

Assessing and Improving Fitness to Drive in the Elderly People: a Scoping Review of Policies and Guidelines

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Abstract

Background: Several countries in the world have distinct policies and frameworks to assessment and promote fitness to drive in the elderly. Accordingly, this study has been conducted to analyze the processes, models, and policies to assessment fitness to drive and improving driving in the elderly in the world.

Method: Expected data were collected using keywords older, old, elderly, aging, ageing, senior, polic*, process, programme, plan, guideline, framework, driving capacity, driving eligibility, safe drive, fitness to drive, renewal driving license, commercial driver, driving qualification, driving ability, driving evaluation, driving assessment and their Persian equivalents from various English-language databases included: PubMed, Web of Science, Scopus, Embase, and Persian-language databases Included: IranDoc, SID, and Magran. In this study, the Arkesy and O'Malley frameworks were employed.

Results: Eventually, 24 papers and reports were included in the study. Vision assessment was the main item to judge the fitness to drive in the elderly, followed by driving assessment, cognitive assessment, and motor assessment. The in-person, postal, and online renewal of license were the most common method of renewal. General practitioners were the principal performers to measure driving fitness. In most all reports and papers, there were policies on empowering the elderly driver, including providing safe driving tips, optional driving skills tests, holding retraining courses, and so on. The most significant supporting policies included introducing alternative transportation to preserve the independence of the elderly. This study explained that clinical assessment is normally performed in drivers older than 75 years old to diagnose disorders and treat and prevent them in distinct time periods.

Conclusion: Most high-income countries have worthwhile experience in measuring and improving the fitness to drive in the elderly and enforce different laws according to environmental, social, and political conditions. Utilizing these experiences by considering economic and social differences can be useful and practical for middle and low-income countries.

Introduction

According to statistics provided by the World Health Organization, Road Traffic Injuries (RTIs) cause more than 1.35 million deaths annually, and more than 50 million people are injured, which investigations explain that this figure is quickly increasing [1]. RTIs require most countries to spend as much as 3% of their gross domestic product. Statistics explain that 93% of RTIs casualties happen in low and middle-income countries, while these countries have only 60% of the world's vehicles [2]. RTIs cause a high rate of death and injury among all age groups [3–5]. The elderly is one of the most high-risk groups in terms of accidents and injuries. Injuries caused by accidents in the elderly are increased due to reducing the abilities and degeneration of body systems [6, 7]. Older drivers with 65 years old and older allocate 16% of all road accidents and 25% of road casualties to themselves [8]. Evidence reveals that the risk of an accident is higher in the elderly with dementia; also, the risk of accidents in the elderly with Alzheimer's

disease increases 8 times [9]. RTIs have the highest frequency, mortality, and decrease of DALY amongst the elderly among all accidents [10, 11]. Studies explain that more than 35% of accidents in the elderly referred to hospitals are correlated to RTIs [12]. Accidents and events are the fifth principal cause of death in people older than 65 years old, and these people are hospitalized more prolonged so that studies determine that the frequency of the accidents among the elderly includes a high percentage of total costs of hospitals [10, 13–15].

Driving in the elderly can be an efficient factor in keeping their personal independence and mental health [16]. The number of older drivers is increased by growing the world's elderly population so that it is expected that one in five drivers in the United States to be 65 or older by 2030 [16]. Studies explain that more than 51% of traffic accidents in people older than 65 years old are caused by a crash between two vehicles. Furthermore, there is a significant relationship between the experience of traffic accidents and the elderly [17]. Elderly drivers in the United States included 18% of all drivers with licenses, 13% of all drivers involved in traffic accidents resulted in death, and 17% of all drivers killed by RTIs in 2015 [18].

Different countries in the world implement policies and frameworks to assess the eligibility and fitness of the elderly to drive. In the United States, each state owns a specific framework and policy to renew the order's driving license; The state of California, for example, makes the driving knowledge test mandatory for people older than the age of 75, which is mandatory for all drivers older than the age of 70 in Indiana. Currently, all older drivers who have a certain age are required to renew their driver's license at shorter intervals compared to younger drivers in 19 US states [19]. The Driving and Vehicle Licensing Agency (DVLA), which is responsible for assessing the driver's fitness to drive, revoke the license of all persons older than the age of 70 according to law, which is renewed for three years at the request of the elderly and with the condition of having legal requirements [20]. Also, private vehicle drivers are obligated to take a vision test once every 10 years before the age of 45, and then every five years until the age of 75 and consequently, annually in New South Wales, Australia [21].

There is no specific and comprehensive framework or guideline for assessing and improving fitness to drive in the elderly in many countries, mainly in Low and Middle-Income Countries (LMICs) and there is no special attention to the physical, mental, and other specific conditions of the elderly, which can not only cause to increase the RTIs in these people but also can jeopardize physical and mental health and lack of independence in this age group. Consequently, policymakers and officials can perform a scoping review of policies and programs in distinctive countries to achieve comprehensive and practical information for designing programs in countries that do not have such programs. Hence, this study was conducted to identify the processes, models, and policies for assessing and improving fitness to drive in the elderly.

Materials And Methods

The Arkesy and O'Malley frameworks were used in this study, which was introduced as one of the most comprehensive and first frameworks for conducting scoping review studies in 2005. This framework includes six steps: Identification of the research question, Identification of relevant studies, Study

Screening, Data charting, Data analysis and reporting the results and Consultation exercise [22]. This article does not have a review protocol.

Stage 1: Identification of research question

The main research question of this study is as follows:

"How are the experiences and policies to assessment and improve the driving fitness in the elderly in various countries?"

This specifically includes the following cases:

- 1- What are the general specifications (time of issue, issuer country, target group, and age basis for suspension of driver's license or the beginning of driving fitness assessment courses for the elderly in different countries) and published studies or reports?
2. What are the items of judgment on driving fitness (such as physical, vision, mental health condition, etc.) in the applicants to renewal the elderly driver's license?
- 3- What are the License renewal policies (license renewal process, renewal fee, renewal reminder method, etc.) of the elderly driver in various countries?
- 4- What institutions or individuals are responsible for implementing the process of renewing the license of elderly drivers in different countries?
5. What empowerment policies are for older drivers in different countries?
6. What are the protection policies for the elderly deprived of driving?
7. What treatment and prevention policies do different countries implement for older drivers?

Inclusion and Exclusion Criteria

At least one aspect of driving eligibility in the elderly was mentioned in the inclusion criteria. Exclusion criteria also include all reports and studies that were not in English and Persian, or papers and reports conducted on driving eligibility in other population groups, or papers and reports in the field of driving eligibility for certain vehicles such as trains, city trains (subways), agricultural vehicles such as tractor, and so on.

Stage 2 Identification of relevant studies

The required data were collected using the keywords older, old, elderly, aging, ageing, senior, polic*, process, programme, plan, guideline, framework, driving capacity, driving eligibility, safe drive, fitness to drive, renewal driving license, commercial driver, driving qualification, driving ability, driving evaluation, driving assessment from databases PubMed, Web of Science, Scopus, Embase, and Persian-language

databases Included: IranDoc, SID, and MagIran (**additional file 1: search strategies in databases**). The last search to identify new papers was conducted on December 4, 2020.

Databases of European Association for Grey Literature Exploitation (EAGLE) and Health Care Management Information Consortium, (HMIC) SIGLE (System for information on Grey, Literature in Europe) were also searched for Gray literature.

After excluding the papers that had an inadequate relationship with the objectives of the study and selecting the main papers, the papers available in the source list of the selected papers were searched again to improve the assurance of identification and review. citations check was also checked for selected papers through Google Scholar. More searches were performed through the Google search engine. Also traffic accidents experts were additionally contacted.

Stage 3: Screening Studies

All stages related to select and screen the papers were performed by two members of the research team independently. Disagreements were resolved through discussion, and, if necessary, disagreements were referred to a third party who had more information and experience. The titles of all papers and documents were first examined, and papers that were not in agreement with the objectives of the study were excluded from the research. In the next stages, the abstract and the full text of the papers were studied, respectively, to identify and exclude the studies that included exclusion criteria and had an inadequate relationship with the study's objectives. Endnote X5 resource management software was utilized to organize, study titles and abstracts, and also identify the repetitive cases. PRISMA flowchart [23–25] was employed to report the selection and screening process results.

Stage 4: Data charting

7 data extraction forms were designed in Word 2010 software with two team members' participation to extract the data. Form 1 includes general information about the included studies, such as country and state, study name, author or publishing organization, type of study, year of publication, the distinction between professional and non-professional drivers, objective study group, study format, and basic age for older drivers.

Form 2 included the items to judge the eligibility related to a driver's license renewal application for the elderly, such as physical, mental, driving history, and other items for judging a driver's qualification. Form 3 owns two main sections: renewal policies and suspension policies; renewal policies include license renewal process, license validity period, license renewal policies, policies for achieving a license renewal fee, time, and manner of reminding to renewal the license. Form No. 4 includes individuals and organizations involved in the process of renewing the elder's license, which has made of three sections: policy-maker, administrator, and executors of the process and their duties. Form No.5 includes policies for the empowerment of older drivers, which include four sections: class education, road tests, providing safe driving points, and other information. Form No. 6 is a protection policy for elderly drivers deprived of driving, which has been classified into four parts: introducing alternative transportation, introducing

alternative jobs, psychological support and follow-up, and other policies. Form No.7 also includes treatment and preventive policies, maintain and promote the health of older drivers. Team members reviewed and edited data extraction forms after design. The information was extracted by two members independently from the selected papers, and the uncertainties were resolved in consultation with other members of the research team.

Stage 5: Data analysis and reporting the results

The Content Analysis method manually analyzed, summarized, and reported the extracted information after extracting the information by the data extraction form. The content analysis identifies, analyzes, and reports themes within the text and is widely applied in qualitative data analysis [26–29]. The data were encoded by two researchers independently. The stages of data analysis and coding were as follows:

Awareness of the text of papers (immersion in the results of papers), identifying and extracting fundamental fields (identifying and extracting papers more related to fundamental fields), inserting papers in the specified fields, reviewing and completing the results of each fields utilizing the results of papers in each field and ensuring the reliability of fields and results extracted in each field (achieving an agreement between the two coders through discussion and resolving the disagreements).

Stage 6: Consultation exercise

Guidelines and recommendations were presented in the form of paper discussion and suggestions after extracting and reporting the results based on the extracted results and the research team members' opinions.

Results

439 studies were removed in examining the title and abstract among 675 guides, papers, and instructions extracted from databases and manual text search, and after removing repeated cases. Additionally, 150 studies were excluded from the full literature review, which ultimately, 24 documents were included in the study (one Australian study that has been divided into 9 studies by each state) (Figure 1).

General characteristics of studies

Studies included were 7 were papers and 17 instructions. The period of publication of the included studies was between 2003 and 2020 and the middle year of publication of the studies was 2016. The study was conducted in six countries, all of them were high-income countries, and Australia had the most studies (10 studies). Among the 24 included studies 16 studies did not distinguish between professional and non-professional drivers (**Table 1: specifications related to measuring and improving driving skills in the elderly**) (**additional file2: general specifications of studies**).

Baseline age to assessment fitness to drive in the elderly

Most studies (13 cases) did not mention the baseline age of elderly drivers. Among the studies that referred to the baseline age of elderly drivers, the highest frequency was 70 years old (4 studies). A study conducted in the USA explained that the baseline age differs from state to state, ranging from 65 to 80 years [21]. According to the increase in life expectancy in Canada to over 80 years, the baseline age for renewing the driving license of the elderly has been considered 80 years in this country [30] (**additional file 3: base ages for vision assessment, driving assessment and clinical assessment of elderly drivers in Australia by state**).

Judgment items in assessment fitness to drive in the elderly

20 studies referred to physical items, 10 studies referred to driving assessment and history, 5 studies to psychological items, and 4 studies to other judgment items on driving fitness in the elderly among 24 studies included. Judgment items on elderly driving fitness were classified into 5 groups (Figure 2).

Vision test was the main item of judgment about the eligibility of elderly drivers, as 75% of the studies mentioned it. Most USA states have a vision test, regardless of age at the time of renewing the driving license, while the vision test is compulsory only for older drivers in other states [19]. In the USA, the AARP/American Association of Retired Person self-assessment handbook is prepared for the elderly, which is a combination of hand and foot tests as well as self-administrate tests such as the Trail Making Test (TMT). This tool enables the possibility of self-assessment of reaction time, attention, vision, near miss experiences, and driving behavior. The new modified tool called Driving Decision Workbook also provides medical status and medication use, as well as more details on driving issues in addition to assessing vision, cognition, reaction time, accidents, and traffic conditions [31].

Policies to renewal and suspend driving licenses for the elderly

8 studies in the United States, Ireland, Australia, New Zealand, and Canada referred to the process of renewing an older driver's license among the 24 included studies [8, 21, 30, 32-36]. Two studies referred to complete the driver's license renewal application form as the first stage in the renewal process [32, 34]. Two studies [21, 36] referred to complete the self-declaration (self-assessment), and 4 studies [8, 21, 32, 33] referred to the medical assessment and receiving a medical certificate. Furthermore, 3 studies [8, 32, 36] referred to the examination of elderly driving before the renewal of the license by driving assessment specialists, and also one study [30] referred to the examination of the elderly's driving history as part of the process of renewing the driving license. 3 studies mentioned that the patient referred to a driving rehabilitation specialist if necessary [8, 32, 33]. If the patient has a mild to moderate medical condition, the physician should refer the person to a driving rehabilitation specialist for rehabilitation and return to safe driving. There is a need to follow and monitor the elderly condition to prevent and manage medical

conditions that cause sudden disqualification in the elderly, as well as to prevent psychological damages, but only one study referred to follow the elderly conditions after renewing the license [8].

Different countries have various processes for screening and identifying unsafe older drivers at the time of renewing their licenses. For example, there is a three-stage process for identifying, assessing, referring, or revoking in the United States. At the stage of identifying all elderly drivers in terms of medical risks, medicine risks, drug and alcohol abuse, acute events and driving concerns, and if a disorder is distinguished, the person is referred to the CDRS(Certified Driver Rehabilitation Specialists) or DRS(Driver Rehabilitation Specialists) in the presence of mild or moderate disorders for further assessment of vision, neuromuscular function, and cognitive impairments , and the driver's license is canceled and the person is restricted from driving in the presence of severe, uncontrollable and irreversible disorders [33]. In Australia, drivers in most states are obligated to offer a medical self-report on driving fitness when renewing or obtaining a license. This information may be directed to a medical assessment or nonrenewing the license. Each state has specific requirements for a medical or driving test before renewing the license according to the age and type of vehicle [21].

Face-to-face renewal with 5 cases [19, 21, 33, 36, 37] is the most prevalent method of renewing the license in the elderly among the methods to renewing the license in the elderly, and the postal [19, 34, 37] and Online methods [34, 36] with 3 and 2, respectively, are other methods of renewing the license in the elderly. All three methods are common in some countries; elderly people with diseases must renewing their driver's license in person and after a clinical assessment (**Table 2: driver license renewal method in the elderly and its validity period in included studies**).

However, if the person does not have a specific illness, he/she can renewing his / her license in absentia (by mail or online) [37] .

Among the studies included, 18 studies did not mention the validity period of the elderly driver's license, the validity period was 4 years in two studies, 2 years in one study, 3 years in one study, the average validity period of the license in the various states was 4.4 and 5 years in a study at the ages of 75 and 80 and then two years [32] .

5 studies referred to the policies for getting a license renewal fee and other related costs such as driving test fees [21, 30, 33, 34, 38]. In the United States, driving assessment are not frequently covered by insurance, and patients have to pay out-of-pocket for rehabilitation services from \$ 200 to \$ 400 for assessment and \$ 100 per hour for rehabilitation [33] . In Northern Ireland, if you apply for a renewal of your license more than two months before the expiration of your current license, you will not be charged any fees for renewing your expired license [34] .

3 studies referred to time and manner of reminding to renew the driver's license in the elderly [34, 36, 37] . In Northern Ireland, about two months before the expiration of the current license, the DVA sends an extension notice to the elderly driver (DLR1) [34] .

7 studies referred to various types of driving suspension policies in the elderly [8, 21, 33-37]. In Australia, it is advised to the person to avoid driving for a period of time depending on the type and severity of the disease or medical condition, for example, if a person experiences anesthesia, depending on the opinion of experts, he/she should avoid driving until their physical and mental condition is not compatible with safe driving. In the case of more moderate surgeries or the use of short-term anesthetics, the patient may be able to drive after a night's sleep. The patient may not be safe to drive for at least 24 hours in the case of longer surgeries with general anesthesia. Medical professionals should determine the period without driving after surgery, and a practical assessment of the individual driving may be useful in determining driving eligibility [21]. In Northern Ireland, if an elderly driver suffers from cataracts, but his/her vision is adequate for driving, she/he should avoid driving at night and also in intense sunlight [34].

Trustees and executors of the process of renewing the driver's license in the elderly

7 studies introduced a general practitioner, 7 studies a specialist, 3 studies a driving assessor, and 3 ones referred to the drivers themselves as executors and participants among the 24 studies in the process of renewing a driver's license in the elderly (Figure 3).

4 studies referred to the policymaker of the process of renewing the driver's license in the elderly [19, 21, 34, 37]. In the United States, several jurisdictions in the United States and abroad attempt to remove the risks related to elderly driving through laws and policies related to driving and renewing the licenses [19]. In Northern Ireland, the DVA organization regulates the process to renew the license for the elderly [34]. In Australia, Austroad and the National Transport Commission (NTC) organizations are responsible for policy-making [21]. In another study, the Department of Planning, Transport, and Infrastructure has been identified as a major policymaker in Australia [37].

Empowerment policies for elderly drivers

13 studies referred to the road tests as part of the driver's license renewal process among the 24 included studies. 5 studies consider it necessary to provide safe driving tips for empowering older drivers [8, 31, 34, 36, 38]. Also, 5 studies referred to classroom training as a tool for empowering the elderly driver [9, 30, 31, 36, 37] (**Table 3: types of empowerment policies in included studies**).

Supportive policies for elderly deprived of driving

9 studies included supportive policies for the elderly deprived of driving [8, 9, 21, 31, 33, 34, 36-38]. The main supportive policy was to introduce alternative transportation to the elderly, which was mentioned in 7 studies [8, 9, 33, 34, 36-38]. One of the main reasons for the requirement of the elderly has been named to drive, prepare food and purchase items, in this regard, in the UK, the elderly can pay for a fixed monthly

payment and use the (All-you-can-eat) service for in absentia food ordering. Transportation in London for the elderly, there are specific discounts on rail transport on the oyster card. It is also suggested to encourage the pilot implementation of alternative transportation options such as the use of self-driving vehicles by the government [9]. In Australia, a card is issued to an elderly person who is deprived of driving that he or she can use public transport for free at certain times using that card [39]. North East Driver Mobility organization has been created in the UK in order to help people maintain their independence as a driver or passenger. This organization provides the following services:

- Assess driving ability.
- Counseling on vehicle compatibility.
- Counseling on how to get in and out of the vehicle and maintain a wheelchair.
- Specialized driving instruction.
- Informing and counseling on alternatives to car use, such as transportation services in the community.

Treatment, prevention, maintaining and improving health policies

16 studies referred to the policies to treatment, prevent, maintain, and improve the health of older drivers through screening, clinical assessment, and general performance assessment. In different Australian states, for example, there are special conditions for clinical assessment for various types of driver's licenses, that older drivers after a certain age must pass a clinical assessment at pre-determined intervals to renew their license [21]. In the UK, an elderly person may be contested if he/she has a specific medical condition that was not reported and may affect a person's safe driving and cause a vehicle accident. In this case, insurance may even refuse to cover the elderly person [34]. In the United States, physicians have advised that physicians help their elderly patients maintain safe mobility in two methods. Physicians provide effective treatment and preventive health care and play a role in determining the elderly's capacity to drive securely. In many cases, physicians can keep patients on the road for longer period by identifying and managing diseases such as cataracts and arthritis or by stopping tranquilize medication. Improving cardiovascular and bone health can also reduce serious injuries and increase recovery in an accident [8]. A practical driver assessment may indicate a person's necessary to participate in a rehabilitation or retraining program in Australia. This course is set based on practical driver assessment results and may use for vehicle correction training or instruction to improve driving confidence. At the end of the course, the patient's driving skills may be reassessment, and a report sent to the driving license authority [21].

Due to the limited number of words in the main text of the article, some of the findings of the study in the form of mega data are presented in additional file 4.

Discussion

The results of 24 studies (papers and guides) on the subject of assessing fitness to drive in the elderly were extracted. The results reveal that studies conducted in this field do not have much history, and researchers and policymakers have paid attention to this issue with delay. While traffic accidents and aging are not new issues, assessing fitness to drive of the elderly person has been considered more in recent years. One of the reasons for this issue is the exponential increase of the elderly population in the world, particularly in high-income countries. So it is estimated that by 2030, one in five drivers in the United States will be elderly [16]. Another reason to consider this issue is the increasing statistics of the number of deaths in traffic accidents in all age groups and particularly among the elderly so that studies have revealed a significant relationship between the phenomenon of traffic accidents and the elderly [17]. Professional and non-professional elderly drivers were not distinguished in most of the included studies. According to the difference in conditions and hazards between professional and non-professional drivers, it is more satisfying to assess the driving fitness of professional drivers more carefully because these people drive longer and on intercity roads, also, driving with public transport or vehicles carrying dangerous goods is very sensible and has a high risk for the driver and other traffic users.

All studies related to high-income countries (such as the United States, Canada, Australia, New Zealand, the United Kingdom, and Northern Ireland). One of the reasons these countries pay attention to assessing the driving fitness of the elderly can be the economic and social situation of these countries. Additionally, life expectancy in these countries has been increased due to the high level of health and healthy lifestyle in high-income countries and was resulted in an increase in the number of the elderly population, which requires more attention to the specific requirements and conditions of this age group. The experiences mentioned in this study have less generalizability for middle-income countries, but these countries can utilize the experiences of the included studies to set and implement a proper framework relevant to their socio-economic conditions.

According to the results of the studies, there is no agreement on the base age for older drivers, and the base age covers the range of 65 to 85 years. It looks that the approach of determining the base age is not a proper approach for elderly drivers, and it is more satisfying to use a systemic approach to identify high-risk elderly drivers. The elderly may have various health conditions according to differences in their hereditary status and lifestyle; consequently, setting age 65 would increase costs, and older age would increase the risk of not identifying high-risk elderly drivers. It is recommended that an age range be considered, and within this range, high-risk drivers to be identified on a case-by-case and systematic base. In this view, it is recommended that a family physician assess the health of the elderly periodically. Elderly self-declaration and concern expressed by the elderly family or friends should also be considered a worthwhile source of information. Notwithstanding, it is recommended to use a combined approach due to the various conditions of the young people, the elderly, and old people to renew the driving license. Therefore, it is recommended to renew the license along with accurate driving and medical assessment at the ages of 65, 70, 75, 80, 82, 84, 86, 88, 90, and annually after the age of 90.

Few studies referred to the history and assessment of driving and psychiatric items. Both groups of judgment items are very significant and can influence a person's safe driving. The influence of one medical condition or multiple medical conditions on a person's driving is not perpetually apparent; therefore, a practical assessment of the driver may be effective. Driving assessment are performed to create an opportunity to maintain and improve drivers' confidence, learn tips and tricks, and identify new technologies in vehicles. Some elderly people may select driving as a second career for livelihood due to approaching retirement age and feeling lonely and depressed due to unemployment and increasing costs (the costs related to health, food, services, etc.), particularly in low and middle-income countries. It is more beneficial that governments satisfy the costs of the renewal process to protect the elderly, and also provide rehabilitation and treatment services in the case of special medical conditions and impose restrictions in driving (temporarily or in special circumstances such as night driving, driving on the highway, etc.) to support the employment of this group of elderly people instead of being lastingly suspended.

The main item of judgment in the physical part was the vision assessment. Nonetheless, the results of some papers do not consider the visual acuity assessment alone sufficient because they do not measure peripheral vision (field of vision). Two studies have analyzed US data from 1980 and concluded that compulsory visibility testing is associated with a reduction in deadly accidents [40]. A recent study explained that standard vision assessment might not exhibit driving risk effectively. Surprisingly, it was revealed that visual acuity has a very inadequate correlation with driver safety at best condition; consequently, it is not a reliable indicator of the possibility of involvement in future accidents [9]. Despite the highly significant items such as medicine take, reaction time, attention (selective and divided attention), judgment, decision-making, flexibility, and muscle traction in driving safety, fewer studies have discussed these issues. It is recommended that assessment be comprehensive due to the being multifaceted driving skills, for example, the peripheral field of view, and assessment visual disorders such as cataracts, severe sunlight sensitivity, and in addition to evaluating visual acuity. Assessment of cognitive impairment is also a very important item in assessing the fitness to drive of the elderly driver and items such as attention, focus, reaction time, decision-making power, memory, and so on should be evaluated through various methods such as self-assessment (self-regulated tests such as TMT and drawing the clock) by a physician or the use of driving simulators.

7 studies referred to the process of renewing the driver's license for the elderly people that policymakers can develop a localized process according to the conditions of their country. Different licensing renewing processes are utilized in older drivers in different countries depending on the structure and social and economic conditions. Considering the mental and physical condition of this age group, it is more satisfying to utilize a simple process without repetitions and unnecessary bureaucracies; at the same time, the renewal process must have high accuracy and credibility in screening and identifying unsafe drivers due to the high sensitivity of driving safety for the elderly and more broadly, for the complete society. It is additionally more beneficial for the executors of this process (physicians, driving evaluation specialists, etc.) to trade-off in mild or moderate medical conditions in favor of the mental health and independence of the elderly.

According to the information of the included studies, face-to-face renewal is the most prevalent way to renew a driver's license in the elderly. The results of a study have shown that the compulsory renewal of a license decreases the number of fatal traffic accidents in drivers older than the age of 85 by 28% [19]. It looks that the face-to-face method is the most suitable way to renew a driver's license for the elderly older than 85 years old. Notwithstanding, it is more satisfying for authorities who issue the license to consider an online and efficient program to renew the driver's license for elderly drivers aged 65 to 85 years old with a clean driving record, along with the presentation of a clinical assessment license by a physician, for the convenience of the elderly and cost reduction. It is more satisfying to utilize process managers with different specialties due to the sensitivity and multifaceted nature of the issue of assessing driving fitness in the elderly. recommended that the physician not start the elderly assessment to concentrate more on identifying the patient's physical or cognitive disorders and allocate this task to a trained driving evaluator [9]. Consequently, it is more satisfying to utilize various specialties (such as specialists, dentists, physiotherapists, surgeons, optometrists, and other specialists along with the driver and his/her family) in the process of assessing the driving fitness of the elderly. Notwithstanding, it is more beneficial for the policymaker and trustee to implement this process to be a single institution or organization with sufficient authority and resources to maintain consistency and continuity in assessing the driving fitness of the elderly.

Only 9 studies among the included studies referred to protective policies for elderly drivers, especially elderly drivers deprived of driving that need more attention to this issue that needs more attention to this issue. Because elders normally plan their place of residence and shopping, considering they continue to drive, many psychological and social problems can be generated for them if they are deprived of driving. Accordingly, proper empowerment policies should be available for elders in addition to the controls for identifying unsafe drivers with physical, mental, and psychological disorders so that the elders experience the most extended period of safe driving. This will make the elders have a better quality of life and a sense of personal independence. Consequently, it is more satisfying that empowerment policies for older drivers are prior to temporary or permanent suspension of driving. Governments also require to plan to support older professional drivers' livelihoods by implementing policies such as providing them with alternative employment, retirement, and a pension, or providing them with free social security insurance.

It is most beneficial to raise issues related to these disorders' potential effects on independent personal mobility in the early stages of the disease management process for some advanced medical conditions, such as dementia or MS. Because, people often make decisions about employment, place of residency, and recreational and social activities based on the assumption of continued access to cars in a lively society, it is recommended that if a person suffers from these progressive complications, he or she be aware of possible driving limitations in the future. It is significant to give the patient as much time as possible so that she/he can change his/her lifestyle. Taking help from an occupational therapist may be applicable in these cases [21]. Countries such as the United States, Australia, and New Zealand have valuable experience in road design for elders, which can be a standard example for other countries, but what is helpful in road design for the elders can be useful for everyone [9].

There was treatment, prevention, maintenance, and promotion of health in most of the studies by performing health assessments and screenings, and in this case, high-income countries have very worthwhile experiences. It is most satisfying to start preventive policies and health maintenance policies at ages before the aging so that the elderly can continue to drive for longer periods of time. This will reduce treatment costs and increase the quality of life of the elderly.

According to the results of examining the texts and experiences of researchers, this study comprehensively summarizes and analyzes the information and evidence in the field of experiences and policies to assess and improve driving fitness in the elderly for the first time and provides comprehensive and practical information for readers and decision-makers. However, it encountered several limitations in this study; one of the most important cases is limited access to countries' information and experiences. A possible reason for this could be the non-publication of countries' programs and policies or publishing them in local languages (other than English).

Conclusion

Information and evidence in the field of experiences and policies to assess and improve driving fitness in the elderly were summarized and analyzed in this study by utilizing a scoping review. Comprehensive and beneficial information in various fields was presented for readers and decision-makers. The results revealed that most high-income countries have worthy experiences and policies in estimating and improving the driving fitness of the elderly and design and execute different laws according to environmental, social, and political conditions. Applying these experiences regarding economic and social inequalities can be useful for middle and low-income countries.

Declarations

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Consent for publication

Not applicable.

Availability of data and materials

Datasets are available through the corresponding author upon request.

Declaration of interests

No competing interests were disclosed.

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Authors' contribution

Developing the study design: SM, SA.

Study selection: SM, SA, MS, BK.

Data analyze and report: SM, SA, MS, BK.

All authors read and approved the final draft of the manuscript.

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Tables

Table 1: Specifications related to measuring and improving driving skills in the elderly (number = 24)					
2 (8.3%)	65 years old	Base Age for Elderly Drivers (24)	10 (41.6%)	Australia	Countries Conducting Studies (24)
4 (16.6%)	years old		7 (29.1%)	USA	
3 (12.5%)	75 years old		3 (12.5%)	Canada	
3 (12.5%)	80 years old		2 (8.3%)	England	
12 (50%)	No mention to base age		2 (8.3%)	New Zealand	
13 (54.1%)	Public	Target Group of Studies (24)	1 (4.1%)	Northern Ireland	Report Type (24)
9 (37.5%)	Clinical and driving specialists		9 (37.5%)	Divided into professional and non-professional drivers	
2 (8.3%)	Both		15 (62.5%)	Not divided into professional and non-professional drivers	

Table 2: Driver license renewal method in the elderly and its validity period in included studies

Country / State (reference number)	Driver license renewal method			Driver license validity period			
	Face to face	Online	Mail	2 years	3 years	4 years	Variable *
USA / all states (19).	■	□	■	□	□	□	□
Northern Ireland (34).	□	■	■	□	■	□	□
Australia / South Australia (37).	■	□	■	□	□	□	□
Australia / all states (21).	■	□	□	□	□	□	□
USA/ Portland (33).	■	□	□	□	□	□	□
USA/ Kentucky (35).	□	□	□	□	□	■	□
New Zealand (32).	□	□	□	□	□	□	■
Canada / Ontario (30).	□	□	□	■	□	□	□
USA / Michigan (36).	■	■	□	□	□	■	□

* At the ages of 75 and 80 and every two years thereafter
 **Uninformed studies were excluded from this table.

Table 3: Types of empowerment policies in included studies

Country / State (reference number)	Road test	Provide safe driving tips	classroom training
USA / all states (19).	■	□	□
Northern Ireland (34).	■	■	□
England(38).	■	■	□
England(9).	□	□	■
USA / Michigan (31).	■	■	■
Australia / South Australia (37).	□	□	■
Australia / Capital (39).	■	□	□
Australia / New South Wales (40).	■	□	□
Australia / Northern Territory (41).	■	□	□
Australia / Queensland(42).	■	□	□
Australia / South Australia (43).	■	□	□
Australia / Tasmania (44).	■	□	□
Australia / Victoria (45).	■	□	□
Australia / Western Australia (46).	■	□	□
USA / all states (8).	■	■	□
Canada(30).	□	□	■
USA / Michigan (36).	□	■	■

* Uninformed studies were excluded from this table.

Figures

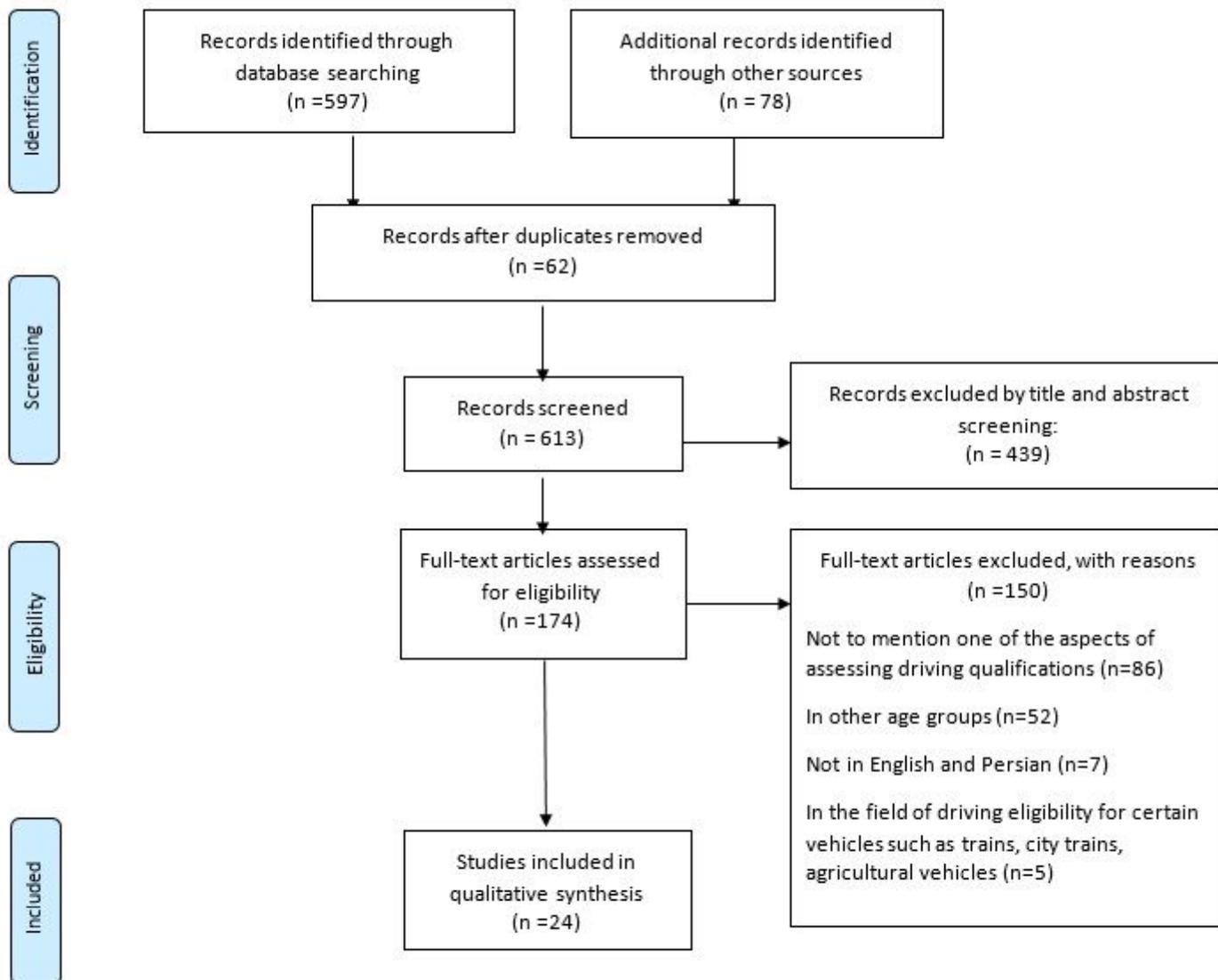


Figure 1

PRISMA 2009 Flow Diagram

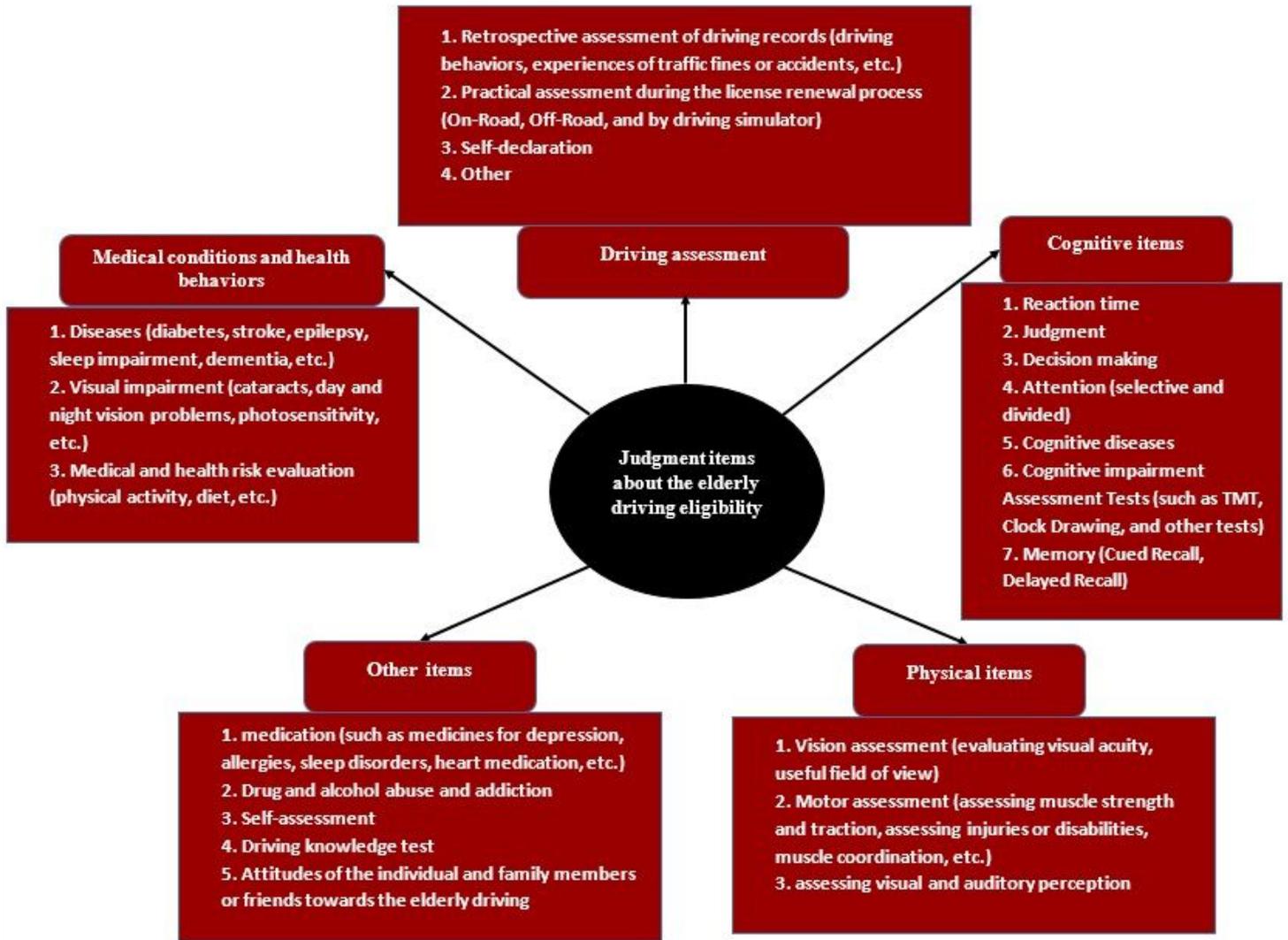


Figure 2

Judgement items in assessment fitness to drive in the elderly

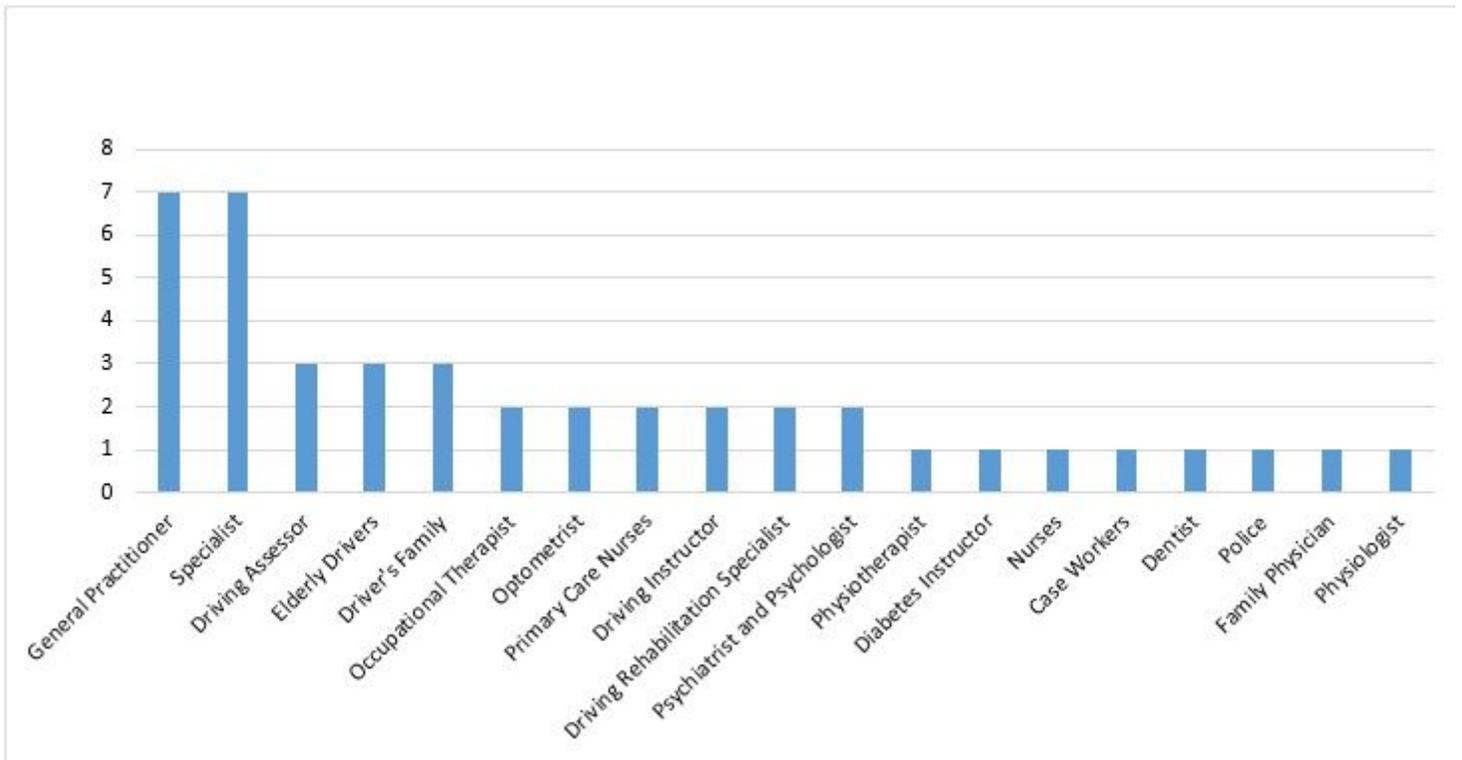


Figure 3

Frequency of executors in the process of remaining the certificate of the elderly

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