









Scientific publications on driving by older adults: scope review

Danielle Félix Arruda Mourão¹ 
Eveline Alves Oliveira² 
Alice Silva Osterne Ribeiro² 
Paulo César de Almeida¹ 
Thalis Rebouças de Oliveira³ 
Maria Célia de Freitas¹ 

Abstract

Objective: To map national and international scientific evidence regarding driving by older adults. **Method:** Scope review based on the manual proposed by the Joanna Briggs Institute. Searches were conducted in the MEDLINE, Web of Science, Scopus, SciELO databases, and grey literature through Google Scholar. **Results:** Out of 1,194 studies identified, 189 papers meeting eligibility criteria were selected. Pioneering countries in publications were Australia and the United States, with the peak of research occurring between 2013 and 2014. Study participants included healthy older adults (63.49%, 120), followed by those with Alzheimer's disease (17.46%, 33), Mild Neurocognitive Disorder (11.11%, 21), Parkinson's disease (6.88%, 13), and other comorbidities (19.58%, 37). Various interventions were identified, with 94.02% (178) assessing the effectiveness of instruments measuring the fitness of older drivers. **Conclusion:** There was a prevalence of studies aimed at identifying assessment tools to measure the functionality of older drivers. This underscores the importance of standardized, validated, and economically viable assessments that contribute to identifying at-risk drivers. The need for interventions in geriatrics and gerontology was evident, emphasizing the necessity for actions to establish a specialized multidisciplinary team in vehicular driving. This approach seeks to align licensing guidelines with the specific needs of older drivers, taking into account social, economic, political, and educational aspects, particularly within the Brazilian traffic departments.

Keywords: Older adult.
Vehicle Driving. Driver's
License Examination. Traffic
Safety. Occupational therapy.

¹ Universidade Estadual do Ceará, Departamento de Enfermagem, Programa de Pós-Graduação em Cuidados Clínicos em Enfermagem e Saúde (PPCCLIS). Fortaleza, CE, Brasil.

² Universidade Estadual do Ceará, Departamento de Enfermagem, Grupo de Pesquisa Enfermagem, Educação, Saúde e Sociedade. Fortaleza, CE, Brasil.

³ Universidade Federal do Ceará, Departamento de Estatística e Matemática Aplicada. Fortaleza, CE, Brasil.

The authors declare that there is no conflict in the conception of this work.

There was no funding to carry out this work

Correspondence

Danielle Félix Arruda Mourão
daniellearruda.doutorado@gmail.com

Received: 22 May, 2023
Approved: 8 November, 2023

INTRODUCTION

Driving is a complex instrumental activity of daily living, highly valued among older individuals and closely linked to the feelings of well-being, autonomy, and independence, as outlined in the official document Occupational Therapy Practice Framework: Domain and Process¹. The cessation of driving hinders the fulfillment of tasks, potentially leading to social isolation and depressive symptoms².

Driving licenses for older adults can vary based on the country, age, and the driver's health status. European countries implement different validity periods, ranging from indefinite licenses in Austria and Germany to restricted licenses renewed every three years in Greece and Ireland for drivers above 65 years old³. Regarding health aspects, 24 federations in the United States and the District of Columbia have optional assessment policies, while in the remaining 26 states, mandatory mental tests assessing information interpretation and appropriate judgment are required^{4,5}. In Brazil, Law number 14,071 of 2020 states: "when there is evidence of physical or mental disability, or progressiveness of illness that may reduce the ability to drive the vehicle, the expected deadlines may be shortened", being the responsibility of the expert⁶.

According to guidelines published by the American Association of Motor Vehicle Administrators, aging is associated with a decline in functional abilities (sensory, physical, and cognitive), which can impact both the fitness and performance of older drivers, potentially resulting in an inability to drive^{7,8}. Various factors compromise the motor competence of older drivers, including diminished visual and auditory acuity, musculoskeletal deficiencies (strength and flexibility), clinical condition, side effects of medications, and cognitive decline. The latter warrants attention to reaction time, processing speed, and attention, as they are crucial for the safety of the driving act⁹.

Cognitive declines are typically associated with neurodegenerative diseases, but there are individuals with these limitations who do not meet the diagnostic criteria for dementia. These individuals fall under the category of Mild Cognitive Impairment (MCI),

currently referred to as Mild Neurocognitive Disorder (MNCNCD). Identifying older drivers with cognitive impairment poses a challenge for scholars in the field, necessitating assessments across various domains⁹.

It is essential to understand that discussions regarding driving competence are challenging and often give rise to significant family conflicts. The ethical considerations surrounding the decision to cease driving are delicate, thereby straining the physician/ patient relationship⁹. Consequently, a notable gap emerges in public safety and collective health, a concern that should not only be of interest to families but also to healthcare professionals, traffic authorities, and governmental bodies.

Thus, the importance of compiling research in this context is acknowledged, with the objective of mapping national and international scientific evidence regarding driving by older adults.

METHOD

This is a scope review based on the manual proposed by the Joanna Briggs Institute¹⁰, utilizing the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)¹¹. The review followed the five stages of development: 1 - identification of review questions; 2 - locating relevant studies; 3 - study selection; 4 - data extraction; 5 - synthesis, summary, reporting of results to maintain the rigor of the review process¹². The protocol for this scope review has been appropriately registered on the Open Science Framework (OSF) (<https://osf.io/>), with a DOI number: 10.17605/OSF.IO/86BNK.

The mnemonic strategy Population, Concept, and Context (PCC) was employed, where P = older adults; C = licensed older adults; C = assessment of vehicular driving globally. Accordingly, the guiding question was formulated: What are the national and international scientific evidences regarding vehicular driving by older adults?

The search strategy was developed using the indexers: Health Sciences Descriptors (Descritores Ciências da Saúde - DeCS) and Medical Subject Headings (MeSH), in conjunction with uncontrolled

language: "aged"; "automobile driver examination"; "neuropsychological test"; "geriatric assessment"; "cognition" and "occupational therapy". The Boolean operator AND was also employed to enhance sensitivity.

To conduct the searches, the following databases were accessed: Latin American and Caribbean Health Sciences Literature (LILACS) and Medical Literature Analysis and Retrieval System Online (MEDLINE) via the Virtual Health Library (Biblioteca Virtual de Saúde - BVS), Web of Science from the Institute for Scientific Information, Scopus and the Scientific Electronic Library Online (SciELO). Additionally, for grey literature, Google Scholar was utilized.

Full-text papers were included in the review if the population studied consisted of individuals aged 60 years or older, in accordance with the older person's statute in Brazil¹³. Additionally, included were papers that addressed the guiding question. Exclusions comprised letters to the editor, pre-communications, editorials, experiential reports, works published in event proceedings, and book chapters. No temporal restrictions or language limits were applied.

The searches were conducted in January 2023, using a paired and blind approach. Following the removal of duplicate studies in the EndNote reference manager and data refinement through Rayyan QCRI, titles and abstracts were assessed by two independent reviewers (EAO and ASOR), adhering to the inclusion criteria. Any discrepancies or uncertainties were resolved through discussions until consensus was reached between the researchers. Reviewers then proceeded to read the full papers to identify publications aligned with the stated objective, and exclusions were duly justified. Persistent disagreements were resolved by a third reviewer (DFAM), who evaluated the inconsistencies.

For data extraction, the template "Source of evidence details, characteristics and results extraction instrument"¹⁰ from the Joanna Briggs Institute (JBI)

was adapted and organized into a table with 10 items, divided into two chapters. The first chapter pertained to study characteristics (title, author, year, country, objective, and population), and the second focused on results extracted from the studies (method, type of intervention, outcome, and researchers' professions).

Regarding levels of evidence, the papers were analyzed and categorized based on the type of study, following the criteria outlined in the JBI Levels of Evidence¹⁴. Classifications were distributed across efficacy, diagnosis, prognosis, economic evaluations, and significance.

The data were organized into five categories: population (healthy older adults and those with comorbidities), types of intervention (educational and evaluative), country and year of the papers, and finally, the profession of researchers (authors of the papers and assessors of tests).

The information was stored in a database, aided by text editing programs and spreadsheets designed in statistical software to reorganize variables and facilitate the construction of graphical elements.

DATA AVAILABILITY

All the datasets supporting the results of this study are available upon request from the corresponding author, Danielle Félix Arruda Mourão.

RESULTS

Identified 1,194 papers, removed 805 duplicates, 81 after title and abstract analysis, and 119 after applying eligibility criteria (population below 60 years, not responding the guiding question, inaccessible, and also including letters to the editor, theses, and reports). Thus, 189 papers were included in this review, with the search and study selection process outlined in the flowchart (Figure 1. [Supplementary File](#)).

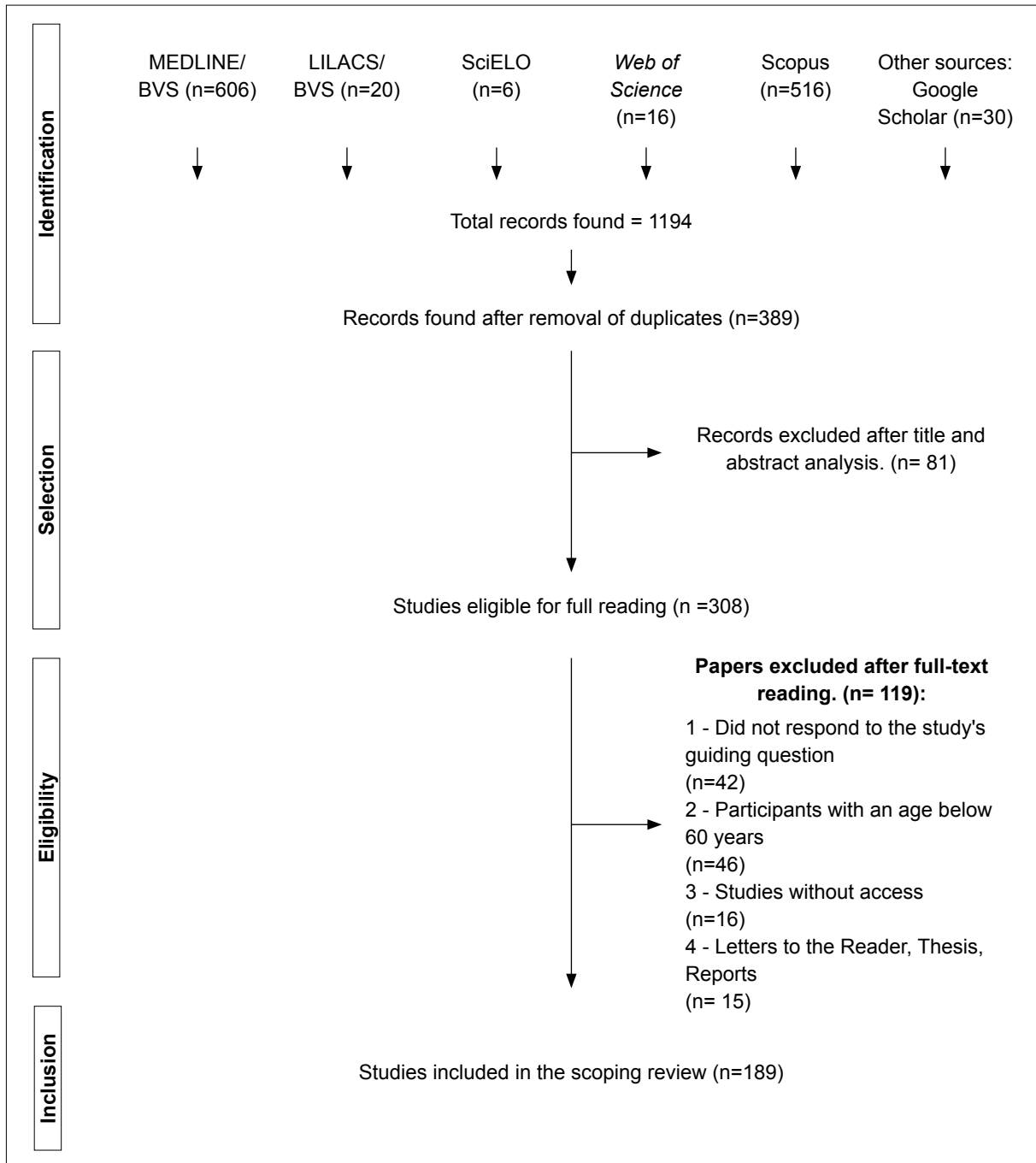


Figure 1. Flowchart of the research process, inclusion and exclusion of peer-reviewed studies for the evidence map and scoping review. Fortaleza, CE, 2023.

Source: Adapted from PRISMA-ScR¹¹.

The selected papers were produced in 21 countries, distributed across the following continents: 20.63% (39) in Europe (United Kingdom, Ireland, Belgium, Sweden, France, Portugal, Italy, Norway, Finland, Austria, Denmark, Netherlands, and Germany); 56.08% (106) in the Americas (United States, Canada, Argentina, and Brazil); 17.46% (33) in Oceania (Australia and New Zealand); and 5.82% (11) in Asia (Japan and Iran).

When considering the year of publication of the papers, it was identified that they were published between 1991 and 2023. During this period, scientific productions were not detected in only four years. The precursors in 1991 were Australia and the United States, which, together with Canada, appeared most frequently in the publications, with 68 (35.98%), 31 (16.40%), and 27 (14.29%) papers found, respectively.

In contrast, scientific productions in other countries did not exceed 10 papers, including Brazil, where nine (4.76%) were identified. It is worth noting that the decade from 2011 to 2021 was the period

of greatest interest in the subject, resulting in a high number of publications, totaling 52.91% (100), with the peak occurring between 2013 and 2014 (Figure 2).

Interest in the theme emerged from various professional categories; however, physicians, psychologists, and occupational therapists stood out with a higher number of publications. Physicians (306) contributed to the authorship of 117 papers, distributed across specialties: 183 general practitioners, 45 neurologists, 40 geriatricians, 15 psychiatrists, 14 ophthalmologists, six physiatrists, one otolaryngologist, one cardiologist, and one orthopedist. Psychologists (192) were present in 91 studies, and occupational therapists (185) in 84 papers. In addition to authoring papers, these three professional categories were also prominent in test administration. However, in this role, occupational therapists took the lead, appearing in 44 studies, followed by psychologists in 20, and physicians in nine. It is noteworthy that other professional categories either did not administer tests, were not identified, or were classified as "other" due to an insignificant number of publications (Figure 3).

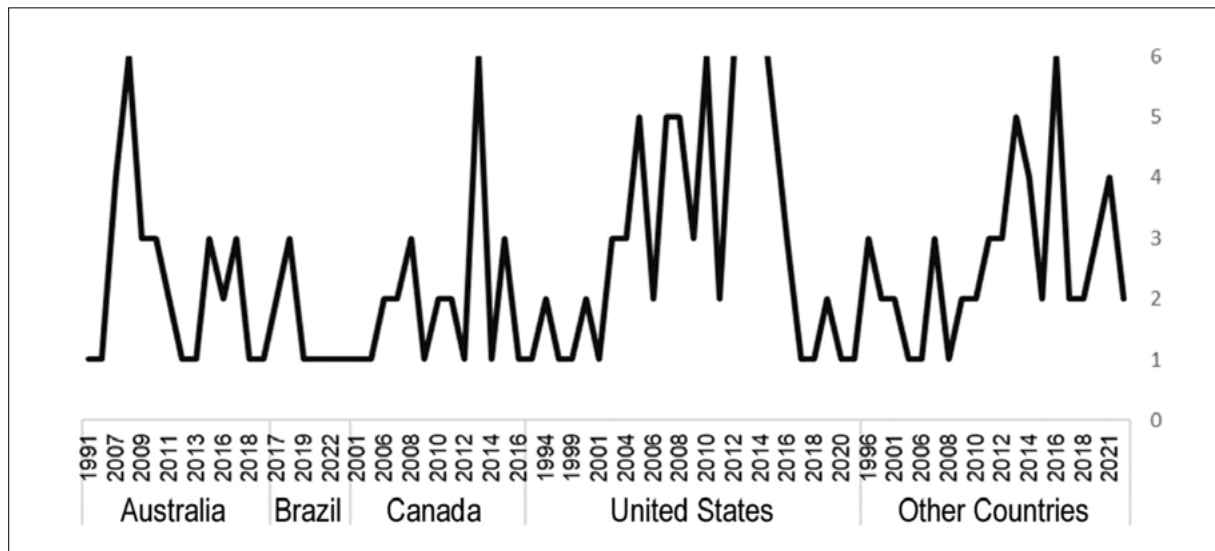


Figure 2. Scientific production on the vehicular driving of older adults by country and year of publication (1991-2023).

Source: Prepared by the authors.

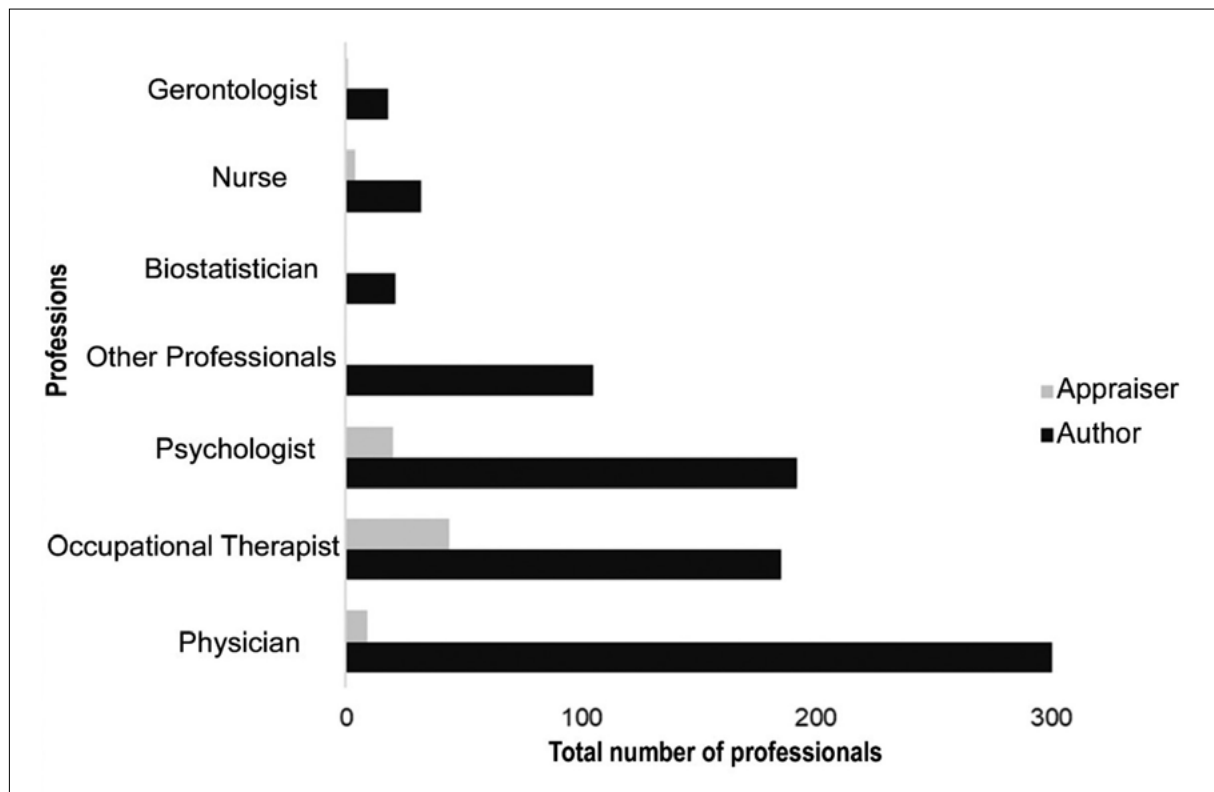


Figure 3. Number of scientific publications on older drivers categorized by professional status of the author or evaluator of tests. Fortaleza, CE, 2023.

Source: Prepared by the authors.

In papers^{8,15-18}, it was identified that the evaluation process of motor competence is developed through interdisciplinary collaboration among healthcare professionals. The off-road (at clinic) assessment begins with a screening conducted by a social assistant, involving an interview on driving and psychosocial history, along with a nurse who investigates health history and variables influencing the decline of essential functions for driving. Physicians analyze clinical aspects affecting driving, when necessary, request diagnostic tests, and assess the effects of medications on driving. The psychologist performs mental screening, planning, and organization. This is followed by the administration of tests evaluating physical, sensory, and cognitive functions by an occupational therapist. The gold standard evaluation, on-road, is conducted by a driving instructor sitting in the passenger seat, providing instructions, analyzing rules, and ensuring safety in driving situations. Simultaneously, the occupational therapist in the back seat assesses qualitative aspects of the

driver's behavior in terms of vigilance, confidence, distraction, and impulse control, and may also make vehicle adaptations and driving restrictions. After these procedures, the assessment team convenes to discuss performance, classify the driver, and make recommendations to be conveyed during the feedback meeting that the social assistant conducts with the driver and their family.

Regarding older drivers, it was observed that 55.70% (127) were healthy older individuals, 14.47% (33) had Alzheimer's disease (AD), 9.21% (21) had Mild Neurocognitive Disorder (MNCD), 5.70% (13) had Parkinson's disease, and 14.91% (34) had other comorbidities. It is important to note that some studies were scored more than once due to their development with more than one type of participant and/or being conducted in more than one country.

Diverse types of interventions were identified and categorized according to their approach, being

evaluative and educational. Evaluative interventions accounted for 94.38% (185), further subdivided into 79.59% (156) interventions assessing the effectiveness of instruments measuring the driving fitness of older adults; 8.16% (16) interventions evaluating the performance/procedures of healthcare professionals to assess the fitness of older drivers; 2.55% (5) interventions examining the behavior of family caregivers regarding older drivers; and 4.08% (8) interventions appraising licensing guidelines across various countries (Table 1).

The papers^{19,20} addressing interventions assessing the performance/procedures of healthcare professionals underscored the importance of identifying the extent to which they evaluate mental function for driving fitness in the face of diverse limitations, be they cognitive, physical, or sensory. The objectives of these investigations were centered on detecting strategies employed by professionals for ceasing driving in older individuals; quantifying the effectiveness and reliability of different assessors in categorizing driving behaviors in older adults for licensing authorities; and examining how to

provide recommendations regarding licenses for older drivers.

Concerning educational interventions, 5.61% (11) were focused on: three on the education of older adults, six on raising awareness and training professionals for the assessment of older drivers, and two on guiding and supporting family caregivers. It is noteworthy that the intersection of intervention types with countries exceeds 100%, due to studies conducted in two or more countries (Table 1).

Upon analyzing the levels of evidence in the studies, 69.84% (132) were identified for Efficacy; 15.87% (30) for Diagnosis; 9.52% (18) for Significance; 4.76% (9) for Prognosis, and no studies were identified for Economic Evaluations. Among the levels of evidence for Efficacy, observational studies without a control group of level 3E stood out. Regarding levels of evidence for Diagnosis, studies on test accuracy among non-consecutive patients of level 2B were prominent. As for Significance, the prevalence was of unique qualitative studies of level 3. For Prognosis, initial cohort studies of level 1B were emphasized (Table 2).

Table 1. Participants and types of interventions identified in the 189 selected studies and distributed by country. Fortaleza, CE, 2023.

	Countries					Total %
	USA	Canada	Australia	Brazil	Others	
Participants	n (%)	n (%)	n (%)	n (%)	n (%)	Total %
HOP	46 (20.18)	22 (9.65)	17 (7.46)	9 (3.95)	33 (14.47)	55.70
PAD	17 (7.46)	3 (1.32)	5 (2.19)	-	8 (3.51)	14.47
POCD	6 (2.63)	1 (0.44)	4 (1.75)	-	10 (4.39)	9.21
PPD	6 (2.63)	1 (0.44)	3 (1.32)	-	3 (1.32)	5.70
POD	17 (7.46)	2 (0.88)	7 (3.07)	-	8 (3.51)	14.91
Total	92 (40.35)	29 (12.72)	36 (15.79)	9 (3.95)	62 (27.19)	100.00
Types of Interventions	n (%)	n (%)	n (%)	n (%)	n (%)	Total %
EDU	7 (3.57)	4 (2.04)	-	-	-	5.61
IA	58 (29.59)	21 (10.71)	25 (12.76)	9 (4.59)	43 (21.94)	79.59
PA	7 (3.57)	1 (0.51)	3 (1.53)	-	5 (2.55)	8.16
GA	2 (1.02)	-	3 (1.53)	-	3 (1.53)	4.08
FA	2 (1.02)	-	1 (0.51)	-	2 (1.02)	2.55
Total	76 (38.78)	26 (13.27)	32 (16.33)	9 (4.59)	53 (27.04)	100.00

HOP: Healthy Older Participants; PAD: Participants with Alzheimer's Disease; POCD: Participants with Other Cognitive Diseases; PPD: Participants with Parkinson's Disease; POD: Participants with Other Diseases; EDU: Educational; IA: Instrument Assessment; PA: Professional Assessment; GA: Guideline Assessment; FA: Family Assessment. Source: Prepared by the authors.

Table 2. Classification of the level of evidence of the studies included in the review according to the Joanna Briggs Institute (2013).

CLASSIFICATION OF LEVELS OF EVIDENCE	
Efficacy	
Level 1A - Systematic review of controlled randomized controlled trials (RCTs)	2
Level 1B - Systematic review of RCT and other study designs	2
Level 1C - Randomized Controlled Trial	8
Level 1D - Pseudo-Randomized Controlled Trial	13
Level 3A - Systematic review of comparable cohort studies	3
Level 3B - Systematic review of comparable cohort studies and other lower-level study designs	3
Level 3C - Cohort study with a control group	7
Level 3D - Case-control study	13
Level 3E - Observational study without a control group	39
Level 4A - Systematic review of descriptive studies	1
Level 4B - Cross-sectional study	32
Level 4C - Case series	3
Level 4D - Case study	2
Level 5C - Bench research/ single expert opinion	4
Diagnosis	
Level 2A - Systematic review of accuracy studies of tests among non-consecutive patients	1
Level 2B - Study of test accuracy among non-consecutive patients	22
Level 3B - Diagnostic case-control study	1
Level 4B - Individual diagnostic performance studies	6
Prognosis	
Level 1B - Initial cohort study	5
Level 3B - Cohort study (or control arm of an RCT)	4
Significance	
Level 3 - Single qualitative study	15
Level 5 - Single expert opinion	3

Source: Prepared by the authors.

DISCUSSION

Among the 21 countries distributed across four continents identified in this review, the prominence of the United States, Australia, and Canada can be explained by the concern for the safety of older drivers predating the 1990s. This is evidenced by a study conducted in 1988 in the United States, which mentioned the obligation for physicians to report to local licensing authorities when patients presented health issues²¹.

In this regard, researchers from these countries were motivated to develop programs linked to

licensing authorities, comprising interviews with older drivers and their family members, clinical assessments, neurocognitive, physical, and sensory evaluations, in addition to on-road assessments, to facilitate the identification of drivers at risk.

In the United States, the DriveWise program addresses clinical concerns and emotional needs of drivers whose driving safety is in question; it is staffed by professionals specialized in the field of gerontology⁹.

In Australia, the Occupational Therapy Driver Off-Road Assessment Battery (OT-DORA) was

developed to assess driving performance using a series of standardized tests that should be used in conjunction with the licensing guidelines of the VicRoads project²².

In Canada, a program was developed in partnership with provincial and federal transportation agencies, called Candrive. The aim of Candrive is to create a valid screening tool to identify drivers who require comprehensive evaluation and to determine driving safety²³.

In Brazil, the studies identified in this review focused on the following aspects: 1- characterization of older drivers²⁴; 2- assessment of gait speed, grip strength, cognition, and frailty, associating them with results from physical and mental fitness exams conducted for vehicular licensing or with the number of traffic violations in different driving environments^{16,25-30}; and 3- the search for instruments for evaluating older drivers³¹. However, educational, evaluative, and rehabilitative programs linked to traffic departments for older individuals, their families, and professionals involved in the (re)licensing process were not identified. This gap underscores the need for further research on the subject. It is noteworthy that the Brazilian Traffic Code⁶ provides for assessments and clinical exams for the general population and does not mandate specific evaluations for the (re) licensing of individuals aged 60 or older.

The decade highlighted in the publications of this review spanned from 2011 to 2021, justified by two factors. The first factor underscores the unprecedented global growth of individuals aged 60 and above during this decade, a trend not witnessed since the 1950³². The second factor is linked to the establishment of the Decade of Action for Road Safety 2011-2020, which contributes to the findings of the study. This global initiative prompted governmental institutions worldwide to adopt preventive measures against traffic accidents. It is noteworthy that during this period, traffic incidents held the eighth position among causes of death on a global scale³³.

The professional category of the authors involved in the production of studies is a relatively underexplored aspect in the literature, yet it proves to be pertinent in uncovering the knowledge domains that have demonstrated interest in the subject

matter and their respective needs. This exploration aims to propel advancements in scientific research and, consequently, in interventions targeted at the pertinent population. In this regard, it was observed that, despite physicians being the most prominent professional category in the authorship of papers, geriatricians did not emerge as the most prolific contributors on the subject, nor did professionals specializing in gerontology.

The "Clinician's Guide to Assessing and Counseling Older Drivers"⁷ aligns with the findings by emphasizing that healthcare professionals should concentrate on a comprehensive driving assessment, encompassing both clinical evaluation and on-road assessment. This evaluation should measure higher-order functions in executive domains such as decision-making, navigation, and problem-solving. The results should be utilized for informed judgment regarding the individual's likely driving capability.

The Austroads document³⁴ underscores that actions of the multidisciplinary team should be grounded in the early identification of functional decline, investigation into the driver's daily routine, and optimization of their capacity. Emphasis is placed on the significance of counseling the driver and the close collaboration of healthcare professionals with licensing authorities. This collaboration involves issuing reports regarding health conditions, vehicle adaptations, rehabilitation, or driving restrictions.

It was observed that evaluative interventions were directed towards four approaches: the behavior of family caregivers concerning older drivers, the role of healthcare professionals, the effectiveness of assessment instruments, and licensing guidelines. Concerns related to these approaches are pertinent to numerous countries globally, including Brazil, as they encompass crucial objectives for older adult care in traffic and hold significance for the practice of geriatrics and gerontology.

Regarding interventions concerning the assessment of the effectiveness of instruments measuring the driving aptitude of older individuals, a common interest among researchers was identified in the search for programs, protocols, batteries, screening tools, screening measures, or even tests that serve as reliable predictors for assessing the motor

competence of this population. In the literature, other studies^{35,36} emphasize that the application of isolated tests is not conclusive in predicting the risks associated with driving among older drivers, whether or not they exhibit cognitive limitations.

Research^{4,37} on interventions assessing licensing guidelines in various countries converge on a systematic proposal that advocates for the use of assessment instruments based on a community-referenced model. This model involves a three-tiered evaluation process, including: 1- a brief screening of skills, 2- a standard knowledge test along with perceptual response time, and 3- assessment by experts and/or on-road evaluation. Importantly, this model does not rely on age as a determining factor. These studies highlight the advantages of restrictive (re)licensing policies, incorporating a transitional stage of restricted driving. This approach avoids premature and often abrupt and traumatic cessation of driving, enabling individuals to remain on the road safely for as long as possible. In accordance, member countries of the Organization for Economic Cooperation and Development (OECD), in their 2001 report with projections for 2030, caution national governments to reconsider licensing policies and strategies. They advocate for collaboration with universities to work within research groups to develop programs aimed at assessing functional limitations that impede traffic safety. The report also emphasizes the identification of limitations that can be overcome, outlining effective rehabilitation options³⁸.

Educational interventions, in turn, focused on the education of older individuals, awareness and training of professionals for the assessment of older drivers, as well as guidance and support for family/caregivers.

Concerning the education of older drivers, the studies^{9,39} included in the review present educational programs designed to assist this demographic in maintaining safe driving practices. These programs involve practical interventions addressing safety content, behavioral changes, and adjustments for both the driver and the vehicle. The aim is to prevent traffic violations and accidents through education on safe driving practices. In agreement, a systematic review conducted in 2020⁴⁰ discusses the impact of

interventions on the driving behavior of healthy older individuals. It points out that the benefits depend on the type of training conducted. For example, education-based training with widespread use has proven efficacy in increasing knowledge and self-awareness among drivers. However, this isolated action is not sufficient to improve the ability to drive safely or reduce collisions. On the other hand, computer-based interventions indicated a reduction in the risk of involvement in accidents over time, proving to be a viable option. Mixed interventions also yielded positive results, as perceived by drivers, in terms of skills and positive behavioral changes upon returning to the road.

Regarding the awareness and training of professionals for the assessment of older drivers, the studies revealed data on gaps in the knowledge of these professionals. This situation engenders a sense of insecurity related to how to support patients as they approach the moment of ceasing driving or during the application of driving performance assessments⁴¹. Consistent with these findings, Scott et al.⁴² reported the difficulty that general clinicians face in managing conversations about ceasing driving with patients with dementia. They emphasized the importance of patients and their families understanding the impacts that dementia has on driving to facilitate the acceptance of discontinuing vehicular operation when the time comes.

Guidance and support for family/caregivers are crucial, considering that some spouses contribute to the continuation of unsafe driving by older individuals. For instance, Jett et al.⁴³ mention the preference of wives to act as co-pilots for their spouses rather than assuming the responsibility of driving. They highlight the difficulty that family members/caregivers face in convincing older drivers that driving has become unsafe. In alignment with this, Liddle et al.⁴⁴ described strategies used by family members of drivers with dementia during the cessation process. These strategies include collaborative negotiation of driving cessation agreements, family members volunteering to drive, reducing the visibility of the car or related items, and restricting the routes and times of driving. The significance of support groups for caregivers is also emphasized.

Regarding levels of evidence, 15.87% of the total search (189) was classified as level 1 for efficacy and prognosis ratings. A similar finding was evidenced in the systematic review conducted by Classen et al.⁴⁵, highlighting the need for more continuous randomized clinical trials and level 1 studies. Well-designed intervention studies provide valuable insights into the effectiveness of these actions and contribute to informed clinical decision-making.

It is noteworthy to add that, although expert opinion falls under level 5 in terms of evidence, this type of study enables researchers to understand the scenario related to vehicular driving from the perspectives of professionals, family members, and the drivers themselves. Regarding this, Neilson et al.⁴⁶ emphasize the importance of such studies, noting the need for qualitative data to comprehend the challenges that healthcare professionals face in their daily practice.

Considering the complexity of the subject matter, it is believed that the limitations of this review manifested when elucidating the comorbidities that may impact vehicular control and in addressing the instruments employed in the assessment process of the drivers in question, which may have been superficially expounded upon.

CONCLUSION

This review has delineated scientific evidence regarding diverse perspectives on older individuals' vehicular operation within both national and international contexts. It has underscored that the United States, Australia, and Canada have undertaken a substantial body of research encompassing evaluative and educational interventions, thereby affording enhanced support to older drivers, their families, and healthcare professionals, in collaboration with governmental entities.

It further emphasized the imperative for new studies concerning the subject matter, given global projections indicating a rapid surge in the older population in the coming years. Additionally, it identified the significance of additional randomized clinical trials, characterized by methodological rigor, to facilitate effective interventions in geriatrics and

gerontology. This approach aims to refine the profile of the older driver, engage in deliberations on and counsel regarding vehicular operation, and provide recommendations pertaining to driving restriction or cessation.

In Brazil, lacunae were observed concerning the productivity of studies, the utilization of specific assessments in the (re)licensing process, educational interventions for drivers and their families, and the training of a multidisciplinary team within traffic departments.

In this context, it is imperative for researchers in the fields of geriatrics, gerontology, and traffic specialists, in collaboration with traffic authorities, to conduct studies that provide specific assessments for older drivers. These studies should encompass rehabilitation when feasible, support for family/caregivers, and preparation for cessation of driving, with a focus on enhancing the self-awareness of the older individual.

Finally, the adaptation of licensing guidelines that address the social, economic, political, and educational specificities of the older driver, and the pursuit of a standardized, validated, and economically viable assessment that contributes to the identification of at-risk drivers, are important requisites globally.

AUTHORSHIP

- Danielle Félix Arruda Mourão conceived, developed the methodology, validated, and drafted the original manuscript;
- Paulo César de Almeida e Thalys Rebouças de Oliveira contributed to data curation and formal analysis;
- Alice Silva Osterne Ribeiro participated in data investigation and visualization;
- Eveline Alves Oliveira contributed to validation, drafting (original draft, revision, and editing); and,
- Maria Célia de Freitas supervised and assisted in the review and editing process of the text.

Edited by: Maria Helena Rodrigues Galvão

REFERENCES

- Occupational Therapy Practice Framework: Domain and Process—Fourth Edition. *The American Journal of Occupational Therapy*. 2020 Aug 31;74(Supplement_2):7412410010p1–87.
- Fraade-Blanar LA, Ebel BE, Larson EB, Sears JM, Thompson HJ, Chan KCG, et al. Cognitive Decline and Older Driver Crash Risk. *J Am Geriatr Soc*. 2018;66(6):1075–81.
- (Kit) Mitchell CGB. The Licensing of Older Drivers in Europe— A Case Study. *Traffic Injury Prevention*. 2008 Aug 15;9(4):360–6.
- Kulikov E. The Social and Policy Predictors of Driving Mobility Among Older Adults. *J Aging Soc Policy*. 2010; 23(1):1–18.
- Stav WB. Updated Systematic Review on Older Adult Community Mobility and Driver Licensing Policies. *Am J Occup Ther*. 2014;68(6):681–689.
- Brasil. Lei no 14.071, de 13 de outubro de 2020. Altera a Lei no 9.503, de 23 de setembro de 1997 (Código de Trânsito Brasileiro), para modificar a composição do Conselho Nacional de Trânsito e ampliar o prazo de validade das habilitações; e dá outras providências. 2020. Available at: <https://www.in.gov.br/web/dou/-/lei-n-14.071-de-13-de-outubro-de-2020-282461197>
- Clinician’s Guide to Assessing and Counseling Older Drivers. 4th ed. New York: The American Geriatrics Society; 2019.
- Urlings JHJ, Cuenen A, Brijs T, Lutin M, Jongen EMM. Aiding medical professionals in fitness-to-drive screenings for elderly drivers: development of an office-based screening tool. *Int Psychogeriatr*. 2018;30(8):1211–25.
- O’Connor MG, Kapust LR, Hollis AM. DriveWise: An Interdisciplinary Hospital-Based Driving Assessment Program. *Gerontol Geriatr Educ*. 2008;29(4):351–62.
- JBI Manual for Evidence Synthesis [Internet]. JBI; 2020. [Accessed in January 2023]. Disponível em: <https://jbi-global-wiki.refined.site/space/MANUAL>
- Tricco AC, Lillie E, Zarin W, O’Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Ann Intern Med*. 2018;169(7):467–73.
- Arksey H, O’Malley L. Scoping studies: Towards a Methodological Framework. *Int J Soc Res Meth*. 2005;8(1):19–32.
- Brasil. Lei n. 14.423, de 22 de julho de 2022. Altera a Lei n. 10.741, de 1º de outubro de 2003, para substituir, em toda a Lei, as expressões “idoso” e “idosos” pelas expressões “pessoa idosa” e “pessoas idosas”, respectivamente. *Diário Oficial da União*. 25 jul. 2022; Seção 1.
- JBI Levels of Evidence [Internet]. 2013 [Accessed in August 2023]. Available at: https://jbi.global/sites/default/files/2019-05/JBI-Levels-of-evidence_2014_0.pdf
- Hollis AM, Lee AKW, Kapust LR, Phillips LK, Wolkin J, O’Connor MG. The Driving Competence of 90-Year-Old Drivers: From a Hospital-Based Driving Clinic. *Traffic Inj Prev*. 2013;14(8):782–90.
- Lenardt MH, Lourenço TM, Betioli SE, Binotto MA, Sétlik CM, Barbiero MMA. Handgrip strength in older adults and driving aptitude. *Rev Bras Enferm*. 2023;76(1):e20210729.
- Unsworth CA, Baker A, Lannin N, Harries P, Strahan J, Browne M. Predicting fitness-to-drive following stroke using the Occupational Therapy – Driver Off Road Assessment Battery. *Disabil Rehabil*. 2018;41(15):1797–802.
- Dickerson AE, Molnar LJ, Eby DW, Adler G, Bedard M, Berg-Weger M, et al. Transportation and Aging: A Research Agenda for Advancing Safe Mobility. *Gerontologist*. 2007;47(5):578–90.
- Lovas J, Fereshtehnejad SM, Cermakova P, Lundberg C, Johansson B, Johansson K, et al. Assessment and Reporting of Driving Fitness in Patients with Dementia in Clinical Practice: Data from SveDem, the Swedish Dementia Registry. *J Alzheimers Dis*. 2016;53(2):631–8.
- Unsworth CA. Using Social Judgment Theory to Study Occupational Therapists’ Use of Information When Making Driver Licensing Recommendations for Older and Functionally Impaired Adults. *Am J Occup Ther*. 2007;61(5):493–502.
- Kapust LR, Weintraub S. To Drive or Not To Drive: Preliminary Results From Road Testing of Patients With Dementia. *Topics in geriatrics*. 1992;5(4):210–6.
- Unsworth CA, Russell K, Lovell R, Woodward M, Browne M. Effect of Navigation Problems, Assessment Location, and a Practice Test on Driving Assessment Performance for People with Alzheimer’s Disease. *J Alzheimers Dis*. 2019;67(3):1035–43.

23. Marshall S, Bédard M, Vrkljan B, Tuokko H, Porter MM, Naglie G, et al. Candrive - Development of a Risk Stratification Tool for Older Drivers. *J. Gerontol.* 2023;16.
24. Lenardt MH, Carneiro NHK, Binotto MA, Cechinel C, Lourenço TM, Sakai LM. Características dos idosos submetidos aos exames para a carteira de habilitação veicular. *Cogitare Enferm* [Internet]. 2017;22(1):1–10. Available at: <http://dx.doi.org/10.5380/ce.v22i1.48220>
25. Binotto MA, Lenardt MH, Carneiro NHK, Lourenço TM, Cechinel C, Rodríguez-Martínez M del C. Fatores associados à velocidade da marcha em idosos submetidos aos exames para habilitação veicular. *Rev Latino-Am Enfermagem.* 2019;27:e3138.
26. Lenardt MH, Binotto MA, Carneiro NHK, Lourenço TM, Cechinel C. Associação entre cognição e habilitação para direção veicular em idosos. *Av Enferm.* 2018;36(2):179–87.
27. Binotto MA, Lenardt MH, Carneiro NHK, Cechinel C, Lourenço TM, Bento PCB, et al. Associação entre cognição, velocidade da marcha e habilitação veicular em idosos. *Acta Paul Enferm.* 2021;34:eAPE00541.
28. Lenardt MH, Garcia ACKC, Binotto MA, Carneiro NHK, Lourenço TM, Cechinel C. Non-frail elderly people and their license to drive motor vehicles. *Rev Bras Enferm.* 2018;71(2):350–6.
29. Lenardt MH, Bettioli SE, Sakai LM, Carneiro NHK, Binotto MA, Moraes DC. Pré-fragilidade em idosos e a habilitação para direção de veículos automotores. *Rev Rene* [internet]. 2017;18(4):483–90. Available at: <http://periodicos.ufc.br/rene/article/view/20231>
30. Vasques AM, Borelli WV, Pinho MS, Portuguese MW. Verbal Learning as a predictor of risks of accidents in elderly drivers. *Arq Neuro-Psiquiatr.* 2022;80(1):30–6.
31. Vasques AM, Portuguese MW, Radaelli G, Gomes R. Avaliação cognitiva de condutores automotivos idosos: revisão integrativa. *Psico* [internet]. 2018;49(1):94–100. Available at: <https://revistaseletronicas.pucrs.br/ojs/index.php/revistapsico/article/view/27446>
32. World Population Prospects - Department of Economic and Social Affairs Population Division - United Nations [Internet]. [Accessed in February 2023]. Available at: <https://population.un.org/wpp/Graphs/Probabilistic/POP/60plus/900>
33. World Health Organization. Global status report on road safety 2018 [Internet]. Geneva: World Health Organization; 2018 [Accessed in March 2023]. 403 p. Available at: <https://apps.who.int/iris/handle/10665/276462>
34. Assessing fitness to drive for commercial and private vehicle drivers: medical standards for licensing and clinical management guidelines. 6th ed. Austrália: Austroads; 2022.
35. Krasniuk S, Crizzle AM, Toxopeus R, Mychael D, Prince N. Clinical Tests Predicting On-Road Performance in Older Drivers with Cognitive Impairment. *Can J Occup Ther.* 2023;90(1):44–54.
36. Eramudugolla R, Laird M, Black AA, Cameron ID, Wood JM, Anstey KJ. Inability of the Mini-Mental State Exam (MMSE) and high-contrast visual acuity to identify unsafe drivers. *Accid Anal Prev.* 2022;168:106595.
37. Fildes BN, Charlton J, Pronk N, Langford J, Oxley J, Koppel S. An Australasian Model License Reassessment Procedure for Identifying Potentially Unsafe Drivers. *Traffic Inj Prev.* 2008;9(4):350–9.
38. OECD. Ageing and Transport: Mobility Needs and Safety Issues [Internet]. OECD; 2001. [Accessed in January 2023]. Available at: <https://doi.org/10.1787/9789264195851-sum-en>
39. Stav W. CarFit: An Evaluation of Behaviour Change and Impact. *Br J Occup Ther.* 2010;73(12):589–97.
40. Castellucci HI, Bravo G, Arezes PM, Lavallière M. Are interventions effective at improving driving in older drivers?: A systematic review. *BMC Geriatr.* 2020;20:125.
41. Butler M, Brookland R, Shope JT, Kerse N, Connolly MJ. Medical fitness to drive assessment with older drivers: A qualitative study with general practitioners in New Zealand. *J Transp Health.* 2020;17:100856.
42. Scott TL, Liddle J, Pachana NA, Beattie E, Mitchell GK. Managing the transition to non-driving in patients with dementia in primary care settings: facilitators and barriers reported by primary care physicians. *Int Psychogeriatr.* 2019;32(12):1419–28.
43. Jett K, Tappen RM, Rosselli M. Imposed versus involved: Different strategies to effect driving cessation in cognitively impaired older adults. *Geriatr Nurs.* 2005;26(2):111–6.
44. Liddle J, Tan A, Liang P, Bennett S, Allen S, Lie DC, et al. “The biggest problem we’ve ever had to face”: how families manage driving cessation with people with dementia. *Int Psychogeriatr.* 2015;28(1):109–22.
45. Classen S, Monahan M, Auten B, Yarney A. Evidence-Based Review of Interventions for Medically At-Risk Older Drivers. *Am J Occup Ther.* 2014;68(4):e107–14.
46. Neilson D, Chacko E, Cheung G. Assessing driving fitness in dementia: a challenge for old age psychiatrists. *Australas Psychiatry.* 2019;27(5):501–5.