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

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Abstract

Background: This study has been conducted to analyze the processes, models, and policies to assess fitness to drive and improving driving in the elderly in the world.

Methods: The Arkesy and O'Malley frameworks were employed. Articles with at least one aspect of driving eligibility in the elderly were included. Expected data were collected using appropriate keywords from PubMed, Web of Science, Scopus, Embase, IranDoc, SID, and MagIran. Data were analyzed using the Content Analysis method.

Results: Out of 675 records, 24 papers and reports were included in the study that all of them were High-Income Countries (HICs). Among the studies that referred to the baseline age, the highest frequency was 70 yr old (4 studies). Vision assessment was the main item to judge driving fitness (mentioned in 75% of the studies). The in-person (5 studies) was the most common method of renewal. General practitioners were the principal performers to measure driving fitness (7 studies). Thirteen studies referred to the road tests as part of the driver's license renewal process. 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, etc. The most frequently supporting policies included introducing alternative transportation.

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

Keywords: Assessment; Elderly; Prevention; Fitness to drive; Road traffic injuries

Introduction

According to statistics provided by the WHO, 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). Statistics explain that 93% of RTIs casualties happen in Low and Middle-Income Countries (LMICs), 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 allocate 16% of all road accidents and 25% of road casualties to themselves (8). In Iran, the majority of road traffic crash (RTCs) victims were 21 to 30 yr old and the elderly were over 65 yr old (5). 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). In Iran, the rate of hospitalization of the elderly due to traffic accidents is increasing (5). More than 35% of accidents in the elderly referred to hospitals are correlated to RTIs (12). Accidents are the fifth principal cause of death in elderly people (10, 13-15).

Different countries in the world implement policies and frameworks to assess the fitness of the elderly to drive. In the United States, each state owns a specific framework and policy to renewal 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 (16). Moreover, 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 (17).

Although many High-Income Countries (HICs) have specific policies and programs to assessing and improving fitness to drive in the elderly people, in many LMICs such programs and policies have not been heeded. The existence of such programs can improve the driving safety of the elderly and prevent the occurrence of RTIs. Using the experience and information available in different countries to formulate such programs and policies is essential.

We aimed to identify and review models and policies to improve driving skills in the elderly to help policymakers to design a framework for measuring the driving fitness of 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 (18).

Stage 1: Identification of research question
The main research question of this study is as follows:

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

This specifically includes the following cases:

1- What are the general specifications and published studies or reports?

2. What are the items of judgment on driving fitness in the applicants to renewal the elderly driver's license?

3- What are the License renewal policies 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 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, aging, 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. The last search to identify new papers was conducted on Dec 4, 2020.

Citation check (Check the references list of retrieved articles to ensure that articles are not lost) and Gray literature (evidence and documents that are not accessible by searching databases and other commercial publications) were done. Citations check was also checked for selected papers through Google Scholar. Moreover, 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 identify the repetitive cases. PRISMA flowchart (an international statement and guide to conducting and reporting the high-quality systematic reviews and meta-analyses)

(19-21) was employed to report the selection and screening process results.

Stage 4: Data charting

Seven data extraction forms were designed. Form 1 includes general information about the included studies. Form 2 included the items to judge the eligibility related to a driver's license renewal application for the elderly. Form 3 owns two main sections: renewal policies and suspension policies. Form No. 4 includes individuals and organizations involved in the process of renewing the elder's license. Form No.5 includes policies for the empowerment of older drivers. Form No. 6 include a protection policy for elderly drivers deprived of driving. Form No.7 also includes treatment and preventive policies, maintain and promote the health of older drivers. 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 (22-25). The data were encoded by two researchers independently.

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

Overall, 439 studies were removed in examining the title and abstract among 675 guides, papers, and instructions extracted from databases and manual text search, includes 597 articles from

English databases, 0 articles from Persian databases, and 78 articles and reports from other sources 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) (Fig. 1).
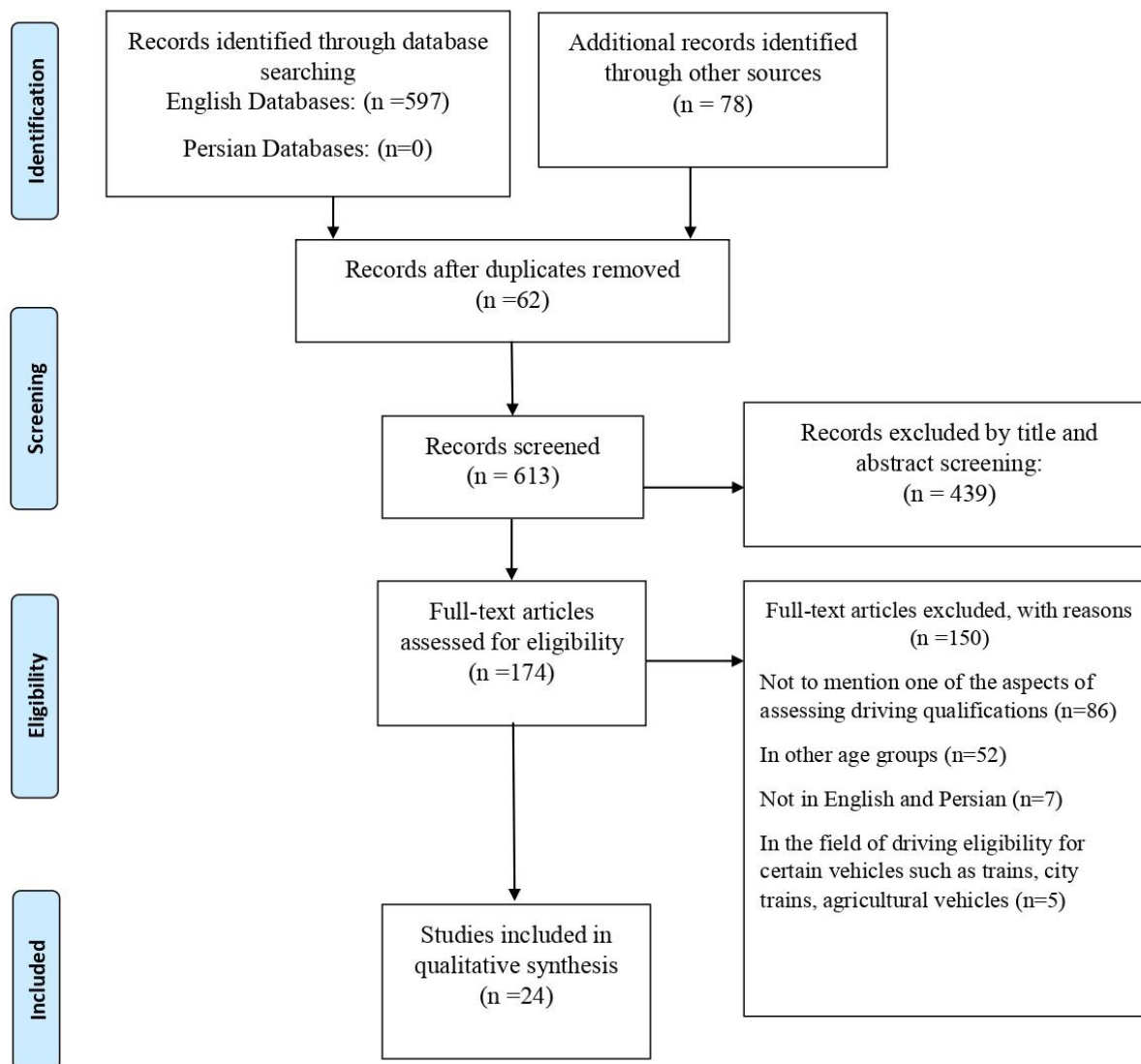

Identification

Records identified through database searching
English Databases: (n =597)

Persian Databases: (n=0)

Additional records identified through other sources
(n = 78)

Records after duplicates removed
(n =62)

Screening

Records screened
(n = 613)

Records excluded by title and abstract screening:
(n = 439)

Eligibility

Full-text articles assessed for eligibility
(n =174)

Full-text articles excluded, with reasons
(n =150)

Not to mention one of the aspects of assessing driving qualifications (n=86)

In other age groups (n=52)

Not in English and Persian (n=7)

In the field of driving eligibility for certain vehicles such as trains, city trains, agricultural vehicles (n=5)

Included

Studies included in qualitative synthesis
(n =24)

Fig. 1: PRISMA 2009 flow chart

General characteristics of studies

Studies included were 7 papers and 17 instructions. The period of publication of the included studies was between 2003 and 2020. These studies were conducted in six countries, all of them were HICs, and Australia had the most studies (10 studies). Sixteen studies did not distinguish between professional and non-professional drivers (Table 1).

Table 1: Specifications related to measuring and improving driving skills in the elderly (number = 24)

Variables	Variable level	*N (%)*	*Variables*	Variable level	*N (%)*
Countries Conducting Studies (24)	Australia	10 (41.6)	Base Age for Elderly Drivers (24)	65 yr old	2 (8.3)
	USA	7 (29.1)		70 yr old	4 (16.6)
	Canada	3 (12.5)		75 yr old	3 (12.5)
	England	2 (8.3)		80 yr old	3 (12.5)
	New Zealand	2 (8.3)		No mention to base age	12 (50)
	Northern Ireland	1 (4.1)	Target Group of Studies (24)	Public	13 (54.1)
Report Type (24)	Divided into professional and non-professional drivers	9 (37.5)			
	Not divided into professional and non-professional drivers	15 (62.5)		Clinical and driving specialists	9 (37.5)

Baseline age to assess 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 yr old (4 studies).

Judgment items in assessing fitness to drive in the elderly

Twenty studies referred to physical items, 10 studies referred to driving assessment and history, five studies to psychological items, and four studies to other judgment items on driving fitness in the elderly among 24 studies included. Judgment items on elderly driving fitness were classified into five groups (Fig. 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 (16).

Policies to renewal and suspend driving licenses for the elderly

Eight studies referred to the process of renewing an older driver's license among the 24 included studies (8, 17 , 26, 27-31). Face-to-face renewal with 5 cases (16, 17, 28, 31, 32) 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 (16, 29, 32) and Online methods (34, 36) with 3 and 2, respectively, are other methods of renewing the license in the elderly (Table 2).

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, in one study the average validity period of the license in the various states was 4.4 and 5 years in one study at the ages of 75 and 80 and then two years (27).

Five studies referred to the policies for getting a license renewal fee and other related costs such as driving test fees (17, 26, 28, 29, 33). Three studies referred to time and manner of reminding to renew the driver's license in the elderly (29, 31, 32). In Northern Ireland, about two months before the expiration of the current license, the DVA sends an extension notice to the elderly driver (DLR1) (29). Seven studies referred to various types of driving suspension policies in the elderly (8, 17, 28-32). In Australia, it is advised to the person to avoid driving for some time depending on the type and severity of the disease or medical condition. 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 h 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 (17).
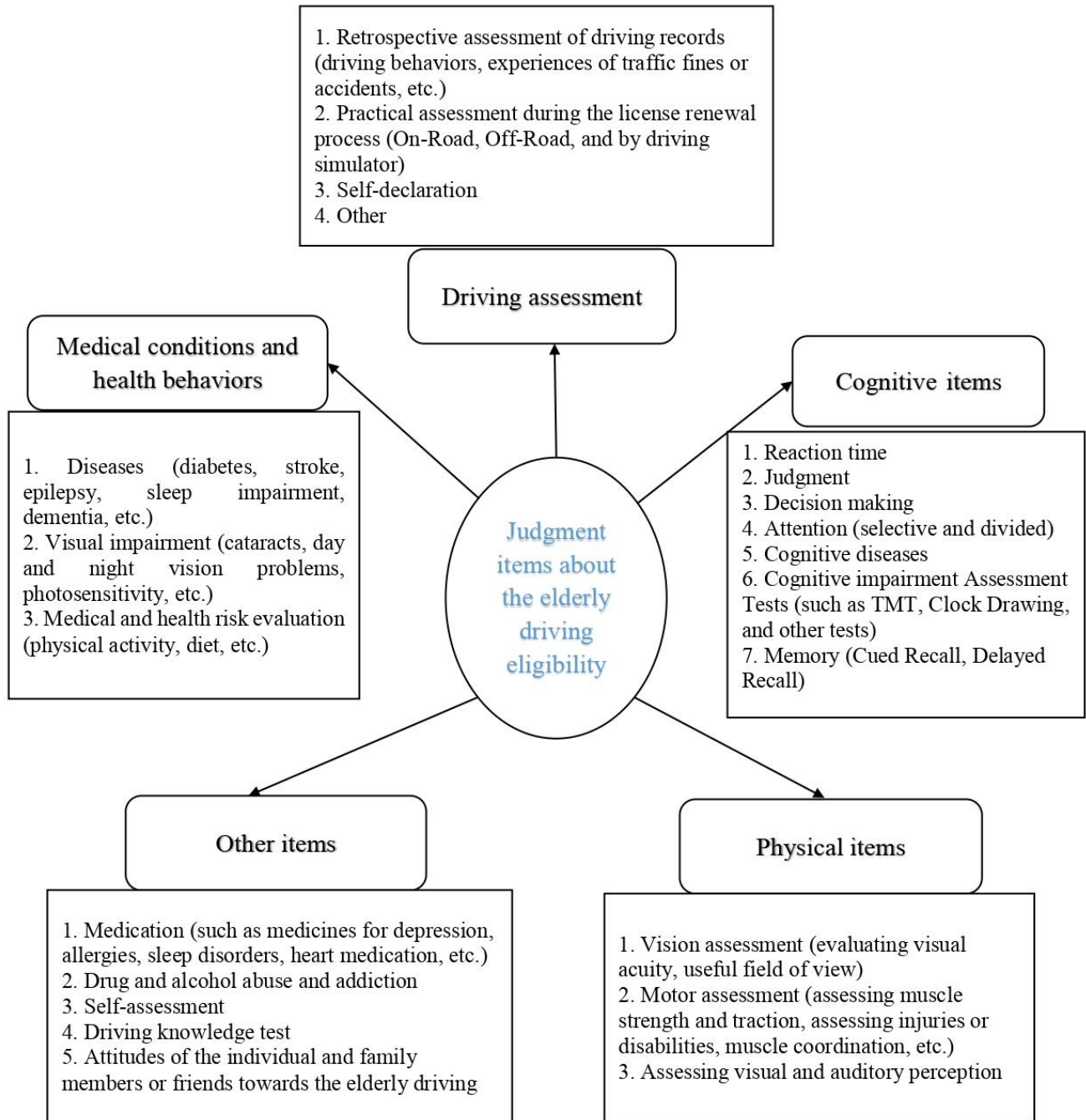
Driving assessment

1. Retrospective assessment of driving records (driving behaviors, experiences of traffic fines or accidents, etc.)
2. Practical assessment during the license renewal process (On-Road, Off-Road, and by driving simulator)
3. Self-declaration
4. Other

Medical conditions and health behaviors

1. Diseases (diabetes, stroke, epilepsy, sleep impairment, dementia, etc.)
2. Visual impairment (cataracts, day and night vision problems, photosensitivity, etc.)
3. Medical and health risk evaluation (physical activity, diet, etc.)

Cognitive items

1. Reaction time
2. Judgment
3. Decision making
4. Attention (selective and divided)
5. Cognitive diseases
6. Cognitive impairment Assessment Tests (such as TMT, Clock Drawing, and other tests)
7. Memory (Cued Recall, Delayed Recall)

Judgment items about the elderly driving eligibility

Other items

1. Medication (such as medicines for depression, allergies, sleep disorders, heart medication, etc.)
2. Drug and alcohol abuse and addiction
3. Self-assessment
4. Driving knowledge test
5. Attitudes of the individual and family members or friends towards the elderly driving

Physical items

1. Vision assessment (evaluating visual acuity, useful field of view)
2. Motor assessment (assessing muscle strength and traction, assessing injuries or disabilities, muscle coordination, etc.)
3. Assessing visual and auditory perception

Fig. 2: Judgment items in assessment fitness to drive in the elderly

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 yr	3 yr	4 yr	Variable*
USA / all states (16).	☑	☐	☑	☐	☐	☐	☐
Northern Ireland (29).	☐	☑	☑	☐	☑	☐	☐
Australia / South Australia (32).	☑	☐	☑	☐	☐	☐	☐
Australia / all states (17).	☑	☐	☐	☐	☐	☐	☐
USA/ Portland (28).	☑	☐	☐	☐	☐	☐	☐
USA/ Kentucky (30).	☐	☐	☐	☐	☐	☑	☐
New Zealand (27).	☐	☐	☐	☐	☐	☐	☑
Canada / Ontario (26).	☐	☐	☐	☑	☐	☐	☐
USA / Michigan (31).	☑	☑	☐	☐	☐	☑	☐

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

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

Seven studies introduced a general practitioner, seven studies a specialist, three studies a driving assessor, and three 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 (Fig. 3).

Four studies referred to the policymaker of the process of renewing the driver's license in the elderly (16, 17, 29, 32). In Northern Ireland, the DVA organization regulates the process to renew the license for the elderly (29). In Australia, Austroads and the National Transport Commission (NTC) organizations are responsible for policymaking (17). In another study, the Department of Planning, Transport, and Infrastructure has been identified as a major policymaker in Australia (32).

Empowerment policies for elderly drivers

Out of 24 papers, thirteen studies referred to the road tests as part of the driver's license renewal process. Five studies (out of 24 papers) consider it necessary to provide safe driving tips for empowering older drivers (8, 29, 31, 33, 34). Moreover, five studies (out of 24 papers) referred to classroom training as a tool for empowering the elderly driver (9, 26, 31, 32, 34) (Table 3).

Supportive policies for elderly deprived of driving

Nine studies included supportive policies for the elderly deprived of driving (8, 9, 17, 28, 29, , 31-34). The main supportive policy was to introduce alternative transportation to the elderly, mentioned in 7 studies (8, 9, 28, 29, 31-33). 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 deprived of driving that he or she can use public transport for free at certain times using that card (43).

Table 3: Types of empowerment policies in included studies

Country/State (reference number)	Road test	Provide safe driving tips	classroom training
USA/all states (16)	☑	☐	☐
Northern Ireland (29)	☑	☑	☐
England (33)	☑	☑	☐
England (9)	☐	☐	☑
USA/Michigan (34)	☑	☑	☑
Australia/South Australia (32)	☐	☐	☑
Australia/Capital (35)	☑	☐	☐
Australia/New South Wales (36)	☑	☐	☐
Australia/Northern Territory (37)	☑	☐	☐
Australia/Queensland (38)	☑	☐	☐
Australia/South Australia (39)	☑	☐	☐
Australia/Tasmania (40)	☑	☐	☐
Australia/Victoria (41)	☑	☐	☐
Australia/Western Australia (42)	☑	☐	☐
USA/all states (9)	☑	☑	☐
Canada (34)	☐	☐	☑
USA/Michigan (32)	☐	☑	☑

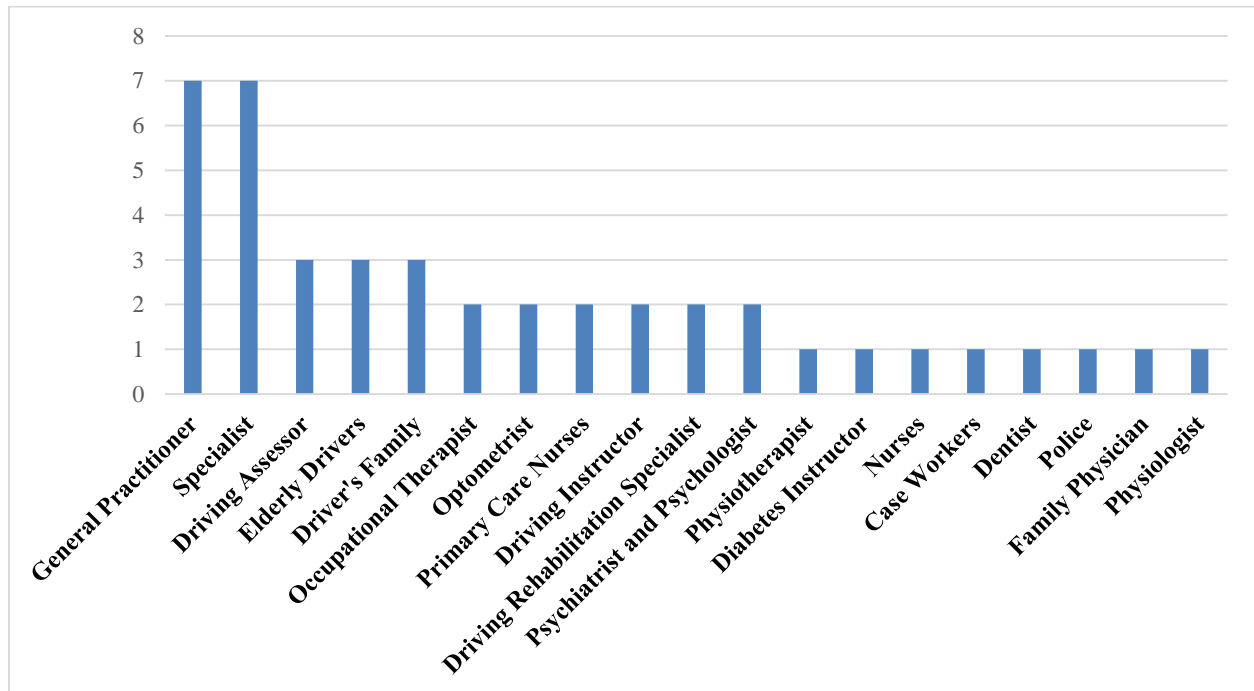* Uninformed studies were excluded from this table.

Fig. 3: Frequency of executors in the process of renewing the certification of the elderly

Treatment, prevention, maintaining, and improving health policies

Sixteen studies referred to the policies to treat, 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 a 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 (17). 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 (29). 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 (8).

Discussion

The results of 24 studies on the subject of assessing fitness to drive in the elderly were extracted. Studies conducted in this field do not have much history, and researchers and policymakers have paid attention to this issue with delay. While RTIs and aging are not new issues, assessing the 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 HICs. Therefore, it is estimated that by 2030, one in five drivers in the United States will be elderly (44). 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 (45).

All studies were conducted in HICs. 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 to over 80 yr (46) due to the high level of health and healthy lifestyle in HICs and was increased the number of elderly population (47,48). The experiences mentioned in this study have less generalizability for LMICs, 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 was no agreement on the base age for older drivers, and the base age covers the range of 65 to 85 years. 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 (49). An age range be considered, and within this range, high-risk drivers to be identified on a case-by-case and systematic basis. 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.

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. 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 LMICs (50, 51). 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.

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 (52). Despite the highly significant items such as medicine take, reaction time, 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.

In seven 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 (53). 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.

Only 9 studies referred to protective policies for elderly drivers, especially elderly drivers deprived of driving that need 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 (54, 55). 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. 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.

There was treatment, prevention, maintenance, and promotion of health in most of the studies by performing health assessments and screenings, and in this case, HICs 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 (55, 56). 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. One of the most important limitations of this study is limited access to countries' information. A possible reason for this could be the non-publication of countries' programs and policies or publication of 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. Most HICs 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 LMICs. In addition to driving assessment items and review of driving records, it is recommended to assess health items comprehensively and in cognitive and physical areas such as vision, the field of vision, muscle strength, etc.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

No competing interests were disclosed.

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