role of the people in the prevention of the RTIs |
|                            | Scientific 1. Lack of an integrated and effective registration and reporting system | 2. Limitations in applicable researches                                                               |
|                            | Systemic 1. Poor public transportation                                          | 2. Traditional management (lack of scientific and systemic attitude in the management of traffic accidents) |
|                            | 3. Problems and weaknesses of driving license system                            |                                                                                                       |
| **Pre-hospital barriers**  | General public 1. Low knowledge and wrong interventions at the accident scene | 2. Making traffic jams for relief forces 3. Low culture (harassing phone calls to road EMS)           |
|                            | Coordination 1. Lack of an integrated and orderly system                        | 2. Lack of a leading and steward organization with sufficient facilities and authorities              |
|                            | 3. Shortages of communication and coordination equipment                        | 4. Weaknesses of regulations and laws                                                                  |
|                            | Limited facilities 1. A limited number of ambulances, equipment, and facilities  | 2. Shortage of capable manpower and inappropriate distribution of them                                |
|                            | 3. Low use of air aid                                                           |                                                                                                       |
| **Emergency and hospital barriers** | Poor organization 1. Most hospitals are educational (care by students with low knowledge and experience) | 2. Poor planning and control of the emergency departments 3. Shortages of care guidelines of trauma patients |
|                            | Manpower 1. Shortage of capable manpower in the care of trauma patients         | 2. Poor planning and management of the manpower                                                      |

and to provide solutions for reducing the RTIs. As a result of implementing this system, the attention to the RTIs was increased and the outputs of the system showed that the real number of the victims of the RTIs is higher than the statistics by the police [111]. The point to keep in mind is the cooperation of the health sector with other sectors and organizations in designing and implementing such systems. Since the RTIs are multilateral and many organizations are involved in it, the data of the RTIs should be integrated from all involved organizations.

**Study limitation**
Although with the best of our knowledge this is the first study of scoping review and meta-synthesis on qualitative studies on the RTIs, it has some limitations. The main limitation of this study was limiting the search of the literature to English and Persian languages because there might be some good studies in other languages that are not included in the synthesis. Subjective interpretation of the findings is another limitation of this study. Petticrew et al. (2013) noted that the results of meta-synthesis should be more interpreted by policymakers and users [112]. But in the present study, this was not possible.

**Conclusion**
This study combined the methods of the scoping review and the meta-synthesis to mapping all qualitative studies on the RTIs to summarize the vast literature into five main themes and 17 sub-themes. The main
themes found in this study were: consequences of the RTIs, needs, risk factors, barriers of prevention, and solutions for the prevention of the RTIs. With this approach, this study provides extensive and practical information for policy-makers, managers, practitioners, and researchers in the field of RTIs. Also, by applying this approach, the gaps in the existing knowledge and areas in need of further research are identified. However, this method is a new method and more studies are needed to become more mature with this method.

Future research
Based on the results of this study, the following topics are recommended for future qualitative studies:

➢ Psychological and social effects of traffic accidents.
➢ Policy-making, management, and organizational tasks of RTIs prevention.
➢ Qualitative studies to investigate RTIs prevention issues in high-risk and vulnerable groups (elderly, children, disabled people, etc.).
➢ Qualitative studies to further investigate the provision of high-quality health care services to traffic accident victims.
➢ Carrying out qualitative studies on experiences, high-risk behaviors, and prevention of traffic accidents with the participation of drivers of public and heavy vehicles.

➢ A qualitative study with policy-makers and senior managers on macro-level issues of traffic accident prevention (policies, rules, and regulations, culture, etc.).
➢ Application of qualitative studies in designing, implementing, and evaluating RTIs prevention interventions and policies.

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s13690-020-00493-0.

Additional file 1. Complete search strategy in PubMed databases for identifying the qualitative studies on Road Traffic Injuries (RTIs) published between 2000 to 2019.

Additional file 2. Results of the quality appraisal of qualitative studies on Road Traffic Injuries (RTIs) published between 2000 to 2019.

Abbreviations
RTIs: Road Traffic Injuries; EAGLE: European Association for Grey Literature Exploitation; HMIC: Health Care Management Information Consortium; SIGLE: System for Information on Grey Literature in Europe; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; CASP: Critical Appraisal Skills Program; LMICs: Low-and-middle income countries; PTSD: Post-Traumatic Stress Disorder; GDP: Gross Domestic Product; HC: Human Capital; WTP: Willingness To Pay; NHTSA: National Highway Traffic Safety Administration; WHO: World Health Organization; IDSP: Integrated Disease Surveillance Project

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Table 4 Solutions of prevention of the RTIs and reduction of their consequences according to the qualitative studies

| Dimensions          | Solutions                                                                 |
|---------------------|---------------------------------------------------------------------------|
| Increasing safety   | 1. Increasing the safety of the roads and vehicles                        |
|                     | 2. Promotion of the use of safety equipment (seat belt, helmet, …)        |
|                     | 3. Making specific ways for bike riders and motorcyclists                 |
| Rules and regulations | 1. Preventing drunk driving                                              |
|                     | 2. More rigidity in driving licensing                                     |
|                     | 3. Appropriate penalties for violation of the regulations                 |
|                     | 4. Making a leader and steward organization with sufficient facilities and authorities |
| Education           | 1. Public education by mass media such as TV                               |
|                     | 2. Specific education at schools                                          |
| Increasing equipment | 1. Increasing public transportation                                       |
|                     | 2. Increasing the human resources for prevention of the RTIs             |
|                     | 3. Providing sufficient support and finance                               |
|                     | 4. Use of new safety tools (intelligent road cameras, driver control cameras, …) |
|                     | 5. Strengthening pre-hospital EMS                                         |
| Scientific solutions | 1. Effective long-term planning                                           |
|                     | 2. Implementing effective and in-time registration, reporting system, and applicable researches |
CONSENT TO PARTICIPATE

Not applicable.

AUTHOR’S CONTRIBUTIONS

SAA designed the project, collected data, analyzed the data, drafted the first version of the manuscript and revised the manuscript. The author(s) read and approved the final manuscript.

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AVAILABILITY OF DATA AND MATERIALS

Supplementary files are available in the journal website.

ETHICS APPROVAL

The study was approved by the Ethics Committees of the Institute of Tabriz University of Medical Sciences (IR.TBZMED.VCR.REC.1397:455).

CONSENT FOR PUBLICATION

Not applicable.

COMPETING INTERESTS

The authors declare that there is no conflict of interests.

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